

D Y PATIL SCHOOL OF ARCHITECTURE

Ajeenkya DY Patil Knowledge City, Charholi (Bk), Lohegaon, Pune-412 105 Ph: 020-35037902
Email: conference2021.dypsoa@dypatilarch.com Website : www.dypatilarch.com



AJEENKYA
D Y PATIL UNIVERSITY | THE INNOVATION
UNIVERSITY

THE 3rd EDITION

NATIONAL STUDENTS CONFERENCE

RESEARCH IN ARCHITECTURE

Organized by

D Y PATIL SCHOOL OF ARCHITECTURE

in association with

**MAHARASHTRA ASSOCIATION OF SCHOOLS
OF ARCHITECTURE [MASA]**

ON

7th & 8th MAY 2021

Principal

Prof. Shubhada Chapekar

Published By

International Journal of Engineering Research

ISSN: ISSN:2319-6890 (online), 2347-5013(print)

ISBN: 978-93-90699-06-3

DOI :.....

Editors

Prof. Shashwati Sinhal

Prof. Prathama Jhaveri

Prof. Himanshu Manjrekar

Prof. Seema Paulzagade

D Y PATIL SCHOOL OF ARCHITECTURE

Ajeenkya DY Patil Knowledge City, Charholi (Bk), Lohegaon, Pune-412 105 Ph: 020-35037902

Email conference2021.dypsoa@dypatilarch.com Website : www.dypatilarch.com



THE 3RD EDITION

NATIONAL STUDENTS CONFERENCE

RESEARCH IN ARCHITECTURE

Organized by

D Y PATIL SCHOOL OF ARCHITECTURE

in association with

**MAHARASHTRA ASSOCIATION OF SCHOOLS OF
ARCHITECTURE [MASA]**

ON

7th & 8th MAY 2021

Published By

International Journal of Engineering Research

ISSN: ISSN:2319-6890 (online), 2347-5013(print)

ISBN : 978-93-93694-35-5

DOI : 10.17950/NSCRA.10.S2.2021.1-667

Editors

Prof. Shashwati Sinhal

Prof. Prathama Jhaveri

Prof. Himanshu Manjrekar

Prof. Seema Paulzagade



Message from Chairman

I am pleased to write once again for the **National Students Conference on Research in Architecture**.

I believe the students have taken well to this platform and are contributing to research meaningfully.

We hope to make this annual event even bigger in the next few years.

I congratulate the Management, Principal, Convener and organizing committee, staff and all students on this occasion and I wish the conference a great success.

Dr. Ajeenkya D Y Patil

President, Ajeenkya D Y Patil University, Pune
Chairman, Ajeenkya D Y Patil Group

Message from Advisor

I am delighted to welcome you all for this **3rd Edition of National Students Conference on Research in Architecture**, hosted by D Y Patil School of Architecture, Lohegaon, Pune.

I have been associated with this conference since its first edition and I am proud to see the progress and growth since the beginning.

This conference is another milestone for the school towards its goal of being the center for Research and Innovation in Architecture.

This edition of the conference is being hosted on virtual platform; I am sure it will be a grand success as the previous two editions.

My Best wishes to everyone associated with the students conference.

Dr. Sushant Patil,

Advisor,

Ajeenkya D Y Patil University, Pune

Message from MASA President

Maharashtra Association of Schools of Architecture (MASA) works extensively to promote meaningful activities for students of Architecture. These activities are meant to support the core education of architecture and to widen their knowledge by exploring avenues for research.

‘Tappolum hi Sadhanam’, research is ‘toppolum’ and ‘sadhanam’ is a continuous process which happens with a lot of efforts and patience. Being in an unpredictable situation of the COVID 19 pandemic, we are all going through a change, a turmoil. Changes occurring around us are of two types- a change in human being and a revolutionary change. The present situation is a revolutionary change which is affecting everything around us, as well as bringing changes in the Architectural field. Our approach to architecture is going to change dramatically post pandemic and if this is not addressed, it will lead to serious problems. Knowledge, Skill, and design are basic components of architecture. Research is very essential in contributing towards knowledge of Architecture. Acknowledgement of the fact that the situation has changed and knowing the purpose of research is the first step of research. The identification of the target group involved in research is yet another step of research. Designing the methodology of research suiting the purpose is also crucial. Clarifying the significance of research is also critical. Encompassing all these essential components research is a very important tool with us which holds the ability of bringing change in the society. Research helps in creating a platform from where the journey of every individual starts, and hence this kind of Students Conference for Research in Architecture, in Pune, is one such initiative where MASA is happy to be a Knowledge Partner for the 3rd edition of the conference.

We congratulate D Y Patil School of Architecture, Lohegaon for organizing and successfully conducting this conference and look forward to the fourth edition.

Thank you & Best Wishes!

Dr. Ujjawala Chakradeo

President, MASA

Message from Principal

It is my pleasure to write down my thoughts on the **3rd Edition of National Students Conference on Research in Architecture 2021**. After successfully hosting the previous two editions of the conference, we have received an overwhelming response to the 3rd edition of the conference which also marks the beginning of our tenth year in education.

This 3rd edition is special because it is the first time, we are hosting this online, and I am sure this will enable more students to participate and benefit.

Research inculcates good habits and unbiased thinking. It helps one to make informed decisions and develop an inquisitive mindset laying down the foundation of a successful professional. The value of research is immense to the field of Architecture. The kind of topics selected, and the work done at such a young age is very promising. I am glad to see that the students have taken this opportunity to present a broad range of research to a jury on a live platform. This also shows the curiosity and enthusiasm of the students to go beyond Architecture and surely this bodes well for the profession. I also appreciate the support provided by the institution heads to their students for participating in the conference and especially the teachers who have guided the students to achieve the research objectives. I thank MASA for continuing to be our knowledge partner and supporting us since the first edition of the conference.

I congratulate the convener Prof. Shashwati Sinhal and her team of dedicated faculty and students on successfully hosting this event. I also appreciate the hard work put in for the success of the conference by the teaching and non-teaching staff of DY Patil School of Architecture. I would like to mention the support received from the paper reviewers and the panel of judges who gave their time and valuable inputs for the conference.

The overwhelming response from the students from last three years has given us a lot of encouragement and we look forward to expanding the reach in the 4th edition of the conference.

Wishing the best to all the participating students and organisers!

Prof Shubhada Chapekar,
Principal,
DYPSOA, Lohegaon, Pune

Message from Convener

It was a privilege and honor to be the Convenor for the **National Students Conference on Research in Architecture 2021, 3rd Edition**, organized on a virtual platform this year by D Y Patil School of Architecture, Lohegaon, Pune with the support from our knowledge partner, Maharashtra Association of Schools of Architecture (MASA). The response received for this third edition of the conference from the schools of Architecture, students and faculty was overwhelming and beyond description.

This Conference is one of its kind which provides a platform for students, to identify topics and methods in architectural research and present them. It aims to inculcate research culture in architecture and encourage students to understand the values of interrelationship of various disciplines within. The conference is open for students of the undergraduate program, post graduate program as well as research scholars enrolled in any recognized University. The two days of the conference consisted of total 11 sessions with 7 sessions of B. Arch, 4 sessions of M. Arch and 1 session for PhD.

Research is an important aspect in architecture, which can contribute to bridging the gap between practice and academics.

As quoted by Vitruvius, *“the successful architect and engineer should have both theoretical and practical knowledge based on a broad and deep understanding of all the sciences, arts, and even nature.”*

With sending out the first flyer in the month of November '19, journey of the 3rd edition of the National Student Conference 2021 on Research in Architecture commenced. The experience of hosting was different from the previous conferences and more challenging as it was on digital platform. I am sure each one of us has got enriched with the knowledge, guidance & insights shared by all the panel members as well as the paper presenters.

My special gratitude to our Principal, Prof Shubhada Chapekar, for her constant encouragement and guidance. I extend my gratitude to the Co-convener, Prof Prathama Jhaveri, who was a key member of the core team. Without her crucial contribution to the conference, it would not be a success. The core committee members, Prof Seema Paulzagade and Prof. Himanshu Manjrekar deserve acknowledgement for their diligent work and consistent efforts.

The message is incomplete without mentioning the student coordinators from 4th year B. Arch Apoorva Patil, Avanie Gangwal, and Srushti Panchal. My special thanks to the authors for writing research papers and the paper presenters, panel members, paper reviewers for being a part of the conference.

Keep following us on social media for updates on the upcoming edition of the conference.

Prof Shashwati Sinhal,
Associate Professor
DYPSOA, Lohegaon, Pune

Conference Committees

Chief Patron



Dr. Ajeenkya D Y Patil

President, Ajeenkya D Y Patil University, Pune
Chairman, Ajeenkya D Y Patil Group

Advisor



Dr. Sushant Patil,

Ajeenkya D Y Patil University, Pune

Principal



Prof. Shubhada Chapekar

D Y Patil School Of Architecture, Pune

Convener



Prof. Shashwati Sinhal
Associate Professor, DYPSOA

Co-Convener



Prof. Prathama Jhaveri
Associate Professor, DYPSOA

Faculty Coordinators



Prof. Himanshu Manjrekar
Assistant Professor, DYPSOA



Prof. Seema Paulzagade
Associate Professor, DYPSOA

Documentation Committee-

- Prof. Sunayanee Banerjee
- Prof. Madhuri Patil

Invitation Committee-

- Prof. Arya Unde
- Prof. Karan Choudhary
- Prof. Aprajita Kaushik

Registration Committee-

- Dr. Amit Kaur
- Prof. Rupali Kale
- Prof. Jeens Thomas

Printing Committee-

- Prof. Jeens Thomas

Technical Committee-

- Prof. Pooja Godbole Soman
- Prof. Shital Golhar
- Prof. Sheetal Tiwari
- Prof. Rasika Medhekar
- Prof. Nikita Pawar
- Prof. Sanjyot Kamalwar
- Prof. Salman Shaikh

Admin Staff

Mr. Mayuresh Lanjekar
Ms. Poonam Kotkar
Ms. Poonam Gaikwad
Mr. Prashant Jadhav
Mr. Digambar Patil

Student Co-ordinators

Apoorva Patil
Srushti Panchal
Avanie Gangwal

- Prof. Jeens Thomas,
- Prof. Sanjita Maindargikar
- Prof. Neha Bagade,
- Prof. Yogesh Kawade

Inauguration & Valedictory Committee-

- Prof. Swati Solunke
- Prof. Nikita Pawar
- Prof. Shweta Raut
- Prof. Nilesh Pore

Social Media Committee-

- Prof. Nishigandha Sakhardande
- Prof. Himanshu Manjrekar

Photography Committee-

- Prof. Raturaj Kulkarni
- Prof. Nilesh Gaikwad
- Prof. Amit Shirke
- Prof. Sanjita Maindargikar

Registration Committee-

- Prof. Veena Shenvi
- Prof. Aanchal Rawal

Student Committee-Online Support Team

Sakshi Diwan
Preetam Kulkarni
Anoushka Sengupta
Deepanshi Jain
Sayali Phadatare
Yachi Johari
Yashika Pardeshi
Shubham Prajapati
Aishwarya Wadkar
Priyanshi Garg
Atharva Dhawale
Ishna Singh
Nivedita Silveri
Rinkal Chaudhary

Panel Members

Dr. Ujwala Chakradeo
Prof. Jayshree Deshpande
Dr. Abhijit Natu
Dr. Kartik Vora
Dr. Supriya Nene
Prof. Laxmi Nagraj
Prof. Suruchi Ranadive
Prof. Ritu Deshmukh
Prof. Vidhya Singh
Prof. Gauri Shiurkar
Prof. Priya Gokhale
Prof. Radhika Vaidhya
Dr. Tarika Dagadkar
Prof. Renuka Chutke

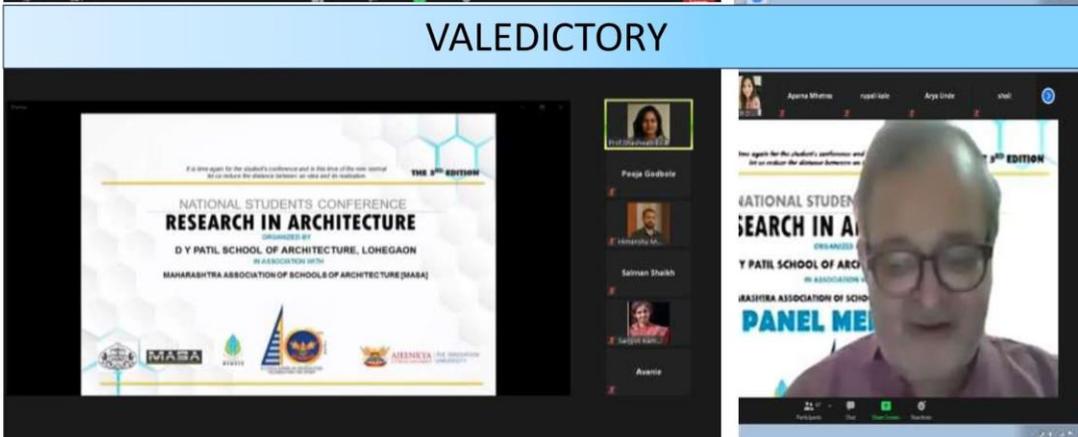
Paper Review Committee

Dr. Ujwala Chakradeo
Ar. Pushkar Kanvinde
Prof. Anil Kulkarni
Dr. Parag G Narkhede
Prof. Laxmi Nagraj
Dr. Arati S. Petkar
Dr. Supriya Nene
Prof. Ritu Deshmukh
Prof. Suruchi Ranadive
Dr. Neeta Lambe
Prof. Renuka Chutke
Dr. Amit Kaur
Prof. Kamini Singh
Prof. Aditi Lanke

List of Winners

Sr. No.	Category	Name of Winner	Name of Institution	Position Secured	Title of Research Paper
1	B.Arch	Mrunmayee Pawar	CTES College of Architecture, Chembur	1 st	Art in Progress Reminiscing the Art & Heritage of the City
2		Arunima Karukayil	D Y Patil School of Architecture, Lohegaon	2 nd	A study of biophilic design to build educational spaces for autism
3		Sanyukta Kulkarni	Marathwada Mitra Mandal's College of Architecture, Pune	3 rd	Healing through built environment: architectural elements and design guidelines
4		Nupur Phadnis	PVP College of Architecture Pune	Special Mention	Changing faces of river and new development along river and its relationship and effects on the historic built fabric on its bank.
5		Apoorva Patil	D Y Patil School of Architecture Lohegaon	Special Mention	The study of acoustical traditional Japanese landscape elements by recommending design interventions for Pune-Okayama-friendship Garden, Pune, India.
6		Roshni Shethia	SMEF'S Brick School of Architecture Pune	Special Mention	Tiny Houses: A Future to Better Living Spaces in Pune
4	M.Arch	Ar. Shrutika Keluskar	CTES College of Architecture, Chembur	1 st	Ubiquitous city services for BioMedical Waste Management Systems in Thane district
5		Ar. Kasturi Bhandakkar	Bharati Vidyapeeth (Deemed to be University) Pune	2 nd	To assess the thermal performance of types of dynamic façade in an office building in hot and dry climate with simulation tools
6		Ar. Chetana Airani	Bhanuben Nanavati College of Architecture Pune	3 rd	Evaluating the Impact of Rooftop Greening Methods on the Urban Microclimate at a Neighbourhood Level (Residential)"
		Ar. Samruddhi Desai	Bharati Vidyapeeth (Deemed to be University) Pune	Special Mention	A study of Carbon Neutrality Assessment Factors in the existing certification system for green campuses in India
7	Ph.D	Ar. Avani Topkar	Lovely Professional University, Punjab	Special Mention	Review of Research of Ghats in India
8		Ar. Prachi Aiyer	Dr. Babasaheb Ambedkar Technological University, Raigad	Special Mention	WIND SPEED CHANGE WITH HEIGHT IN BUILT ENVIRONMENT
9		Ar. Sneha Sharma	Lovely Professional University, Punjab	Special Mention	Review of Methodological Approaches for the study on Housing Preferences

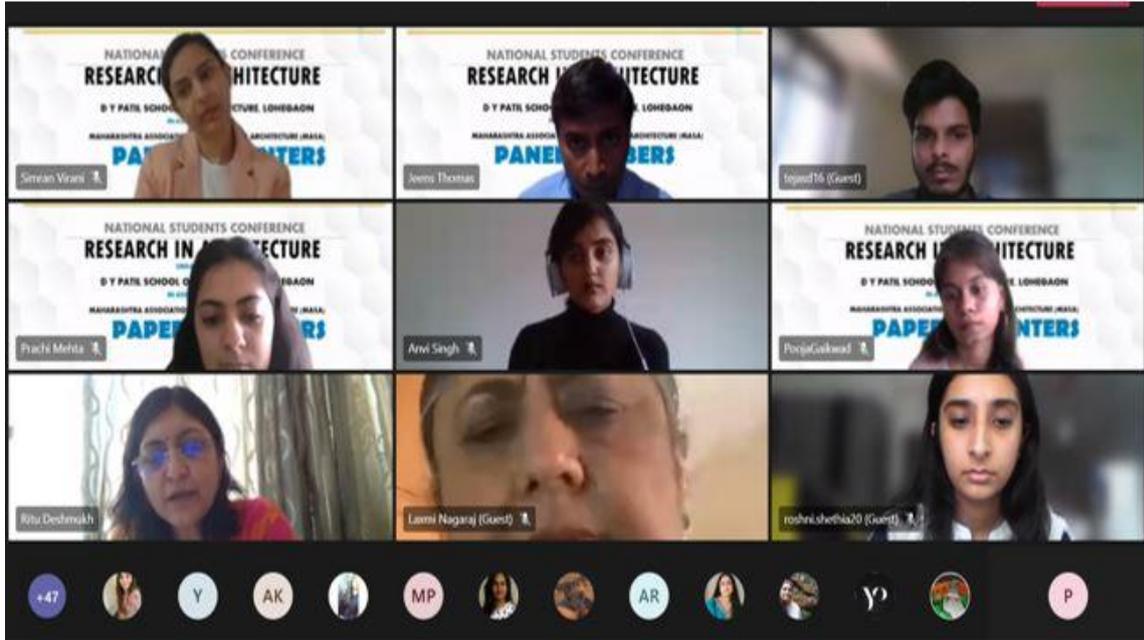
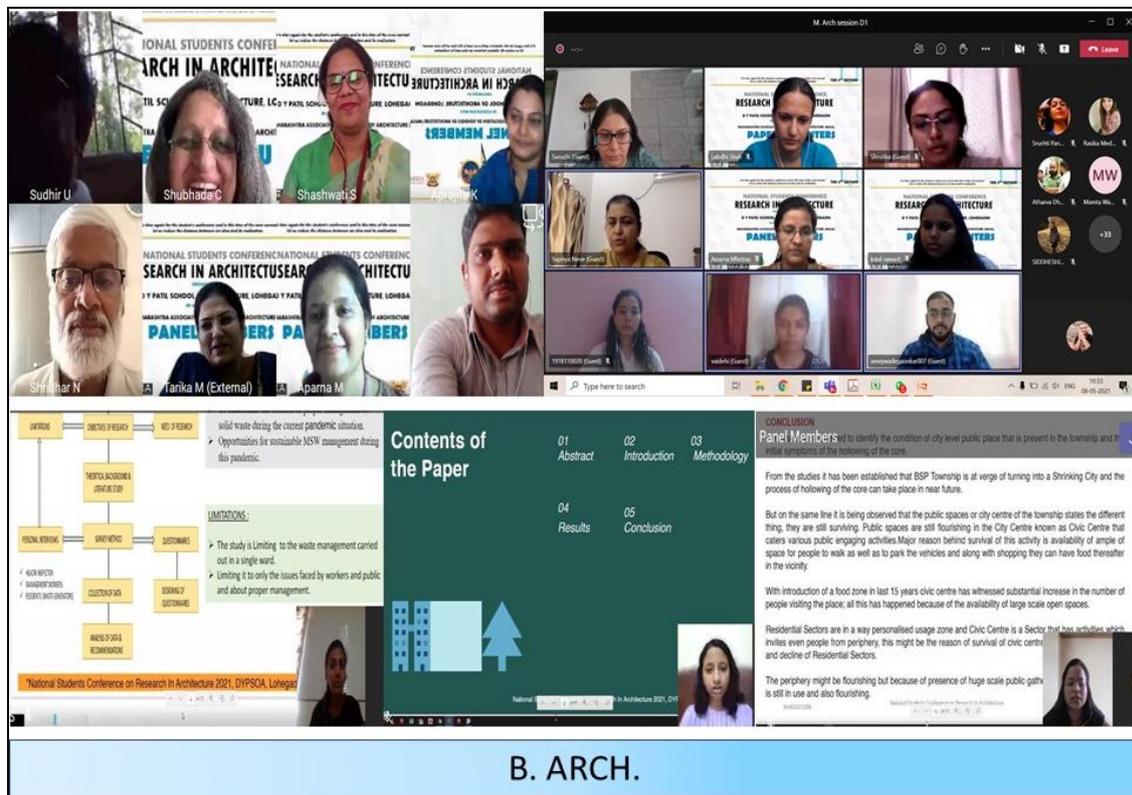
Inauguration and Valedictory



DYPSOA Faculty with Invitees



B.Arch Session

Contents of the Paper

- 01 Abstract
- 02 Introduction
- 03 Methodology
- 04 Results
- 05 Conclusion

CONCLUSION

Panel Members

From the studies it has been established that BSP Township is at verge of turning into a Shrinking City and the process of hollowing of the core can take place in near future.

But on the same line it is being observed that the public spaces or city centre of the township states the different thing, they are still surviving. Public spaces are still flourishing in the City Centre known as Civic Centre that caters various public engaging activities. Major reason behind survival of this activity is availability of ample of space for people to walk as well as to park the vehicles and along with shopping they can have food thereafter in the vicinity.

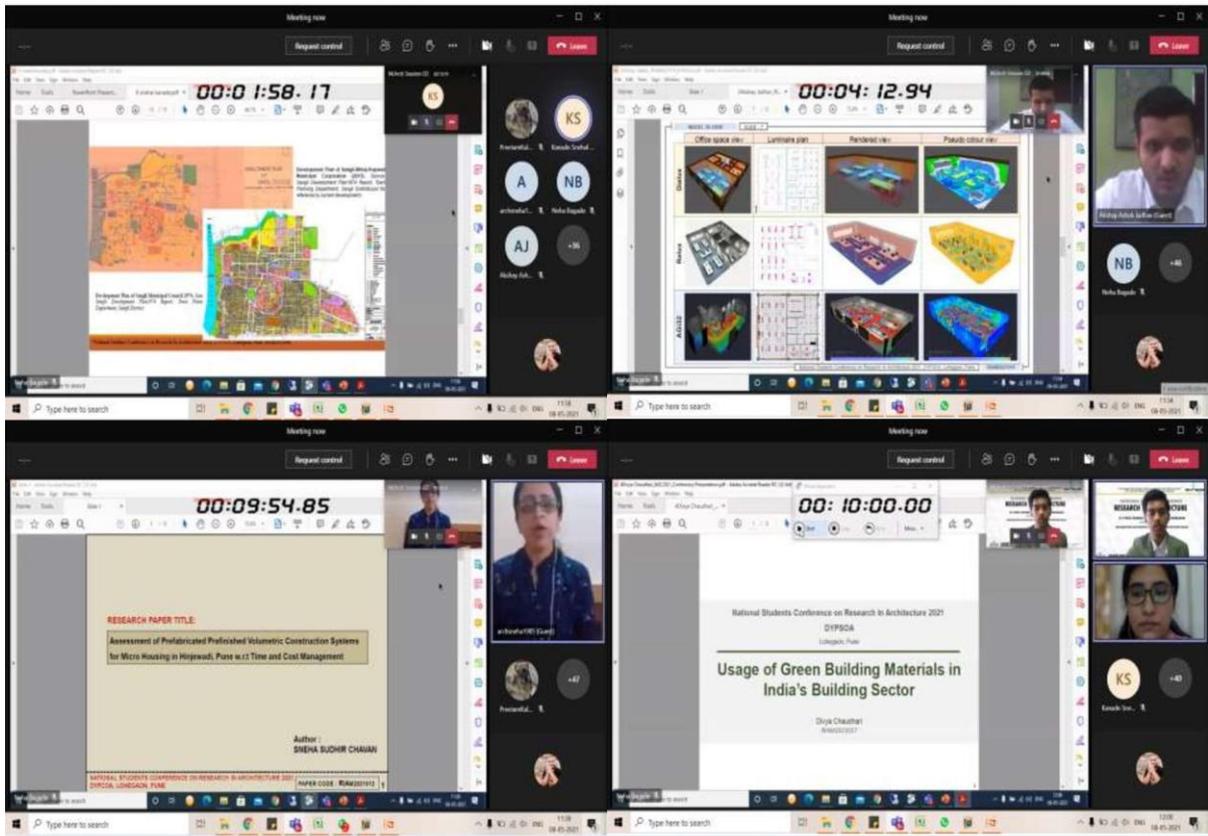
With introduction of a food zone in last 15 years civic centre has witnessed substantial increase in the number of people visiting the place; all this has happened because of the availability of large scale open spaces.

Residential Sectors are in a way personalised usage zone and Civic Centre is a Sector that has activities which invites even people from periphery, this might be the reason of survival of civic centre and decline of Residential Sectors.

The periphery might be flourishing but because of presence of huge scale public path is still in use and also flourishing.

B. ARCH.

M.Arch Session



M. ARCH.

Ph.D Session

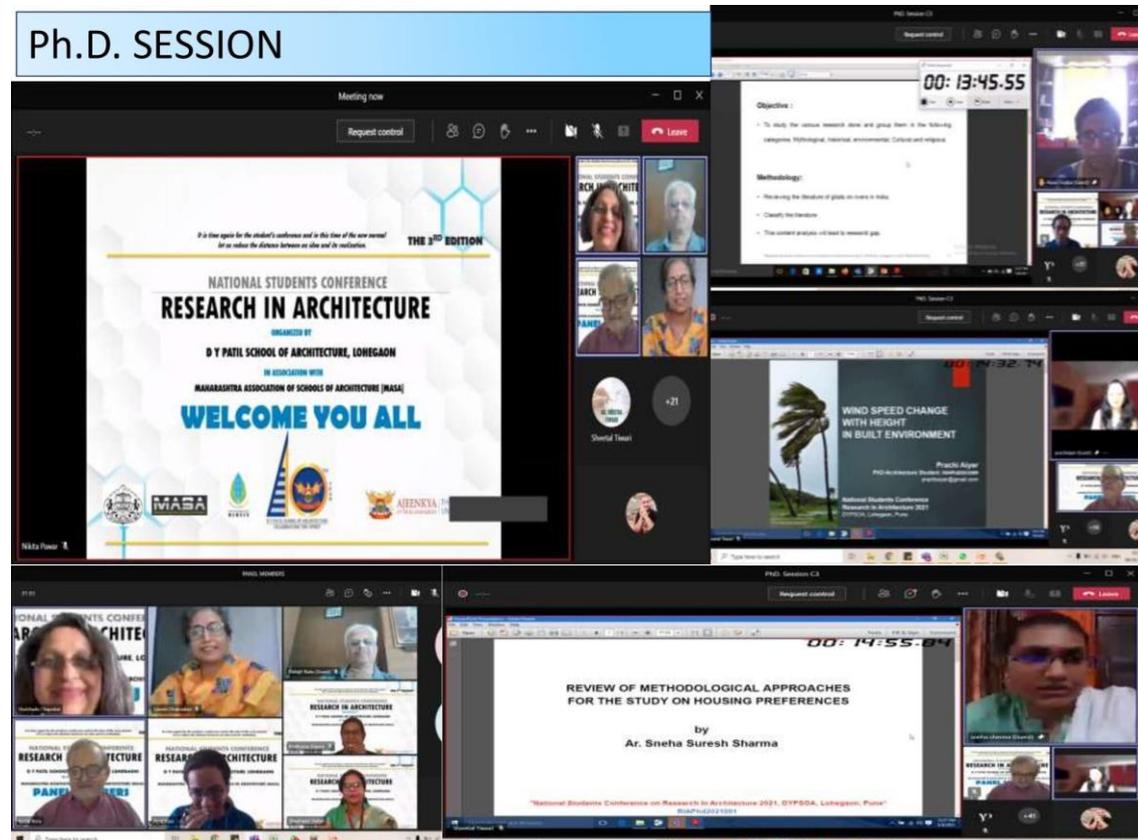
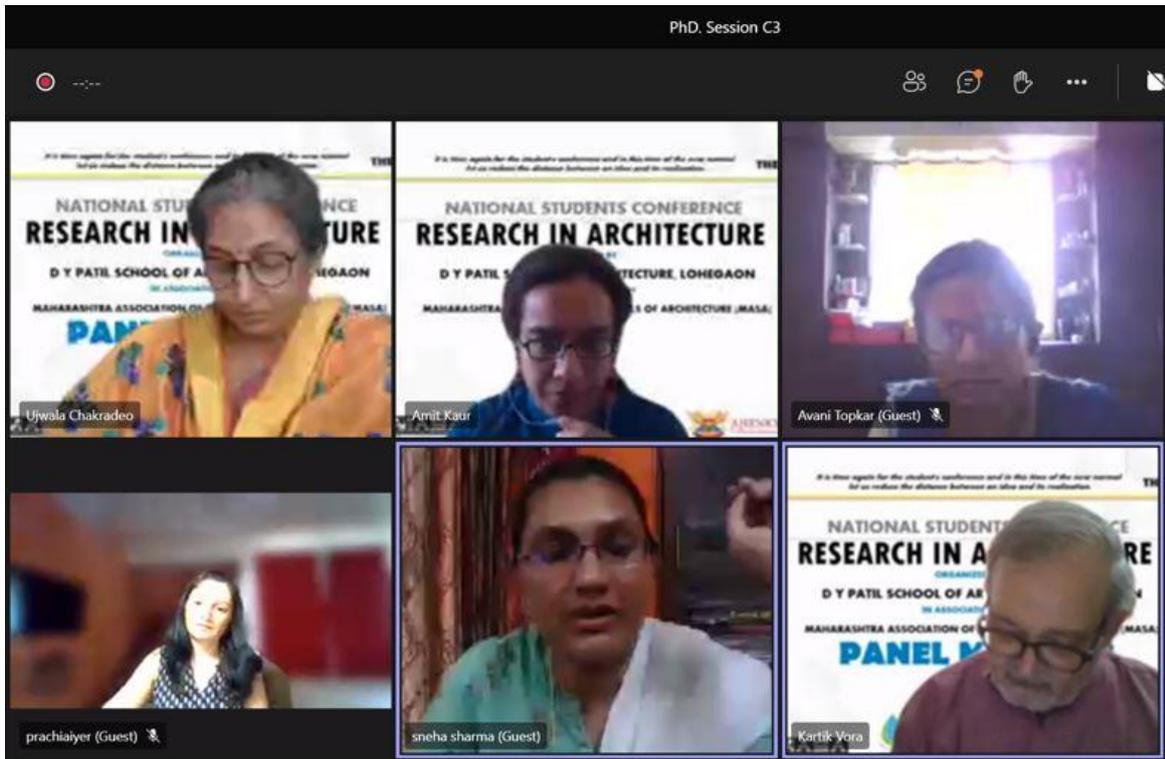


Table of Contents

S No	Name	Paper Titles	Page No.
B.Arch Papers			
1	Aanchal Bhattad	Minimalism in Architecture: By Architect B.V. Doshi in Ahmedabad	01-03
2	Abhishek Mote	Validation of Kevin Lynch's Theory of Imageability In Context to Rural Settlements	04-07
3	Aditi Bodhe	Understanding The Lifestyle Of Tiny House Residents And Development In India	08-11
4	Aditi Jain	Impact of kinetic façade on indoor environment	12-15
5	Aditi Lele	Multi-sensory art galleries-an elemental study	16-19
6	Aditya Kanchan	Amelioration of shape polymer molecules in ventilators	20-22
7	Akshata Patil	Continuity of Indian Architectural traditions in Contemporary Architecture	23-26
8	Akshay Bafna	Analysis of Open Spaces in High-Rise Buildings in Pune	27-30
9	Alafiya Talib	The Surreal Beauty of Architecture: Appraising the ideologies and notions of Antoni Gaudi by traversing through his masterpieces	31-35
10	Aniket Tayade	Investigative Study on Quality of Ambient light in Temples: Case Study of Temples in Pune district	36-41
11	Anushri Shetty	Pollinators and the city	42-47
12	Anvi Singh	Impact of Illumination of Heritage Monuments on their Overall Footfall	48-51
13	Aparna Kher	Living Environments for Outstation Students	52-54
14	Apoorva Jagtap	Contribution of Market to Urban Areas	55-58
15	Apoorva Patil	The study of acoustical traditional Japanese landscape elements by recommending design interventions for Pune-Okayama-friendship garden, Pune, India.	59-63

16	Arunima Karukayil	A study of Biophilic design to build educational spaces for Autism	64-69
17	Atharvi Netragaonkar	The role of bylaws in Architectural Pedagogy	70-74
18	Avanie Gangwal	Daylighting Innovative techniques	75-80
19	Bharat Rolaniya	Need of Open Green Spaces in New Delhi to Mitigate Air Pollution	81-85
20	Devyani Kumavat	Design concern for Seating area in Stadium structures	86-88
21	Divyani Deokar	Shared Open Spaces: In the neighbourhood of PCMC	89-95
22	Drishti Nahar	Traditional and modern architecture: replacement or co-existence	96-98
23	Farida Fidvi	Re-tailoring the podium and tower form for high-density mixed- use development in Mumbai	99-104
24	Gargi Gokhale	Redevelopment guidelines for Shimpri Ali, KasbaPeth, Pune	105-109
25	Haritha Meyyappan	Study of adaptive facades for a sustainable environment	110-112
26	Harshada Hikare	To study origami structures and formulate how they can be used as a quarantine facility unit in Mumbai, by comparing various forms of origami structure concerning its materials.	113-118
27	Himanshi Furia	Psychological impact of colours on interiors spaces in retail stores	119-122
28	Ishita Singh	Reviewing fractal geometry as a design aid in architecture and township layouts	123-126
29	Janhavi Hinge	Paper in architecture	127-131
30	Kaiwalya Apte	Structural system and design strategies of Earthquake resistant Structures with the study of Koti Banal Architecture Uttarakhand	132-134
31	Kasturi Kulkarni	Traditional architecture of Sikkim	135-139
32	Kevin Shah	A.C.T.I.V.E. _ Altering Cognition Through Interactive and Voluntary Engagement	140-145

33	Lata Adwani	Parametric Architecture - Horizons of Future	146-149
34	Madhur Agrawal	Sustainable facade for commercial buildings	150-154
35	Manali Vaishnav	User circulation in multi-specialty hospital: A study of overall satisfaction and way-finding difficulties in lobby area	155-160
36	Manasi Bhuskute	Translation of Political Ideologies into Architecture: A Case of Democratic Architecture	161-164
37	Manasi Thakre	Architecture in mines	165-168
38	Mohini Sathe	Façade Design of High-Rise Housing Building in Warm and Humid Climate with the focus on Mumbai	169-171
39	Moullie Jain	Achieving functional efficiency through flexible housing options.	172-175
40	Mrunal Pandit	Title of paper: study on upgrading infrastructure in Mirkarwada fishing harbour(Ratnagiri)	176-178
41	Mrunmayee Paranjape	Need based architecture: use of its principles in urban housing	179-183
42	Mrunmayee Pawar	Art in Progress: Reminiscing the art and heritage of the city	184-189
43	Nandita Tole	Understanding the problems faced and recommend solutions to implement traditional facades in modern architecture.	190-196
44	Navneet Savaliya	Learning from indigenous architecture: a case of gujarat	197-200
45	Neev Rathod	Eco Resorts In India: Case Study of Resorts In Western India NeevRathod, Ar. RamiyaGopalakrishnan, Dr. VaidehiLavand	201-204
46	Neha Dandawate	Feasibility of Concrete Roads in India	205-208
47	Nikita Vinchurkar	Vegetal Concrete Walls: Hempcrete a carbon sequester.	209-213
48	Nupur Bohara	Study of effect of open spaces on the people living in housing societies and their sense of well being	214-217
49	Nupur Phadnis	Changing faces of river and new development along river and its relationship and effects on the historic built fabric on its bank.	218-222

50	Omkar Dandwate	Rebirth of Architecture after Covid 19 and the new perspective for public spaces.	223-228
51	Pooja Agrawal	Relativity of colour in class room design	229-233
52	Pooja Gaikwad	Sustainability In High Rise Architecture.	234-238
53	Poorva Joshi	Understanding the factors that affect human satisfaction in office buildings	239-243
54	Prachi Mehta	Re-Thinking Urban Markets An amalgamation of public markets and open spaces	244-246
55	Prachita Patil	Studio apartment as a multifunctional space	247-249
56	PradnyaBhokare	Reduction of Carbon footprint by planning a new settlement with sustainable materials	250-253
57	Pradnya Mahajan	Waterworks and Hydraulic System in Mughal Gardens, India	254-256
58	PrajaktaHulyalkar	Use of Maratha Architectural elements in the streetscapes of Pune: case of Bajirao road from Abhinav chowk to AppaBalwant chowk.	257-260
59	Pranali Lad	Skill Development for Rural Entrepreneurship: A study of Palghar district	261-263
60	Pranjali Marathe	Understanding the effect of the metro on the surrounding neighbourhood'sliveability	264-266
61	Prarthana Parate	Challenges faced by the architects while adapting vernacular architecture into contemporary architecture style.'	267-270
62	Prarthana Patel	Site selection criteria for destination five star hotel	271-273
63	Pratha Kanpara	Entwined - A Textile Innovation Hub	274-279
64	Pratiksha Thakur	Rethinking school designa case of zila parishad school.	280-282
65	Pratiksha Mahakulkar	Criticalchallengesinthemanagementofheritageconservationinindia	283-286
66	Prerana Godambe	Human psychology in spaces of confinement context of prison	287-291
67	Pritish Jain	Iconic architecture definition, needs and impacts	292-295
68	Priyanka Dharmadhikari	Need and Feasibility of Adaptive Reuse of Industrial sheds.	296-299
69	Rachit Joshi	Virtual creation A Science Interacting with the Real World without Altering Reality_	300-304

70	Rashi Agrawal	Analysis of 'climate responsive strategies'– ingenious way to energy efficient and sustainable architecture	305-308
71	Revati Dass	Optimal Healing Environment – Accelerating Patient Recovery by Changing the Built Environment	309-312
72	Riddhi Gupta	Container Housing : Study of the economic feasibility of container housing in Pune.	313-317
73	Rinkal Chaudhary	Impact of organic architecture on human psychology	318-321
74	Roshni Shethia	Tiny Houses: A Future to Better Living Spaces in Pune	322-325
75	Rucha Pimlapure	Study of architectural factors affecting the community spirit of the neighbourhoods in pune	326-334
76	Rujuta Killedar	Institutional Landscape Design : Impact assessment of tangible and intangible aspects of designed open spaces in Architecture Institute	335-338
77	Saloni Jain	Diversifying Space Planning Against Exterior Dominance	339-341
78	Samruddhi Dubal	Analysing Different Types of Lateral Opening for a Display Area of Painting Galleries.	342-345
79	Samruddhi Naik	Grasscrete paving system-a step towards eco-friendly streets	346-349
80	Samruddhi Shinde	Parametricism and biomimetics in architecture	350-353
81	Sanika Pandit	Comparative study on factors affecting residential satisfaction in cosmopolitan and old/core areas of Pune city	354-356
82	Sanyukta Kulkarni	Healing through Built Environment: Architectural Elements and Design Parameters	357-360
83	Saurabh Gaikwad	Evolution of Senses & Enhancing the Vision through Architectural Design Spaces for the Blind and Visually Impaired	361-362
84	Saurabh Jagtap	An eco resort	363-365
85	Shanu Rathi	Impact of sadarbazaar street on user safety	366-368
86	Shravani Awati	Outdoor Gyms and Its Impact on Human Behaviour in Pune	369-371
87	ShreeshaBidkar	StreetFurnitureParticipates To Add Value To TheStreets.	372-375
88	Shrotri Pooja	Analysis of geometry in plans of 'Sangameshwar temple' and 'Baneshwar temple' with respect to 'Samarangansutradhara'	376-379

89	Shubha Rao	Wayfinding in alzheimer's healthcare centre	380-383
90	Siddhi Somani	Healing Centre: Evoking the Human Senses	384-387
91	Simran Virani	Evolution of mosque architecture over the centuries, an overview of contemporary mosque architecture	388-393
92	Sneha Dhotre	Bamboo: A futuristic construction material	394-396
93	Srushti Panchal	Role of womens' lifestyle in spatial planning in pol houses, in Ahmedabad	397-400
94	Supriya More	Survey on necessity of hydroponics system for future indian cities. (study on architectural perspective)	401-404
95	Suyash Sherekar	The Relevance of Cultural Centers in the Urban Context	405-407
96	Tanaya Shah	Reactivating Urban Voids	408-410
97	Tanesh Junawane	Digital Tectonics with Brick as a Module	411-417
98	Tanisha Nair	Re-design of prison with respect to colors in a therapeutic manner- exploring the co-relation between mind and architecture.	418-420
99	Tanmay Sawant	Retrofitting towards resilience. strategies of resilient houses in roha (konkan).	421-424
100	Tejas Dholam	Urban equity-transforming kumbharwada	425-428
101	Tejasvini	Biomimicry in architecture - a case of airport design	429-431
102	Tungar. Manas	Artificial Intelligence" in Architecture: Changing patterns in architectural practices.	432-435
103	Utkarsha Pardeshi	Utilisation of raw waste materials from industry	436-437
104	Vaidehi Pande	To study the rebound phenomena in slum rehabilitation projects	438-440
105	Vaishnavi Gokhale	Impact of architectural environment in enhancing the comfortable conditions for pets in shelter homes- a case study on dogs.	441-445
106	Vandana Sharma	Green spaces in drug rehabilitation centre	446-449
107	Vedant Vyas	Cultural hub at Central Pune: Redevelopment of Balagandharva Rangamandir.	450-454
108	Wrick Ash	Impact of physical Office Environment on the Productivity of College Teachers.	455-458

M.Arch Papers			
109	Ar. Vaidehi Pusadkar	Investigation of the environmental impacts of large scale Hindu festival celebrations in Pune in contemporary times.	459-462
110	Ar. Nandita Shah	Aspects of heritage management proposal for M.I.G Highschool building in Kolhapur, Maharashtra	463-467
111	Ar. Anusha Akki	Challenges and strategies of solid waste management during covid-19 conditions at Kalaburagi	468-473
112	Ar. Akshay Jadhav	Comparative Analysis of Simulation Tools for Artificial Lighting Design in Office Space	474-478
113	Ar. Shrutika Keluskar	UbiquitouscityservicesforBioMedicalWasteManagementSystems in ThaneUrban	479-482
114	Ar. Sneha Chavan	Assessment of Prefabricated Prefinished Volumetric Construction Systems for Micro Housing in Hinjewadi, Pune with respect to Time and Cost Management	483-486
115	Ar. AmeyWadegaonkar	A study of everyday urbanism and the meanings that it creates for people - a case of Mutha river Pune	487-494
116	Ar. Samruddhi Desai	A Study of Carbon Neutrality Assessment Factors in The Existing Certification System for Green Campuses in India	495-498
117	Ar. Kajal Sawant	Influence of External Obstruction on Daylight Simulation in Residential Building	499-502
118	Ar. Anuja Joshi	Investigating survival of public space in a shrinking city: Study of Civic Centre in Bhilai Nagar	503-509
119	Ar. Chetana Airani	Evaluating the Impact of Rooftop Greening Methods on the Urban Microclimate at a Neighborhood Level (Residential)	510-513
120	Ar. Kasturi Bhandakkar	Assessing thermal performance of Dynamic Façades in office building for hot and dry climate.	514-519
121	Ar. Pallavi Pathak	Feasibility analysis for preparing management plan for revitalisation of heritage places of old Nashik city – precinct Saraf bazaar	520-524
122	Ar. Divya Chaudhari	Usage of Green Building Materials in India's Building Sector	525-529

123	Ar. Tanvi Gupta	Role of outdoor spaces in architecture education	530-533
124	Ar. Snehal Kanade	Socio-Economic Impact of Princely States, a Case Study of Sangli-Miraj-Kurundwad-Budgaon States	534-545
125	Ar. Swati Godbole	Exploring reasons of load bearing construction technology for bungalow structures being phased out from prevalent construction practices.	546-549
126	Ar. Nidhi Shah	Comparative analysis of awareness towards green buildings amongst Common people and Building professionals	550-553
127	Ar. Madiha Patel	INSIGHT INTO TENSEGRITY STRUCTURES	554-557
128	Ar. Kuheli Roy	Role of Toys For Improving Physical & Mental Health of Children	558-562
129	Ar. Komal Jumade	Adaptation Device: Toilet Accessories for Disabled	563-566
130	Ar. Govinda Bhutada	Drone technology in Construction Project Management	567-570
131	Ar. Pranjal Jagtap	Lifecycleassessmentofgreenhouse(GHG)emissionsfromexistingandprop osedmunicipalsolidwaste management strategies.	571-574
132	Ar.Baba Meshram	Study of Street Vending & Different Types of Vending Carts	575-579
133	Ar. Varun Sarang	Precast Concrete Construction technology for CIDCO Housing in Navi Mumbai.	580-583
134	Ar. Rahin Khan	Investigating the effectiveness of passive design strategies in Mosques at Gulbarga	584-588
135	Ar. Ketaki Deshpande	Place making: A project management tool for developing inclusive student communities	589-591
136	Ar. Kamala Kulkarni	Theoretical Review of a “Health-Wellbeing- Green” Approach In Design And Construction Practice for a Pandemic Resilient Office Interior Fit Out	592-596
137	Ar. Urvashi Shroff	Evaluation of Daylight Distribution in a Hospital room with Complex Fenestration System in Hot & Dry Climate	597-599
138	Ar. Pankaj Kotalwar	Study of environmental Impact of municipal solid waste disposal on Mojenagar, Lohegaon	600-603

139	Ar. Neha Thosar	Post Disaster Site Management	604-608
140	Ar. Minal Lonare	“Study of Environmental Awareness and Environmental Attitudes among Students”	609-612
141	Ar. Swapnil Kanitkar	Facilities management of interior spaces in IT companies (locker management system)	613-616
142	Ar. Sameer Chouhan	Effective communication in construction industry	617-619
143	Ar. Gauri Patel	Risk Analysis and Risk Management in Residential Construction Projects	620-624
144	Ar. Mamta Wani	Noise Pollution due to Construction Activities	625-629
Ph.D Papers			
145	Ar. Prachi Aiyer	Wind Speed Change with Height in Built Environment	630-633

NOTE: The following two authors have withdrawn their papers from publication:

1. Ar. Sneha Sharma
2. Ar. Avani Topkar

Minimalism in Architecture: By Architect B.V. Doshi in Ahmadabad

Aanchal Bhattad, Ar. Vaidehi Lavand, Ar. Ramiya Gopalakrishnan, Ar. Ketaki Gujar
SMEF'S Brick School of Architecture, Pune
Email: aanchalbhattad1999@gmail.com

Abstract: *Minimalism is designing with the clear intention of how space will be used throughout the day and to identify the important element and eliminate the one that is not necessary. In architecture minimalism is more than a style as a lifestyle as proved by - D. Vasilski in her research paper 'Minimalism as one the most usable aesthetically – functional pattern'. In this research paper different aspects of design like organization, planning, façade, materials are discussed. Projects of B.V. Doshi are taken that are built in Ahmedabad to make the comparison easy. Institute projects are taken up as case-study, all case-studies involve different age groups.*

Key words – Minimalism, material, planning, simplicity, nature.

INTRODUCTION

In today's fast-growing world where everything is available at one click, it is easy to get distracted and get attached to materialist things. De cluttering i.e. removing the unnecessary and keeping the things that are important helps us to find peace. Simplicity in architecture is showing structural elements, with limited texture and colour palette keeping in mind the climate and context. As there are no set boundaries for minimalistic architecture, it is usually in rectangular geometry as that space is flexible to use with integration of open spaces.

Ornamentation in architecture is far by the most widely used in ancient times and somewhat in present. Through the classical architecture to Rococo, ornamentation evolved and Rococo was the epitome of ornamentation. All the elements used to make the space with gilded and ornamentation was reflected even in furniture, products and jewellery. The Industrial Revolution on 19th-century architecture led to mass- production of iron and steel, the use of steel was first seen in the public sector for building roads and bridges. People started designing more of an industrial type, one example of this is Eiffel tower in Paris which is considered ornamented by few and crude by others. Later in the late 19th century, the Bauhaus movement led the development of modern art and modern thoughts, characterized by economic sensibility, simplicity, and a focus on mass production which will make elements easy to fix, handle, construct and transportation. Open plan, use of glass, organized spaces and fine craftsmanship were the highlights of Bauhaus style. We owe a great amount for some of the major concepts, mediums, and functions of art that we see present today in the vast mix of media known as Contemporary form. 'Less is more', Mies Van Der Rohe put on the impression of a space in a bold yet subtle way. One such architect who was a pioneer of the modernist movement in architecture was Le Corbusier. Along with Mies and Walter Gropius, Le Corbusier was instrumental in the creation of the international style. This movement was described in rectilinear forms, open interiors, and weightless

structures. The design principles that Le Corbusier advocated function as form. On the other hand many in the process of late modernism, Ar. Louis Kahn who was also called the pioneer of modern architecture used brick and concrete in new and special ways and paid careful attention to the use of sunlight. Both these architects contributed to the modern architecture movement in their own style and philosophy. India was in need of that, after independence definitely it was necessary to start. Prime Minister Jawaharlal Nehru had such a bold vision for the independent area and invited Cobusier to design Chandigarh a city in India. Corbusier and Louis Khan were working in Ahmedabad where B.V. Doshi was a local architect who had also worked with Cobusier in Paris. Doshi's early practice is seen to be influenced by Cobusier's work and his practice reflects on ideas that aim to root architecture in a larger context of culture and environment as well as social, ethical, and religious beliefs. For this research Doshi's three Institutional buildings are taken for case study as they are public buildings with different age groups that would allow comparison between a variety of user experience and planning. All three are located in Ahmedabad to make it easy for comparison.

METHODOLOGY

Case study 1: CEPT University, Ahmedabad.

1. Design and concept: While designing this institute Doshi had in mind the idea of having no restriction for the exchange of ideas and thoughts through an informal environment. There is this journey that Doshi focuses on where the structure unfolds itself. A proper working environment has been created which facilitates faculty and students to teach, learn and interact anywhere. Keeping in mind the user group that is adults there are a lot of nooks and corners to promote interaction and create pause points. The scale of open spaces allows different activities to take place in the same area.
2. Circulation and Organization:

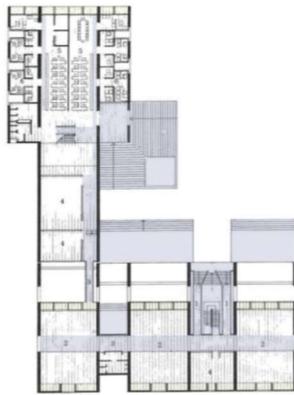


Figure 1: CEPT Plan, Ahmadabad

Leaner plan with circulation space is aligned to the courtyard/ public spaces that promote interaction at different levels. The circulation space equals the habitable space. The changing scale of circulation space defines the kind of activity and the volume of space. This arrangement of the blocks and volumes creates a story through the amount of light entering. The linear planning guides the visitor through a series (Private, semi-private, and public) of spaces making circulation easy.

3. Facade Design: different elements unpretentiously contribute to the subtle look of the facade. it becomes a part and at the same time an aesthetic element of the picture. The frame is created to bring focus at the center staircase and the rest repetitive elements act as a background, creating a simple facade with interesting elements at a few intervals. Use of exposed concrete with brick gives a raw feel to the structure with the use of red and yellow colour at intervals to attract they eyes of public.

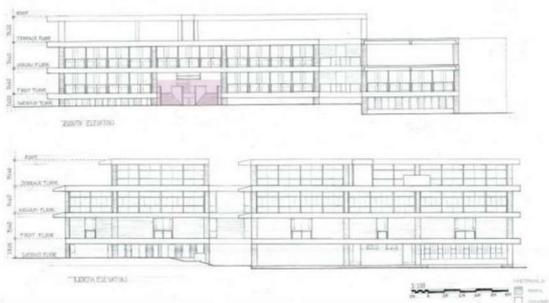


Figure 2: CEPT Elevation, Ahmedabad

Case study 2: Institute of Indology, Ahmedabad

1. Design and Concept: The Institute for Indology in Ahmedabad is one of the Balkrishna Doshi's first project so Cobusier's influence is seen in the structure. He has uses wide pathways for circulation which also become interactive space at different nodes. To preserve the rare manuscripts and their dissemination he proposed a well-light and ventilated half-buried basement. Light plays an important role in the building to define the space and the activity. All the elements were

incorporated in a reinforced concrete form to give building the form of a ship and the detailing of wooden haveli. The intricate thought are very much explained in a subtle way, rather than ornamentation as done in the past but still maintains the character of the place.

2. Organization: The overall planning divides along an axis which is the major part of the circulation. The passage along the block becomes a public space for interaction. The blocks are arranged along a single passage that branches out from the main foyer.

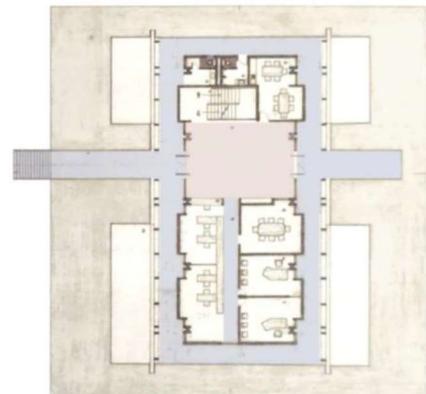


Figure 3: Institute of Indology, Ahmedabad

3. Facade: All the elements one seen in the building are inspired from traditional Indian architecture double stories, veranda of full length, high levels of plinth. Raw look is achieved with the used of exposed cement. Simple geometry on the façade created by brise-soleil that is made up of concrete which helps to reduce heat gain and greats an aesthetic grid too. Opposing the grid, angular lines are used in the semi basement that creates interest to further explore the structure.

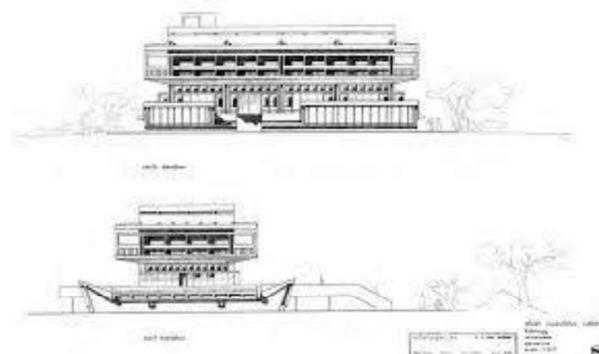


Figure 4: Institute of Indology, Ahmedabad

Case study 3: Shreyas School, Ahmedabad

1. Design and Concept: As it is a school for kids, it is designed in a way which makes way finding interesting and also due to the brise-soleil window there is visual

connectivity with outdoor green spaces and creates a sense of security. Children are more connected to nature due to open planning and open courtyards between every two blocks. Interiors have white paint to reduce heat gain and for space to appear big.

2. Organization: The blocks are arranged in alternating patterns along a single corridor or, where at each part one side of the corridor connects you to nature outside; this unconsciously brings the feeling partly inside and outside. This simplicity in planning makes way finding easy and courtyards between these blocks bring in good light and ventilation.

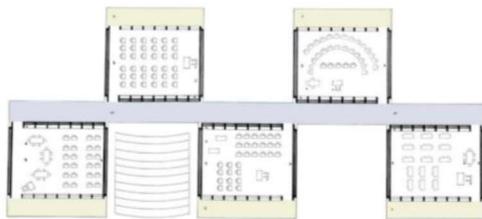


Figure 5: Shreyas School, Ahmedabad

3. Façade: This project has interesting façade with brick envelope on west, windows in north and south. The roof helps in passive cooling of the building. North façade has clear storied window at top and brise soleil window at the bottom which brings in enough light and ventilation and allows children to connect to the outside. Exposed concrete on outside and white on the inside makes the structure look light on the inside and raw on outside.

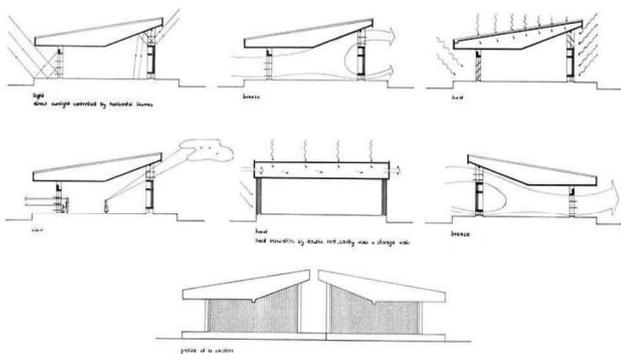


Figure 6: Facade design of Shreyas School, Ahmedabad

CONCLUSION

In conclusion the paper helps in understanding different aspects of minimalism. Though there are not set guidelines for minimalism, there are a few ways minimalism can be achieved. While planning simple circulation is preferred with clear division of public, semi-public and open spaces. Every room should have windows for interaction with nature and the flow of fresh air. Colour palette should be limited to create a simple and serene environment. Structural members can be exposed and in its true form in a de-cluttered space. Lastly minimalism is a lifestyle and with gradual steps can be explored further to create an individual's unique identity, that will reflect in their choices and architecture as well.

ACKNOWLEDGEMENT

I would like to extend my gratitude to my faculties, Ar. Vaidehi Lavand, Ar. Ramiya Gopal and my guide Ar. Ketaki Gujar for guiding me. Other than this I would like to thank my family for supporting me and motivating me throughout the course. I would also like to thank D.Y Patil College for giving me the opportunity to share my research on their platform.

REFERENCES

- (Vasilski, 2016)*
- (Nikita Mehta, 2019)*
- (<https://www.sangath.org/>, 2017)*
- (Students' Council, 2014)*
- (Matt, 2013) (Amin, 2019)*
- (Vasilski, Academia, n.d.)*
- (Amin, 2019)*

Validation of Kevin Lynch's Theory of Imageability In Context To Rural Settlements

Abhishek Vidyadhar Mote

Fourth Year B. Arch

Marathwada Mitra Mandal's College of Architecture, Pune- 4

Email ID- abhishekmote110@gmail.com

Guide- Ar. Ravindra Patwardhan

Abstract: Any built- unbuilt environment has its characteristics and one creates an image of that environment. Kevin Lynch in his book, *The Image of the City*, tossed the theory of imageability which emphasizes the physical quality of an environment. The main objective of the paper was to validate the relation between the imageability and the rural context. The scope of this paper was limited to 3 settlements. Pilot interviews were conducted, and data was collected through wayfinding. Qualitative data was represented through bar diagram and pie chart. Paper concludes with validation of the theory in rural context.

Keywords- Kevin Lynch, Imageability, Rural Settlement, 5 Elements, Wayfinding, Referred Elements.

INTRODUCTION

Kevin Lynch in his book, **The Image of the City**, proposed the theory of imageability which emphasizes the physical quality of an environment which gives it a high probability of evoking a strong mental image in any given observer (Lynch, 1960). Literature study indicates that the theory of imageability is still significant as it widens the scope of urban design and planning practices by considering qualities of the 5 elements: **Paths, Nodes, Edges, Districts and Landmarks**. (Rully Damayanti, 2016)

Lynch's theory of imageability discusses the quality of cities according to the legibility factor of the elements that are perceived by the observers (Rully Damayanti, 2016). The degree of legibility depends on the ability of space to form a mental image (Emine Koseoglu, 2011).

To understand the role of environmental images and to establish this theory, Lynch studied central areas of three American cities: Boston, New Jersey and Los Angeles.

Two principal methods were used by Lynch to apply the theory: Interviews of a small sample of citizens with regard to their image of the environment and a systematic examination of the environmental image evoked in trained observers in the field. (Lynch, 1960)

To understand what the citizens had in their memory, directions were asked and recorded. Visual maps were prepared which presented the significant elements of a city.

On the basis of the study, Lynch classified the physical forms into the five elements.

Paths- They are the channels along which the observer customarily, occasionally or potentially moves. (Lynch, 1960) They can be roads, streets, natural trails, etc.

Nodes- They are the strategic spots in a settlement into which an observer can enter and which forms an intensive foci (Lynch, 1960). In local context, a *chawk* (where 4 roads create a junction) forms a node.

Edges- Edges are those elements which create visual boundaries for the settlements. They can be peripheral roads, a lake, hills, river, etc.

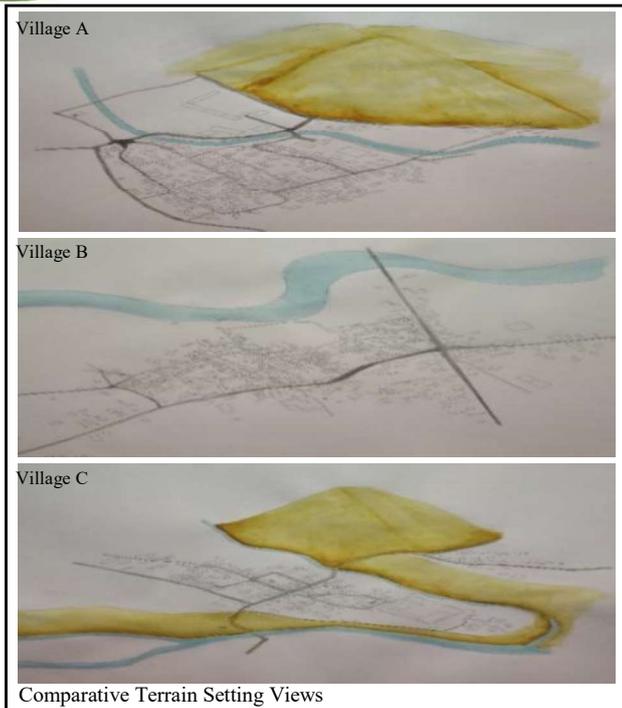
Districts- They are the medium to large sections of the settlement, which the observer mentally enter 'inside of' and which are recognizable as having some common identifying character (Lynch, 1960). Districts can be community-based clusters within a settlement, an economic section, etc.

Landmarks- They are point- references which observers can see externally. They are simple defined physical objects like buildings, sign boards, shops, etc. These elements are frequently used for clues of identity (Lynch, 1960).

RURAL CONTEXT

A human settlement means cluster of dwellings of any type or size where human beings live. They range from a hamlet to metropolitan cities. With size, the economic character and social structure of settlements changes (<https://ncert.nic.in/>).

The sparsely located small settlements having population less than 10,000 are called villages; where primary activities are in majority. Larger settlements having population more than 10,000 are called as semi-urban and urban settlements; where secondary and tertiary activities are in majority (rbi.org.in, 2011). In India, 68.84% population lives in Rural areas and 31.16% lives in Urban areas (Census, 2011). In context to rural areas, 64.1% of the population is engaged into primary



activities (Aayog, 2011) and in urban areas 9% of the population is engaged in primary activities (Point, 2011).

Literature indicates that there has been very little research on how the rural is constructed in architectural practices (Kevin Donovan, 2014).

Lynch's theory of imageability focuses on the urban environment. Therefore, the objective of this paper was to validate the relation between the imageability of an environment and rural settlements.

SCOPE AND LIMITATIONS

Only three villages of Pune district were selected for carrying out the research. Hence, it cannot be generically applied everywhere. Specified number of villages from various districts may produce general data.

METHODOLOGY

Three villages in Pune District were selected for carrying out the research; Walhe (Purandar Taluka), Morgaon (Baramati Taluka) and Wafgaon (Khed Taluka). Two aspects were addressed to validate the theory; Pilot interviews and producing data by asking for directions.

Pilot interviews of 5 persons per village were taken to list the most distinctive elements in their mind. The interviews were recorded and the elements mentioned by each subject were listed.

Origin and destination points were specified for all the villages. The distinctive elements were considered as the origin and destination points, so that the whole village can be covered through way- findings. People were asked for

directions from the origins to destination points. According to the area coverage, 3 origin and 3 destination points for Walhe, 3 origin and 5 destination points for Morgaon and 3 origin and 2 destination points for Wafgaon were identified. The route was asked to 3 random persons from each origin point to each destination point. The directions were noted on maps and the references and preferences of elements given were marked.

The on field mapped data was converted into quantitative data. According to the percentages of the five elements referred, the data was formulated into bar diagram for individual villages. Maps were prepared on the basis of the interviews, referred and preferred elements by defining their frequencies. The sample chosen was random. No specific groups or classes were addressed; however, all the subjects were the residents of the respective villages and had an idea of the village environments.

Village A- Walhe, Purandar Taluka.

It is a large village with population of 4747 (Census, 2011). It is connected with a State Highway. A water stream (odha) passes through the village. The natural setting of the settlement is on flat land with mountains on north-eastern side. The settlement is spread across an approximate area of 0.31km².

Village B- Morgaon, Baramati Taluka.

It is a large village with population of 5321 (Census, 2011). It is connected with Jejuri- Baramati road. The natural setting of the settlement is on flat land with river Karha on northern side. The settlement is spread across an approximate area of 0.67km².

Village C- Wafgaon, Khed Taluka

It is a small village with population of 3004 (Census, 2011). It is situated near Rajgurunagar. The main settlement is on flat land and is surrounded by hills. The settlement is placed between river Welu and a water stream. The settlement is spread across an approximate area of 0.17 km².

RESULTS

Figure 2; the bar diagram represents the percentages of elements referred by the sample while giving the directions asked.

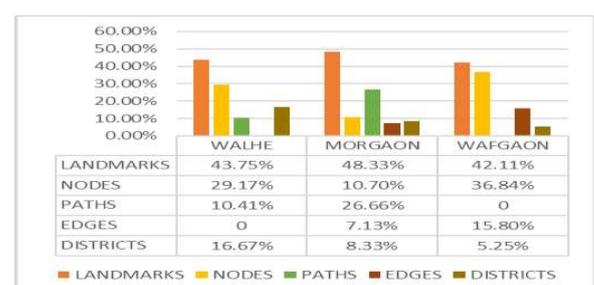
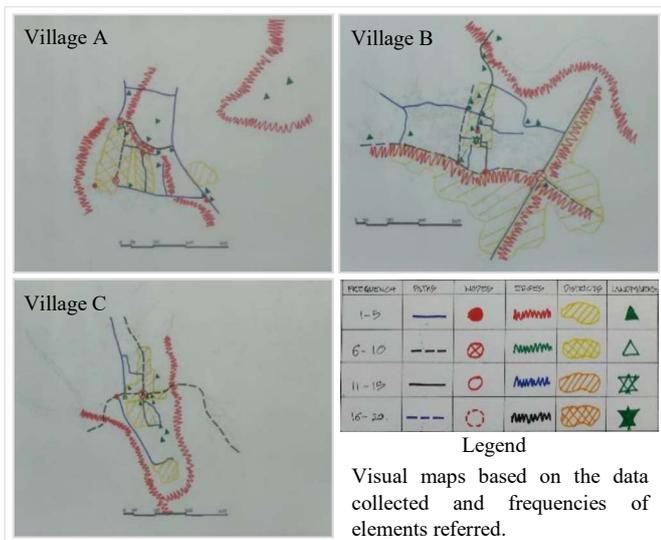


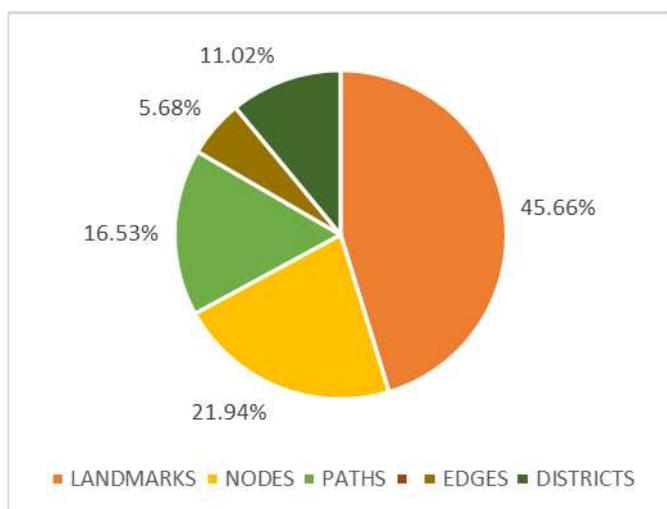
Figure 2

Figure 3 shows the maps of the three villages produced on the basis of the frequencies of the elements referred and preferred.



Figure

Figure 4; Pie chart indicates the average percentages of the elements referred in all the three villages.



Figure

DISCUSSION

According to Lynch, out of the five elements, Paths are the most significant. But, results direct that paths were only referred for 16.26% as elements of wayfinding. Paths are significant as they create the linkages between the other elements. Out of the five, Landmarks were the most referred (45.53%) elements. Nodes were second most referred elements (21.94%).

Excluding Landmarks, the percentages of all four elements varied considerably. In Walhe, referred paths were 10.41%, in Morgaon, 26.79%, while in Wafgaon, the percentage was 0; i.e. no paths were referred while giving the directions. The fluctuation of percentages may be because of the varying

settlement areas and the road connectivity. Morgaon being the largest among the three, more percentage of people gave references of paths and Wafgaon being the smallest, 0% people referred paths.

In rural context, the identified or referred elements were not only built structures but also natural features. In Wafgaon, the river and the water stream created a visual edge. The whole settlement is built in- between these two water features and a small hillock has to be crossed to reach the village. Similarly, in Walhe, a series of mounts called Saat Ranjan was referred. The 7 mounts have historical significance and it creates a visual edge to the village. A temple on a hill was a landmark; along with the built temple, the hill also was the part of references. In Morgaon, the passing river created a visual edge and because of its historical significance, it was mentioned as a landmark. As such natural features were mentioned or referred by the subjects, they helped in creating the image of the village.

In few cases of paths, the preferred roads were also marked and included in maps but, were excluded from the final percentages as they were preferred paths for reaching a destination and were not given as references. Paths were also referred in cognitive patterns i.e. referencing w.r.t. the surroundings like the district which they are in or by right- left directions, etc.

Based on the research carried, all the 5 elements were referred or were the part of the sample memory. Further research can be carried out on these significant elements helping in developing electronic navigation systems for rural settlements.

CONCLUSION

The paper concludes that all the 5 elements were referred in rural settlements and can be used for both, wayfinding and designing environments. In context to rural settlements, the elements can be either built structures or unbuilt natural elements. Hence, the theory of imageability is valid in rural settlements.

ACKNOWLEDGEMENT

I sincerely express my deep sense of gratitude to Ar. Ravindra Patwardhan, Ar. Jyoti Jain Tholiya, Ar. Manas Marathe for extending their valuable guidance and support during this research.

REFERENCES

- i. (2011). Retrieved from rbi.org.in: https://rbi.org.in/scripts/bs_viewcontent.aspx

HYPERLINK

"https://rbi.org.in/scripts/bs_viewcontent.aspx?ld=2035" \l

Understanding The Lifestyle of Tiny House Residents And Development In India

Aditi bodhe, Co-author – Assistant Prof. Mahesh Bangad
(a17031.aditib@bnca.ac.in, mahesh.bangad@bnca.ac.in)

Dr. Bhanuben Nanavati College of Architecture, Karvenagar, Pune, Maharashtra

Abstract: Tiny houses around the world encouraging people to cut down the cost of living and live simply meaningful lives with only essential things. Because large homes comes with larger expenses and cost of living becomes much higher. The phrase “Less is More” by Architect Ludwig Mies van der Rohe perfectly describes the term multifunctional and minimalistic space. “Tiny house movement” started in US to encourage the simpler and affordable lifestyle for the people. Introducing tiny house concept in India would be an effective solution for many people. The results will be analyzed to explore the aspects of life of residents through the survey.

Keywords : Tiny house, Lifestyle, India, Cost effective, Affordability

INTRODUCTION

Every home has an expression as it reflects people's personality and character they reside in. Nowadays, social, economical and cultural values are affecting needs of a person.

People need to understand that you don't always need a large space to build a house, the way you utilize the space is the most important factor. This will lead to a simple and low maintenance life. A tiny house can be minimalistic and yet multifunctional. With an increase in the size, cost of homes people might reconsider their housing situation.

'Tiny house Movement' started in US But the concept of tiny home has been observed in other developed countries like Australia, Canada, Germany, Japan, UK and many more. Tiny house movement is a social movement where people are choosing to downsize their lives by keeping only the essential basic things. Many people are challenging themselves and reconsidering their housing situations to have an independent, affordable and simpler lifestyle. The purpose of the study is to contribute to the understanding of the people why they chose small space living in terms of house satisfaction, controlling the house size, cost, utilization of space, environmental concerns and sustainability.

Aim

- To understand the motivations and challenges amongst the tiny house residents
- To develop the concept of a tiny house in India to have an affordable lifestyle

Background

Looking at the current situation, the increase in population and urbanization in India, Designing tiny houses in India would be one of the great solutions for many people to have an independent and affordable lifestyle. There is no doubt that tiny houses will play a vital role in our housing and sustainability strategies.

Tiny houses can be defined in many ways. There are many predictions possible according to different people.

- Tiny houses are dwelling units on a small scale, a structure less than the area 500 sq.ft.
- A single unit that includes the basic needs of a person.
- Designed and built on the principles of affordability, sustainability, mobility.
- Living with only the essential things by cutting down the unnecessary things.

Tiny homes offer a different way of living which provides some very clear benefits of efficiency and peace of mind. Some of the important benefits are:

- i. Cheaper in cost.**
- ii. Freedom of movement:** Allows you to have a flexible schedule.
- iii. Easy to maintenance:** less space, less energy use means low maintenance.
- iv. Harmony with nature:** Allows you to relate to the surroundings more.
- v. A simpler life:** Offers to have an independent and affordable lifestyle.
- vi. Multifunctional:** Smart way of utilization of spaces.
- vii. Minimalism:** Tiny houses are restricted to minimalist approach due to lack of space.
- viii. Customizing your own house.**

Tiny houses are different in terms of functions than the other traditional houses. They also comes with pros and cons. Less space, less storage space but less expense, less maintenance and less energy use. These spaces can also be treated as vacation homes, temporary housing, studio apartments, guest house or office spaces.

DATA COLLECTION

Case studies of tiny houses in India:

The bunkhouse is designed with adequate ventilation and is hygienic. These units can be moved from one place to another. It includes the basic necessity of a person. The company Buy-India.biz manufactures and sells these homes.



Figure 1 Tiny House in India

Recently, an architecture student Arun Prabhu from Chennai has built a mobile house SOLO.01 on an auto rickshaw. He tried to raise awareness about small scale architecture than entails better utilization of space and affordable housing by building a portable house on an auto rickshaw. The total cost of construction is 1 lakh for the 36 sq.ft portable house on wheels which can fulfill the needs of a person.



Figure 2. Interior views of the house



Figure 3. SOLO.01

Solo 0.1 includes a foyer, living area, kitchen, bathtub and toilet are on a same level and sleeping space, workspace on the mezzanine level at 3.5 ft height. The main purpose of this idea was to offer a solution to cities that are facing a housing crunch and struggling for space. This can be utilized much as temporary housing for people or emergency housing during any natural calamities.



Figure 4. A Home on Wheel – SOLO.01



Figure 5. Interior of SOLO.01

The Nash Tiny House is located on unused family property outside of Starkville, United States of area 648 sq.ft. This is a weekend home owned by a couple. The house includes a living area with a kitchen and dining area and sleeping loft and entrance porch. The

location has lot of advantages as it is far from the urban chaos.



Figure 6. Nash Tiny House, US



Figure 7. Interior view of the house

LITERATURE REVIEW

Tiny house movement has become very popular in other countries like US, Germany, Sweden and many more. People have realized the importance of de-cluttering the lifestyle and the effects of tiny houses on community and environment. A tiny house consists of essential things an individual needs with multifunctional spaces by the smart use of storage space. Living in a small space makes a person independent and free from the urban chaos. This realization has made some people to take a step forward to adopt the lifestyle that offers freedom, affordability and other aspects of life. These houses are a great solution for students, people who want to be independent, for temporary housing. A small space can be utilized in many ways by keeping it minimalistic.

METHODOLOGY

The study has been conducted through qualitative research using the tiny houses case studies and available interviews of residents from the media of the other countries since there is not enough awareness about it in India. The survey was conducted to explain people from Pune what exactly small space living means and the benefits of small space living. The data has been analyzed through the survey, literature study and case studies.

The result might lead to changes in the current situation to improve the design of utilization of space and development of tiny houses in India.

RESULTS

People need to understand what attracts people to shift to the small space living to consider the housing situation in future urban planning. The result has been analyzed to show how this study can help for the development of tiny houses in India.

Customizing your own house using sustainable material, affordability, mobility are the most common reasons from the people of US. This lifestyle focuses less on material things and more focus on other aspects of life. Such small residential spaces can also fulfill day-to-day needs of an individual or a couple with all the necessary functions.

A tiny house varies in type, size and configuration ranging from 400 Sq.ft. A tiny house could be built on:

1. **Tiny House on Foundation:** In this case, the building material and the construction should be selected according to the site.
2. **Tiny House on Wheels:** Allows people to have an adventurous lifestyle and to move and reside in different locations. This is an effective solution for temporary housing.
3. **Tiny House Community:** People can come together and build their house units on a single plot. It can be an apartment with other indoor/outdoor amenities. This concept can also be accommodated into urban housing situation.

The most important aspect of tiny house is multifunctional spaces and modular furniture designed to multiple purposes. There are many ways a small space can be utilized by:

- Keeping the window to wall ratio high, better light and ventilation can be achieved.
- Utilizing the space under the staircases.
- Adding loft to kitchen for a bed or workspace.
- Replacing doors with sliding walls to let space breathe.
- Adding skylights to the rooms can give the natural light.
- Partition walls to divide the space instead of walls.

The majority of survey participants were students (age group 18 to 25) who live alone or far from family. Among all the participants, 64% people would like to settle down in a tiny house and 32% people might reconsider their housing situation to downsize their lifestyle. As seen in figure 9, interest in design and sustainability and environmental factors are found to be the most common reasons to live in tiny houses. As well as, affordability and freedom to travel can be the motivations to change the lifestyle to small space living. These small spaces could be improved by utilizing the space properly and make the house more habitable. Deciding to shift to tiny house lifestyle will allow the residents to live happier by de-cluttering the non-essential things and focus on what's more important.

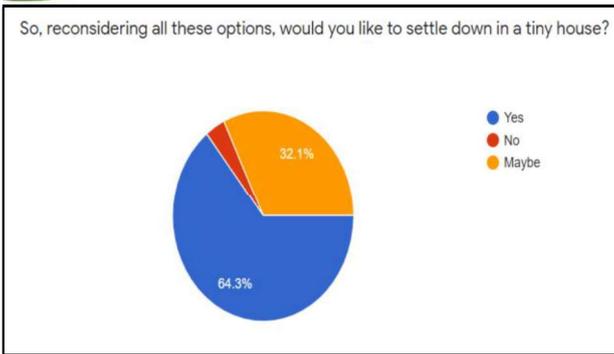


Figure 8. Analysis chart from the survey

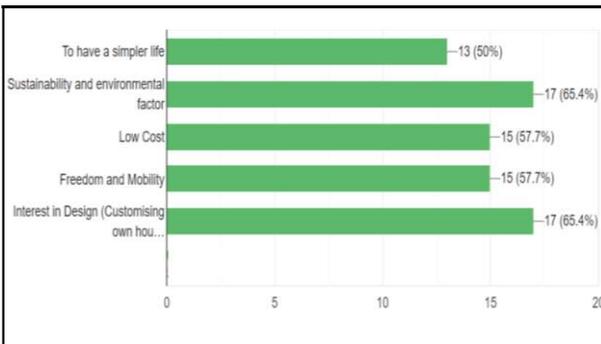


Figure 9. Tiny House Motivations Result from the survey

CONCLUSION

- Sustainability and customizing the house are the most common reasons to live in a tiny house other than affordability, freedom and mobility.
- Small space living can be considered as a different housing situation as most of the people (age group 18 to 25) would like to adopt the tiny house lifestyle.

The future research could be done on

- The construction methods and materials for tiny houses in India based on the different regions.
- How to consider tiny houses in future urban housing situation.

ACKNOWLEDGEMENTS

I would like to thank my mentor Prof. Mahesh Bangad for being my mentor and guiding me throughout the process. Secondly, I would like to thank all respondents who participated in this study.

REFERENCES

- i. Case study in India
<https://tinyhouseblog.com/pre-fab/tiny-house-of-india/>
- ii. Case study (SOLO.01, India)
<https://www.thebetterindia.com/216174/tamil-nadu-architect-sustainable-home-on-auto-rickshaw-solar-innovation-nor41/>

iii. Case study (Nash Tiny House, US)
https://www.archdaily.com/913640/nash-tiny-house-archimania?ad_source=search&ad_medium=search_result_all

iv. https://issuu.com/aishwaryapandit0/docs/dissertation-the_tiny_house_movemen

v. https://issuu.com/alyssadanielewicz/docs/tiny_house_big_thesis

vi. <https://www.thetravel.com/no-excess-20-reasons-why-moving-into-a-tiny-house-is-super-beneficial/>

vii. <https://www.tinyhousebasics.com/fancytinyhouse/>

viii. https://en.wikipedia.org/wiki/Tiny-house_movement

ix. <https://blogs.kent.ac.uk/sustainkent/2019/11/11/how-the-tiny-home-movement-promotes-sustainable-living/>

x. <https://www.buzzfeed.com/morganshanahan/tiny-house-hacks-to-maximize-your-space>

Impact of Kinetic Façade on Indoor Environment

Aditi jain¹ | Ar. Manjusha Gokhale² | Ar. Bijal Vakharia³

1- Architecture Student | E-mail: aditi.jain0206@gmail.com

2- Faculty: Sinhgad College of Architecture, Pune | E-mail: manjushagokhale@sinhgad.edu

3- Faculty: Sinhgad College of Architecture, Pune | E-mail: bijal.vakharia.scoa@sinhgad.edu

Abstract: *To deal with the backlash of using mechanical systems for cooling this research aims to study the alternate ways in which indoor comfort could be achieved using passive cooling techniques namely through different facades and shading devices. The shading devices and the facades can be evaluated based on their thermal implications and the effect of kinetic/manipulative facade on the same. Studying this simultaneously might give us the optimal solution. Therefore, four different types of solutions will be simulated and analyze.*

Key Words: Mean radiant Temperature, Daylight Factor, Operative Temperature, Visible transmittance, Universal Thermal Climate Index (UTCI), Daylight Autonomy (DA).

INTRODUCTION:

People on average tend to spend in between 70% to 80% of their time indoors be it their home or their working space. For many years now, mechanical/man-made systems have been used to provide the desired indoor temperature, but this has an adverse effect and leads to high energy usage. Therefore, architects, ecologists, and building engineers have been seeking ways to improve indoor temperature and thermal comfort levels.

Around 35% to 40% of fossil fuels are used in the building/construction industry. To have a stable equilibrium of energy utilization and indoor thermal comfort level in a building, passive design strategies are gaining more consideration and recognition recently. There are many types of building standards, building codes, and certification systems that aim to reduce energy use while also achieving acceptable thermal conditions. Electrical lighting fixtures of buildings also have a big impact on the energy demand of buildings.

For the case of commercial and industrial buildings, electrical lighting is accounted to represent in between 20% to 60% of the energy demand. According to Fuller M. (Environmental Control Systems: Heating, Cooling, Lighting), if we maximize the daylight exposure, it would reduce this demand and if optimized properly it will also have a positive impact on the cooling demand

as natural light heats less than artificial lighting per supplied lumen on a given surface.

It was concluded, that with growing commercial and IT buildings in India there is a growing need for a sun-adaptive/kinetic façade system that could benefit nature by moderating the indoor temperature in turn reducing the need for mechanical cooling systems.

RESEARCH QUESTION:

Can kinetic/adaptive facade influence the internal temperature of a room and how it fares against other shading devices?

HYPOTHESIS:

The daylight assessment of indoor temperature will essentially be influenced by the angle of the shading device and reflectivity.

Getting the system to be kinetic/adaptive will have an advantageous and beneficial effect on thermal comfort as compared with inactive solutions.

LIMITATIONS:

The study done was done with a clear objective in mind and an organised flow of work but it was limited in some ways. Firstly, the climatic data used for the study was limited to one particular region (Delhi) and month (May). Secondly, the colour study was limited to black and white and the effect of other colours could not be taken into consideration. The third was the software limitation, Energy Plus starts the stimulations from 01:00 and the results are always stimulated for more than one day. This resulted in one of the biggest problems while stimulating kinetic facades.

METHODOLOGY:

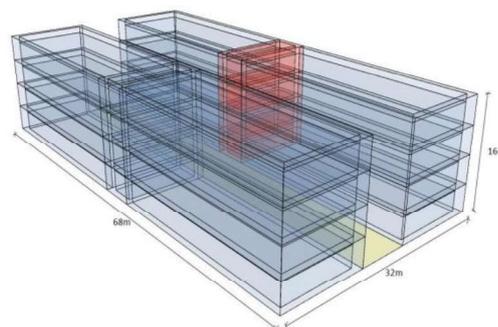


Fig.1 Simplified model of the building selected.

Initially, the climate of Delhi was analyzed during the month of May to face the maximum amount of heat as Delhi falls in the Northern Hemisphere. The area and street selected were then modelled using the software Rhinoceros 3D for visualization. A particular commercial building was then chosen from the street and a single room was modelled in detail. The room was 6m long, 4m wide, and with a height of 4m.

There were 4 floors in the building and hence the room was repeated four times stacked one above the other. Six test points were taken per room at a distance of 1m each along the length of the building. The points were taken at a height of 1.1m from the floor to avoid the heating effect of flooring materials such as tiles, carpet, or wooden flooring.

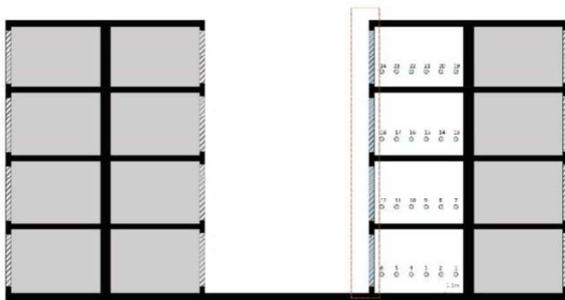
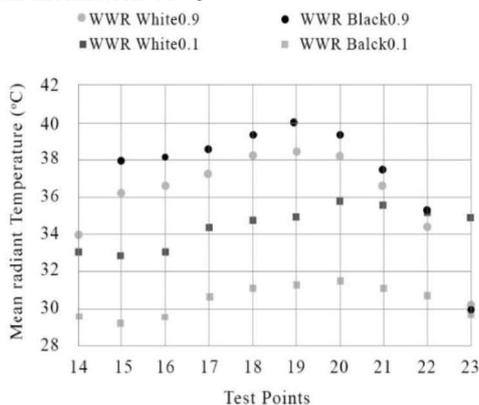


Fig.2 Section of the building displayed with test points.

Alternative 1: The mean radiant temperature and operative temperatures were observed by keeping the Wall to Window ratio at 35% without the help of any shading device.

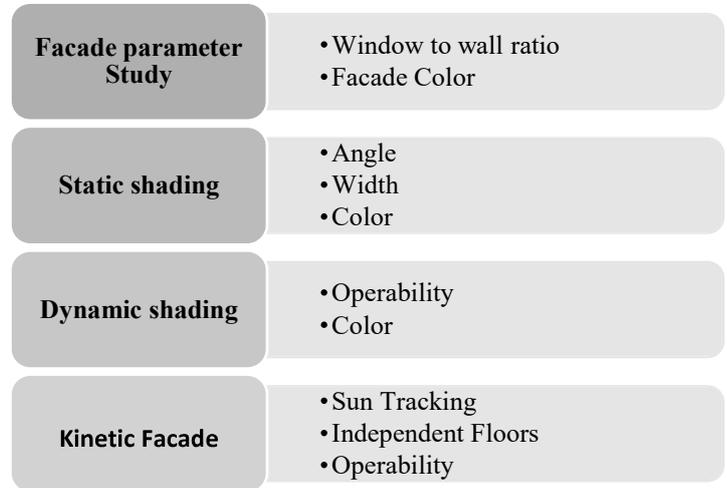
Alternative 2: The effect of a static venetian blind was studied by varying its colour and distance from the facade. The width of the louver was kept as 800 mm with an inclination of 45°.



Alternative 3: Thirdly, a dynamic exterior venetian blind was used which can be opened or closed. The width of the louvers would again be 800mm and it would be analyzed at angles 30°, 45°, 60°, and 90°.

Alternative 4: Finally, a kinetic sun-tracking shading facade was designed. Four stages were introduced in this system which changed from one to the next according to the altitude and position of the sun.

The basic workflow of the system was as follows:



All of the above-mentioned alternatives were then stimulated with help of the software Energy Plus which calculated the thermal index. Energy Plus is a building energy simulation program that engineers, architects, and researchers use to model both energy consumption—for heating, cooling, ventilation, lighting. [iv]

The occupancy of the building was considered as zero and no types of equipment were considered to be placed inside making the considerable load as only that of the building. The construction material inputs were all taken from the ASHRAE handbook [iii]. The facade colour parameters were taken as:

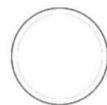
Black paint: Material – Plastic

- Roughness – 0.2
- U-value – 17 W/m²K
- Thermal_{abs} – 0.86
- RGB – 0.1
- Specularity – 0



White paint: Material – Plastic

- Roughness – 0.2
- U-value – 17 W/m²K
- Thermal_{abs} – 0.86
- RGB – 0.73
- Specularity – 0



Metal: Material – Metal

- Roughness – 0.
- RGB – 0.8
- Specularity – 0.9



The details for materials used in building construction and their specifications are listed in table 1 below.

Element	Layers	U-value (W/m ² K)
Walls	Bricks, Plaster, Paint	0.5
Roof	RCC, Roof insulation, Gypsum board	0.3
Window	Fixed window	0.8
Floor	Acoustic tile, Lightweight concrete	1.45

Table 1. Construction materials

RESULTS:

The stimulation done was that of façade parameter with no shading and window to wall ratio of 35%. The result shows that when the outer façade is painted in black the inner room temperature is higher as compared to when the façade is painted white. The biggest temperature difference noted between black and white paint is about 2°C from 12:00 to 16:00.

Fig. 3 MRT of outdoor for different Window to Wall ratio (WWR).

To further study this phenomenon in detail the window to wall ratio was changed 10% and 90% alternatively with both black and white façades. When the window to wall ratio was 10%, the façade with white colour reflected more and hence the outdoor temperature was increased whereas in black façade more heat was absorbed keeping the outdoor temperature lower. On the contrary, when the window to wall ratio was changed to 90%, the MRT of black coloured façade was more than that of white-coloured façade. It was also observed that when the window to wall ratio was increased to 90% the indoor mean radiant temperature rose to about 3°C with black façade colour.

Thereafter, was the study of a static venetian blind, dynamic venetian blind and kinetic/adaptive façade system which showed relief in temperature as compared to no shading. As can be seen in the graph (in fig4.) temperature rises to around 48°C during the hours 12:00 to 16:00 when no shading is done while the lowest operative temperature went to about 35°C.

After the inclusion of a shading device the temperature gets considerably lower with a difference of about 10°C. It is observed that dynamic venetian blind and adaptive façade work better during 07:00 to 15:00 which are the hot time of the day. This could be noted by the green and yellow lines in the graph which are lower than the blue

line. This concludes that the dynamic and adaptive system cools the room more by 1°C-2°C.

The graph also implies that there is minimal difference between a dynamic venetian blind and sun-adaptive façade system and the static solution was not too far behind in terms of effectiveness.

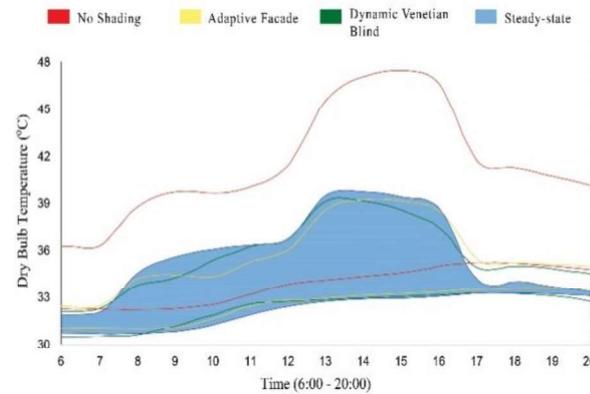


Fig 4. Min. and max. operative temperature at different test points.

CONCLUSION:

The results showed that kinetic/adaptive shading system have effects on indoor temperatures especially during hot periods. It showed the greatest solar mitigation when compared with the other 3 alternatives. Overall, the study showed a need for further research on effects of adaptive shading.

ACKNOWLEDGEMENT:

I would like to express my special thanks of gratitude to my professors Dr. Manjusha Gokhale and Ar. Bijal Vakharia as well as our principal Dr. Banani Banerjee who gave me the golden opportunity to do this wonderful research through which I learned a variety of new things.

REFERENCES:

- i. Rosa Romano, Laura Aelenei, Daniel Aelenei, Enrico Sergio Mazzucchelli What is an adaptive façade? Analysis of Recent Terms and definitions from an international perspective online- <https://journals.open.tudelft.nl/jfde/article/view/2478>
- ii. Stefano Paolo Corgnati, Enrico Fabrizio, Marco Filippi The impact of indoor thermal conditions, system controls and building types on the building energy demand online - <https://www.sciencedirect.com/science/article/abs/pii/S0378778807001454>
- iii. ASHRAE Thermal Environmental Conditions For Human Occupancy online- <https://webstore.ansi.org/Standards/ASHRAE/ANSIASHRAE552020>
- iv. EnergyPlus Department of Energy's (DOE) Building Technologies Office (BTO) online- <https://energyplus.net/>

- v. [v] Arya Ashtiani, Parham A. Mirzaei, Fariborz Haghghat (2014) *Indoor thermal condition in urban heat island: Comparison of the artificial neural network and regression methods prediction - online:*
<https://www.sciencedirect.com/science/article/abs/pii/S0378778814002382>
- vi. Jens Böke, Ulrich Knaack, Marco Hemmerling (2020) *Automated adaptive façade functions in practice - Case studies on office buildings online-*
<https://www.sciencedirect.com/science/article/abs/pii/S0926580519306673>
- vii. Rana Abdollahi Rizi, Ahmad Eltaweel (2020) *A user detective adaptive facade towards improving visual and thermal comfort online-*
<https://www.sciencedirect.com/science/article/pii/S2352710219329341>
- viii. Ameya Pimpalkhare (2018) *'Building' an energy efficient India online-*
<https://www.orfonline.org/expert-speak/42744building-an-energy-efficient-india>
- ix. C. Buratti, M. Vergoni, D. Palladino (2015) *Thermal Comfort Evaluation Within Non-residential Environments: Development of Artificial Neural Network by Using the Adaptive Approach Data online-*
<https://www.sciencedirect.com/science/article/pii/S1876610215023887>
- x. D.B. Crawley, L. K. Lawrie, F. C. Winklemann (2001) *EnergyPlus: Energy Simulation Program online-*
https://www.researchgate.net/profile/Drury_Crawley/publication/230606369_EnergyPlus_Energy_Simulation_Program/links/546a40d80cf2f5eb18077919.pdf
- xi. Shady Attia, Romain Lioure, Quetien Declaude (2020) *Future trends and main concepts of adaptive facade systems online-*
<https://onlinelibrary.wiley.com/doi/full/10.1002/ese.3.725>
- xii. *Climatic data of Delhi*
<https://www.accuweather.com/en/in/delhi/202396/monthly-weather/202396>

Multi-Sensory Art Galleries-An Elemental Study

Author 1: Aditi Lele, Guide: Ar. Fatema Kabir

Aayojan School of Architecture and Design, Pune

Email: aditilele99@gmail.com

Abstract: Emotional experiences are often regarded as keystone for experiencing architecture. Museum or an art gallery experience is multifaced journey that is sensory, aesthetic, social and intellectual. Thus, galleries and museums should be more concerned with fusion of senses and experiences, and be active in involving physical and emotional interaction of visitor. These things will help museum propagate what it has to, in more influential manner. Hence this research focuses/directs to document such multi-sensory strategies which when used in museums will play increasingly instrumental role in visitor experiences and in propagating what gallery wants to depict.

Key words— Multi-sensory, interactive museums, art gallery designs, visitor experience, fusion of senses, emotional experience

INTRODUCTION

“Architecture is the art of reconciliation between ourselves and the world, and this mediation takes place through the senses” (PallasmaaJ, 2005) iv The senses tend to work in synergy to inform each other of a cohesive experience. The tactile realm is simultaneously admired for its ability to preserve impressions of the past. Pallasmaa identifies its potential as a strong connection to time, tradition, and vestige. Nothing excites me more in architecture than this unleashing of a potential that engages the mind in the experience of built form on terms that react to consciousness and the very sensations that prove we are alive. Buildings too are more liberated by what can be conceived, realized and manufactured economically while at the same time becoming ever more responsive to our senses. Our experience of world is mediated to sensory abilities of human body as it navigates, interprets, influence’s our perception. Every sense can be significant in transforming the experiential qualities of architecture.

Architecture is multisensory and mustn’t be dominated only by sight. Architecture designed around senses can elevate our perception into sense of transcended consciousness, in touch with ourselves, society, environment. The multisensory design aspect has been lost going minimalistic with walls, smooth finishes. This has reduced level of user experience as it is through the body that one perceives, engages and enjoys architectural spaces. It is important to understand that architecture is more than materials and forms but deals with human aspect looking at their sentiments, space, environment and interactions between them. Buildings and spaces need not

be dead spaces or shells to live, work and play but have the potential to be rich sources of stimuli affecting the user’s body and mind.

Museum or an art gallery experience is multifaced journey that is sensory, aesthetic, social and intellectual. Thus, galleries and museums should be more concerned with fusion

of senses and experiences, and be active in involving physical and emotional interaction of visitor. These things will help museum propagate what it has to, in more influential manner

This research will show how senses can communicate with user. This will also establish practical approach to architectural design using sensory elements. The research will look into ways how one can learn from the stated examples and can explore it further and use them to evolve his own design to make it interactive. On the same line paper will proceed by discussing senses in relation with the parameters established, with examples, how they evoke each sense and how they promote user interaction to bring about impressive experiences. The hope is to establish design elements to integrate humans into spaces of meaning with unique designs that harbour amazing experiences.

Sense 1: Touch

“The eye is the organ of the distance, whereas touch is the sense of nearness, intimacy and affection. The eye observes and investigates, whereas the touch approaches and feels.” (NSchuler, 2006)iii “The door handle is the handshake of the building” (PallasmaaJ, 2005)iv. In the following statements he stated the role of the sense of touch in the process of integrating our selves with the world, and mentioned the depth of the sense.

It is a symbolic gesture by Libeskind for visitors to experience what the Jewish people during WWII felt. The concrete walls add a cold, overwhelming atmosphere to the space where the only light emanates from a small slit at the top of the space. The building is less of a museum but an experience depicting what most cannot understand. More than 10,000 faces with open mouths, cut from heavy round iron plates, cover the floor of the ground floor void. Visitors are encouraged to interact by walking on the exhibit itself to see the open-mouths in terror and to listen to the jarring clanging sounds when thick metal pieces jostle against other pieces, and the faces clank harshly with a metal-on-metal sound, the faces of soundless screams. Moving about through memory

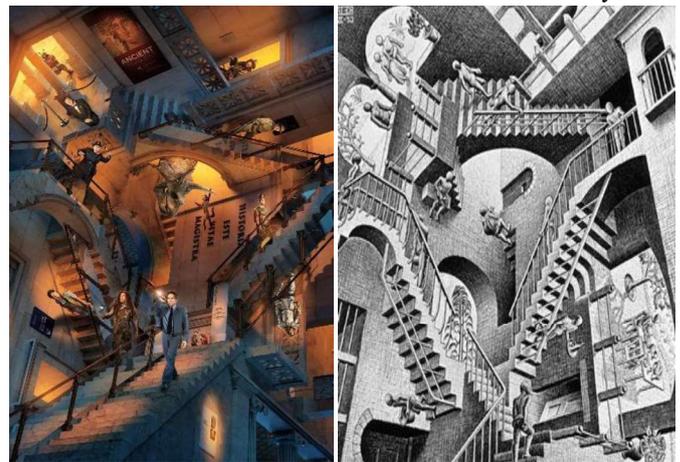


**Figure 1 Shalekhet-Fallen Leaves, Jewish Museum, Berlin
Jewish museum Berlin, Germany**

void by stepping on faces, makes one feel lost, guilty and helpless. A symbol of those lost life during the Holocaust, to see the open mouths screaming and still walking on them triggers negative emotions. The touch of open faces with bare foot helps the visitor to experience the pain that Jewish went through in Germany. Rough, hard, texture of the faces and clinging sound that arises once a person walks through adds to the atmosphere and makes one feel remorseful. As Pallasmaa said that buildings do not react to our gaze, but they do return our sounds back to our ears. (PallasmaaJ, 2005)iv Huge, empty, bare concrete walls with unfinished surface with iron plates of faces stir the painful memories of victims of war. Here in texture, material and to some extent colour plays a huge role in carving out the desired experience and to witness the reality that was long ago. The sense of vision reveals what the sense of touch already knows, therefore the sense of touch can be considered as the unconscious side of the sense of vision. Thus, interaction of visitor with the installation and its material generates numerous memories and emotional experiences which one remembers lifelong. Hence it is necessary to incorporate such kind of elements in art gallery to bring in user interaction.

Sense 2: Vision/sight

senses, and thinking itself is thought of in terms of seeing³⁰.” (PallasmaaJ, 2005)iv “The eye invites and stimulates muscular and tactile sensations.” (PallasmaaJ, 2005)iv As we move across a stairway, the form dictates our pacing, our feeling, our safety and our relationship and engagement with the space around us. It promotes a more conscious visit of the place through its vistas, spots, and of course the overall big picture. As we observe in the picture play of levels can be distinctly seen. Here the staircase, levels, direction tricks our perception. Anyone who has seen a picture or looked at it from a specific angle must have thought of how incredibly do



**Figure 2: Escher Stairway
Escher staircase**

“Sight has historically been regarded as the noblest of the these stairs function and where do they lead. It just amazes the viewer, viewing it from any direction. Standing at the foot of any stairs, the staircase looks as if was much longer and seems to be endless due to the indistinguishable start and end points. (M.CEscher, 1959)ii Experience evoked by looking at this optical illusion is much greater due to composition, use of levels, shade shadow and effect generated. One actually keeps himself in position of human figures and tries to solve the mystery, thus interacting with the illustration. Therefore, visual illusion in equipping the stairway with varying staircases leading to different points and gateways, at optically rising floor, narrowly standing doorways and a human figure on the stairs in order to understand the movement and scale. So, through vision the architect can take the user’s attention and integrate his other senses. There are many determinants for the visual experience such as; light, proportions, hierarchy, order, rhythm, etc. but light is considered one of the most important factors for the visual experience. It becomes very much necessary to bring in such kind of elements which promote user interaction and bring liveliness in an art gallery.

Sense 3: Motion

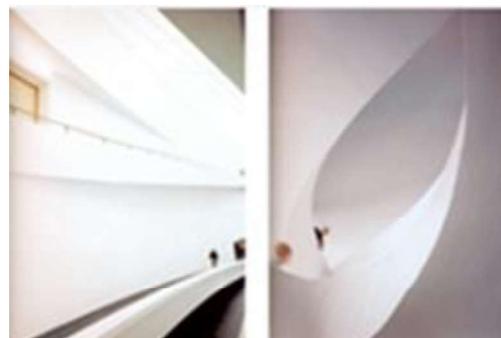


Figure 3: Walls

There are several elements which contribute to the sense of movement in an architectural space, the snaking lines, the

patterns created by the repetitive shapes etc. here you can really feel the strong gust of wind in the above picture, Also, notice how the RCC work used for the walls and soffits dynamically change and show elegant flow. “Textures on and in buildings are seldom used consciously and with psychological or social awareness” (EHall, 1990)iii Having smooth transitions from space to space without any sharp corners, these curves create a feeling of elegance and perfection. Subtle touches like this can make a significant difference. The explorer’s body can feel movement in this situation created by the built space. As described, being in such spaces would give us a sense of ascension or tendency to reach the heavens. Continuity, sequence and flow as well as transparency are considered as the factors promoting sense of movement here. The eye is drawn to move around curves, and it, in turn, can draw the mind to want to follow the curve. The swift and elegant curves take human mind on a smooth and peaceful ride. When a space has curved surfaces, its acoustics can readily change the aurally perceived geometry of the space; the flow of space, elevated planes, hierarchy, rhythm, light, enclosure, opening, asymmetrical curved surfaces or multiple perspectives, as well as linear and radial geometry. An observer sees the pushes and pulls in visual patterns” and “perceptually and artistically, they are quite real. A curvilinear curve is formed dips and arcs of different degrees. It brings a sense of fluidity and playfulness. The effect on the user suggests a kind of movement which could be described as 'psycho-kinetic'; directionality is important and there is a feeling of being virtually drawn along by the form. Considering that fact, if they are real, they would perceptually contain motion. The texture and material have a lot of potential in enhancing the relation between man and his environment, and is of crucial importance to the user of the place. The curve appears as an element that extends in the extension of the extension and in some areas of the interior, generating light and movement. The fluidity of curves is important and this sense of movement is enhanced by a seamless transition in the geometry that sets them out. You can just feel those forces galloping around the structure and the masses counterbalancing each other. To bring in such kind of ideas, elements, surfaces become very much essential, for interactive designs of galleries.

Sense 4: Balance (equilibrioception)



Figure 4: Car installation, Guggenheim museum

The sense of balance or equilibrioception is the perception of balance and spatial orientation. Installation is of the falling or sliding car which is held by numerous strings. One cannot actually get in the car but he or she is allowed to interact with the installation through vision, body movement and experience. As the viewer first sees this installation, he gets the experience as if he is going to fall off along with the car, but this does not happen as the car is balanced by the strings which are tied to it and in turn are locked firmly. It just amazes the viewer, viewing it from any direction. Here It is a reconciliation of opposing forces in an installation that results in visual stability. Acceleration along with balance can be easily felt in this element. You feel stresses inside your body as its parts push on one another to make them all accelerate together. You feel a gravity-like sensation pulling you in the opposite direction due to the strings that hold the car. The explorer’s body can feel this movement in this situation created by the built space. The installation is created in such a way that it is appropriately sized and proportioned in such a manner that it relates to one another and to whole building in harmonious and rational manner. Due to its appropriate scale and correct positioning of elements viewer experiences force of acceleration and feels weightless which is a terrifying feeling, but at the same time he feels balanced or equilibrioception and spatial orientation. Both scale and proportion highly affect in evoking sense of equilibrioception. you can just feel those forces galloping around the structure and the masses counterbalancing each other. Multiple perspectives, as well as linear and radial geometry also give a sense of motion. An observer sees the pushes and pulls in visual patterns” and “perceptually and artistically, they are quite real. Considering that fact, if they are real, they would perceptually contain motion. This gives him the experience that is desired. Hence, we need to bring in such kind of innovative ideas and design in order design interactive experiences for visitors.

Sense 5: Thermoception

Ice berg installation at national museum, Washington DC
Skin senses have the richest and most diverse stimuli which they are sensitive to. Contact is one stimulus, temperature is another. Icebergs invoke the surreal underwater world of glacial ice fields; one tends to feel very cold and somewhere in the middle of ocean due to the atmosphere surrounding him. The installation, due to its sharp edges, pointed tips gives a person a feel of walking in the field of icebergs and automatically one starts to feel cold. Feeling is also enhanced due to the colour pallet and materials used in installation.



Figure 5 Ice berg Installation, at National museum, Washington, DC

We get not just the physical meaning of temperature but the psychological as well. One can feel the stark difference in the temperature and chill throughout the body. Some people tend to feel cold psychologically, may also contribute to feelings of sadness and isolation, introspection. One gets a numbing, wintry and frosty feel once you walk through this installation. It's almost a relief from hot dry climate outside. Here emphasis was placed not simply on appearance of the surface but particularly on their feel (Ramussen, 1962)^v

CONCLUSION

Architecture is primarily created for people; it should stimulate people's senses.

A cross comparison between senses and parameters of architecture can lead to a sensory perceptive design.

Elements on X axis are parameters such as texture, light, scale, colour and levels

Elements on Y axis are senses such as touch, balance, vision, motion, sound and thermoception. If one puts A element of X

axis with B element of Y axis, they get output that will stimulate the senses at particular levels. Hence, we can say that, one can learn from these examples provided and explore them further and use them to evolve his/her own design to make it interactive and also make their design user centric.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my college - Aayojan school of architecture and design, Pune, principal Ar. Anand Ukidve and guide Prof. Fatema Kabir for her valuable guidance, inspiration and encouragement. Her keen and tireless indulgence in this work helped me to reach an irreproachable destination.

REFERENCES

- i. EHall. (1990). *The Hidden Dimension*. In *The Hidden Dimension* (p. 62). United States Of America: Anchor Books.
- ii. M.CEscher. (1959). *grafeik*.
- iii. NSchuler. (2006). *Senses In Architecture*.
- iv. PallasmaaJ. (2005). *The Eyes Of Skin: Architecture And Senses*. Great Britain: Wiley Academy.
- v. Ramussen. (1962). *Experiencing Arcchitecture*. Cambridge: M.I.T Press.

TABLES OF FIGURES

Figure 1 Shalekhet-Fallen Leaves, Jewish Museum, Berlin	17
Figure 2 Esher Stairway	17
Figure 3 walls	17
Figure 4 Car installation, Guggenheim museum..	18
Figure 5 Ice berg Installation, at National museum, Washington, DC	19
Figure 6 Table senses and parameters associated	

BIBLIOGRAPHY

- (n.d.). Retrieved from archdaily.com
- (n.d.). Retrieved from www.jmberlin.de/en/shalekhet-fallen-leaves
- EHall. (1990). *The Hidden Dimension*. In *The Hidden Dimension* (p. 62). United States Of America: Anchor Books.
- Gernot, b. b. (2014). *Architectural atmospheres*. Germany.
- M.CEscher. (1959). *grafeik*.
- MACGILLAVRY, C. H. (n.d.). *THE SYMMETRY OF M. C. ESCHER'S*.
- Mourad, H. S. (2014). *AN APPROACH TOWARDS A MORE USER-CENTERED*.
- NSchuler. (2006). *Senses In Architecture*.
- PallasmaaJ. (2005). *The Eyes Of Skin: Architecture And Senses*. Great Britain: Wiley Academy.
- Ramussen. (1962). *Experiencing Arcchitecture*. Cambridge: M.I.T Press.

Amelioration of shape polymer molecules in ventilators

Author1- ADITYA KANCHAN (adityakanchan1999@gmail.com)
Author2 - Ar. AANCHAL RAVAL (aanchal@dypatilarch.com)
DR. D Y PATIL SCHOOL OF ARCHITECTURE LOHEGAON

Abstract- The escalating view to issue of visual comfort energy efficiency attributes to the architecture of the particular era that leads to development and innovation of dynamic glazing systems not only reduces heat but also helps at controlling incoming solar radiation. In order to gain maximum solar gain in winters and minimize it in summers, as well as ensuring the best possible lighting in the area with no glare to the receiver end. The particular type of systems are called smart windows which enable varying amount of heat (SHGC) and light (VLT) that penetrate through the particular ventilator or glass surfaces as needed, while maintaining outward vision.

Keywords: Polymer, molecules, energy efficiency, solar energy

INTRODUCTION

It starts from thinking of a structure from a view of it as a part of nature and not as an independent structure as the structure can be divided into two parts as one be imposed on nature as other be created by it. Or another way of saying it can be that it is designed by nature and other be designed for her. So working towards energy efficiency of buildings to achieve carbon neutral buildings is characteristics and requirements directing towards technological advancements but in an organic way while not disturbing the echo of nature. The envelope of a particular structure plays a very vital role in the energy performance of a building which significantly affects the wellbeing of the indoor environment. It constitutes a complex system of barriers in environmental filters not only to regulate the heat solar radiation, air but also to convert solar radiations into energy essential for building metabolism. In this context, the transparent part of the building envelope can play the important role of climate filter between the internal and external environments, able to balance visual comfort with a hygrometric wellbeing control needs and reduction requirements for air conditioning and lighting energy consumption. Transparent solutions, however require a much more accurate design, focused on the characteristics of the environmental context, the integration with mechanical equipment and performance targets (distribution of radiant temperatures,

air stratification, etc.); otherwise the transparent shell can turn into the major source of environmental discomfort and energy dissipation of the building. According to the Department of Energy of the United States 25%-35% of energy in buildings is wasted due to inefficient windows. The California Energy Commission estimates that about 40% of the cooling demand of a typical building is due to the solar heat gain through windows having higher installation, operation and maintenance costs that hinder external vision and are often not suitable for energy retrofits. Several pilot projects in this specific field have shown savings up to 60% for lighting, a reduction of the cooling load up to 20%, and the reduction of peak power up to 26%.

MATERIALS AND METHODOLOGY SMART (SMP) WINDOWS

Shape memory polymers (SMPs) have attracted significant attention from both industrial and academic researchers, due to their useful and fascinating functionality. One of the most common and studied external stimuli for SMPs is temperature; other stimuli include electric fields, light, magnetic fields, water, and irradiation. Solutions for SMPs have also been extensively studied in the past decade. In this research, we review, consolidate, and report the major efforts and findings documented in the SMP literature, according to different external stimuli. The corresponding mechanisms, constitutive models, and properties (i.e., mechanical, electrical, optical, shape, etc.) of the SMPs in response to different stimulus methods are then reviewed. Next, this research presents and categorizes up-to-date studies on the application of SMPs in dynamic building structures and components. Following this, we discuss the need for studying SMPs in terms of kinetic building applications, especially about building energy saving purposes, and review recent two-way SMPs and their potential for use in such applications. This review covers a number of current advances in SMPs, with a view towards applications in kinetic building engineering. This can not only change dynamics in consideration to making it livable but reducing the

carbon footprint making it one of nature. It is a heterogenous material having follows:

ACTUATING

1. COLOUR CHANGING
2. SENSING
3. HEATING/COOLING
4. SELF HEALING
5. PHASE CHANGING (freezing and melting).

Based on their mode of operation, intelligent glass is distinguished in two main categories: with passive control, or self-regulating, and with active control, adjustable to user's needs.

Passive dynamical systems

Passive dynamic systems do not require an electrical stimulus for their operation. These systems respond independently to the presence of natural stimuli such as light (photochromic glass) or heat (thermochromic and thermotropic glazing). Compared with active systems they are therefore easier to install and more reliable in the face of the impossibility of being controlled by the user on request.

Photochromic glazing

Photochromic glass is able to modify their transparency properties autonomously in relation to incident light intensity. This ability is due to the presence in the glass paste of organic or inorganic compounds which act as "optical sensitizers" such as metal halides (chloride and silver bromide) reactive to ultraviolet light, or plastics, which absorbs the sun's energy according to the output color spectrum variation.

Thermochromic Glazing

Thermochromic glazing (Pleotint, Ravenbrick, Solarsmart etc.) is capable of autonomously modifying its optical properties according to the external surface temperature, which determines a chemical reaction or a phase transition between two different states. The material therefore remains transparent when temperature is lower than the transition one, while becomes opaque for higher temperatures.

Among the different dynamical active control systems, Electrochromic devices (EC) are particularly interesting, and also allows excellent protection from solar radiation, with SGHC values variable from 0.46 to 0.06, and ultraviolet

radiation while always allowing vision through (unlike PDLC) and, to date, has a higher and proven durability, guaranteed up to over 30 years (one of the first installations of electrochromic glass in the Desert.

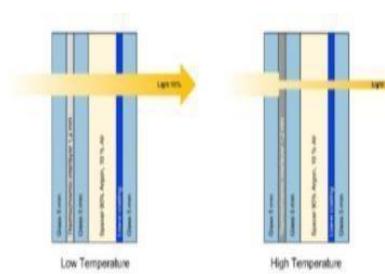


Figure 7. Dynamic active glazing intelligent control

TABLE V. COMPARISON BETWEEN MAIN ACTIVE AND PASSIVE CHROMIC GLAZING ON THE MARKET

Properties	Dynamic glazing			
	Passive systems	Active systems		
	TC	EC	SPD	PDLC
Optical and Thermal performances				
Clear state	Low temperature	Off	On	On
Dark state	High temperature	On	Off	Off
Visible Light Transmission (Clear)	68%	68%	85%	Up to 75%
Visible Light Transmission (Dark)	5%	1%	0.5%	5%
SGHC (Clear)	0.17	0.46	0.51	0.69
SGHC (Dark)	0.12	0.06	0.06	0.35
UV Transmission (Clear)	0%	0.4%	0.3%	0.5%
UV Transmission (Dark)	0%	0%	0.3%	0.5%
Privacy in dark state	No	No	Limited	Yes
Number of light control levels from clear to dark	No	Typically 4 states	Unlimited	2 (transparent and frosted)
Continuous states between dark and clear	Yes	Yes	Yes	No
Light tinting	n/a	Yes	Yes	Yes
Operating temperature	from -20 to 160 °C	from -20 to 70 °C	from -60 to 120 °C	from -20 to 70 °C
Configuration options				
Maximum size	1651 mm x any length	1524 x 2048 mm	1524 mm x any length	1820 x 2587 mm
Shapes	Any shape, including curved	Rectangle, square, trapezoid, triangle	Any shape, including holes anywhere and curved	Any shape, including holes anywhere and curved
Colours	Blue, Green, Bronze, Gray	Blue, Green	Typically Blue	Clear, Bronze, Gray, Green tint
Electrical Properties				
Operating voltage	n/a	12 V DC	65-110 V AC	65-110 V AC
Power requirement for state transition	n/a	2.5 W/m ²	5 W/m ²	5-10 W/m ²
Power requirement for state maintenance	n/a	0.4 W/m ²	0.35 W/m ²	5-10 W/m ²
Switching speed	Several minutes	Typically 1 to 5 minutes to reach 90% of its stage	Typically 1 to 3 seconds	Instantaneous (0.1 sec)
Control	No	Wall switch, Remote control, Movement sensor, Light and temperature sensor, Timer	Wall switch, Remote control, Movement sensor, Light and temperature sensor, Timer	Wall switch, Remote control, Movement sensor, Light and temperature sensor, Timer
Integration with BMS	n/a	Yes	Yes	Yes
Costs and durability				
Cost	Lowest	Medium	Highest	High
Durability	>30 years	>30 years	>20 years	>10 years

**Electrochromic devices (EC)
Suspended particles devices (SPD)**



RESULTS AND TABLES

EXAMPLES



BRISBANE AIRPORT

Regional Medical Center in Palm Springs, California, dates from the year 2003 and the glass is still operative today) along with inferior costs compared to SPD and PDLC devices.

CONCLUSION

This study shows how the use of dynamic windows can bring numerous benefits in terms of energy efficiency, environmental comfort and architectural quality of buildings. Static solutions with selective glass and fixed or mobile screens do not allow optimizing solar gains and light conditions during the year thus limiting, in the design phase, the size of glazed components. Solutions with automated dynamic sun screens coupled with building automation systems offer excellent energy performance, but have high installation, maintenance and management costs, and hinder the view from the inside to the outside.

ACKNOWLEDGEMENT

I would like to express sense of gratitude to my guide Prof. ANCHAL RAVAL for her valuable guidance and encouragement.

REFERENCES

i. [1] A. Llordés, G. Garcia, J. Gazquez and D. J. Milliron, "Tunable near-

ii. infrared and visible-light transmittance in nanocrystal-in-glass composites", *Nature*, pp. 323–326, doi:10.1038/nature12398, 2013.

iii. B. Cazes, "Windows and glazed area technologies and materials in

iv. *Envelope Technologies and Policies Workshop*, Neuilly-sur-Seine, France, 17 November 2011.

v. B. Lamontagne, P. Barrios,

vi. C. Py and S. Nikumb, "The next generation

vii. of switchable glass: the Micro-blinds", *Glass Performance Days*, pp.

viii. 637-639, 2009

ix. D Malmquist and N. Sbar, "The Benefits of Dynamic Glazing" SAGE

x. *Electrochromics, Inc.* July 2013.

xi. D. M Addington and D. Schodek, "Smart Materials and Technologies

xii. for the architecture and design professions", Elsevier Architectural Press,

xiii. 2005.

xiv. IEA, *Energy Efficient Building Envelopes, Technology Roadmap*,

xv. OECD/IEA, Paris, 2013

xvi. IEA, *Tracking Clean Energy Progress 2014* OECD/IEA, 2014, Paris,

xvii. 2014 [8] IEA, *Transition to Sustainable Buildings: Strategies and Opportunities to*

xviii. 2050, OECD/IEA, Paris, 2013

xix. IEA, *World Energy Outlook 2013*, OECD/IEA, Paris, 2013

xx. J. Apte, D. Arasteh and

xxi. P.E. Yu Joe Huang, "Future Advanced Windows

xxii. for Zero-Energy Homes", *ASHRAE Transactions*, Volume 109, Part 2,

xxiii. 2003, pp. 871-884, ASHRAE, 2003.

Continuity of Indian Architectural Traditions In Contemporary Architecture

Akshata Shashikant Patil

Sinhagad College of Architecture, Vadgaon, Pune

Email: akshatapatil0911a@gmail.com

Abstract: Indian architectural traditions are rooted in its culture, history and region. There are many architectural traditions which are observed in India. Jali in Indian Architectural has a very distinct position. After Independence of India there were many architects who got inspired from Jali traditional system and exhibited the principles in their work. Currently there is a group of Contemporary Indian architects who through their work exhibits the continuity of architectural traditions and some of these architects are Hasmukh Patel, Sanjay Puri and Manit Rastogi and Sonali Rastogi. These architects embrace local available material and energy efficient techniques and bridges traditional knowledge of Jali and contemporary practice to produce design. They captured the essence of native tradition and design buildings with respect to the context.

In contemporary situation going back towards traditional architecture is falling away, therefore it is necessary to bring forward the architecture that shows the learnings from traditional systems. The continuity set the contemporary practice to revivify architectural building traditions.

Traditional knowledge with contemporary techniques will create opportunity to promote traditional skills and techniques and help to revive architectural building traditions. Hence the study reveals that there is continuity of architectural traditions in contemporary architecture.

Key words: Indian architectural Traditions, Continuity, Jali and Contemporary architecture.

INTRODUCTION

Architecture is perhaps India's greatest artistic glory. Indian architecture has a long rich history, dating back thousands of years. Indian architecture experiences varieties of traditional architecture spread throughout the motherland as it has a huge asset of heritage and antiquity.

In India history is living in tradition and the diversity of its geographic conditions and socio-cultural milieu to offer tremendous amount of variety and vitality. Architecture truly is the alchemy of time and place. We could learn from this repository of knowledge and the traditional wisdom to find our directions for tomorrow. Architecture inspires from yesterday and aspires for tomorrow.

Jali is one of the most prominent elements of Indian architecture. A Jali or jaali is the term for a perforated stone or latticed screen, usually with an ornamental pattern

constructed through the use of calligraphy and geometry. This form of architectural decoration is common in Hindu temple architecture, Indo-Islamic Architecture and more generally in Islamic Architecture.

Jali describes a perforated stone screen, usually within ornamental pattern. Containing minute carved, delicate geometrical and floral designs, these perforated screens were an integral component of Mughal architecture. Constructed primarily using marble or sandstone, their form includes windows, railings, dividers and outer walls, which provided ventilation and screening from light, imbuing their surroundings with a calm, cool and airy environment. During the day, as sunlight streams through the Jalis, the patterns form magical shadows and reflections that grace the adjacent floors and walls, entrancing and mystifying all who see them.

Jali in modern context is constructed with different materials like concrete, lightweight concrete, bricks, fly ash etc. We can even find precast perforated blocks all-around the world which is used mainly for interior partition's as well as walls for corridors and verandahs.

As the paper focuses on Jali as an architectural element, educational, offices and cultural typology in hot and dry climate are considered. The Ahmedabad Management Association (AMA) and The Indian Institute of Management Ahmedabad (IIM Ahmedabad) New campus by Ar. Hasmukh Patel, 72 Screens, Jaipur and Conventional center, Ahmedabad by Ar. Sanjay Puri and Pearl Academy of Fashion and the British School, New Delhi by Ar Manit Rastogi and Sonali Rastogi.

METHODOLOGY

Study is primarily based on secondary data. The study is to understand the exploration of Jali, an important element of architecture done by Contemporary architects and trace the original path, purpose of selective sampling that meets three major characteristics; (a) Hot and dry climate, (b) Culture, office and institutional, (c) typology and contemporary architect from post-Independence period. The study is about at what level the contemporary architects have adopted traditional Indian systems and the forming of present time architecture in built environment from the exploration, timeline of study from post-Independence period to present

time architecture, collected data from case studies of contemporary architects from websites, magazines and e-books. These case studies helped to collect the different ideologies from architect's work to utilize traditional systems and making structures of the future through the learnings.

Hence this helps me strongly conclude that there are these contemporary Indian architects who are going against the grain in this increasingly concretized country and our Indian Contemporary Architecture having Modern as well as Traditional Indian system of architecture which is led by ideologies or situations.

CASE STUDIES

1. Ahmedabad Management Association, Ahmedabad

Located in the TIRA campus AMA is a public Institution at the forefront of management education. The design was centered on the main criteria that a public institution of this nature should be open and transparent. This notion is translated into the spatial, organization of the building as well as the articulation of the façade. The large glazed openings of the building enable even and deep penetration of daylight, which render the building more transparent. The building comprises of mild steel as material palette for fenestration. Their design is true to the nature of material and technology used, and design that is economically sustainable.



Figure – 1 Ahmedabad Management Association, Ahmedabad

2. The Indian Institute of Management Ahmedabad

An institute of international repute devoted to management education. The campus houses an International Management Centre and accommodates additional hostels for an expanded postgraduate program in management. The new campus buildings have been designed in exposed concrete and brick and fenestrations in combination of mild steel and wood.

3. 72 Screens, Jaipur

Enveloped in abstractly folded planes of perforated screens, this 6 level office building creates a sculptural presence. The building is designed in response to the excessive heat

imbibing traditional elements. The building manifests local tradition creating a structure that is strongly contextual to the site and its location while simultaneously creating a sculptural identity.



Figure – 2: The Indian Institute of Management Ahmedabad

The jaali screens sheath the building on all sides reducing the heat gain and rendering the building very energy efficient. The building is fragmented into triangular facets with jaali as a secondary screen all around it and the interstitial spaces are used for plants to further reduce the heat gain creating a building that is extremely energy efficient in response to the city's 450c summer months that are from mid-March to mid-October.

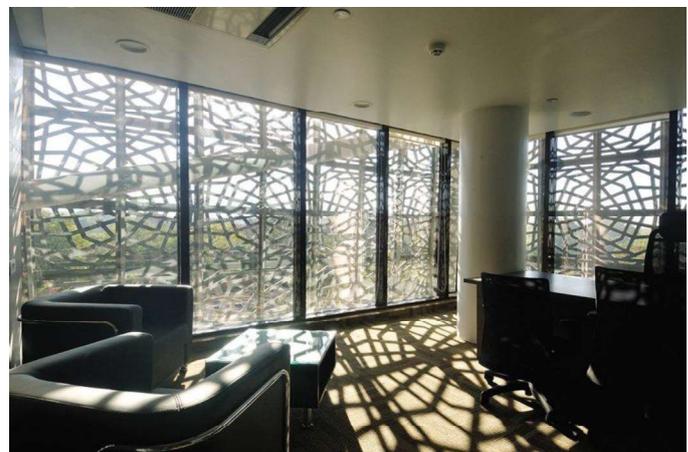


Figure – 3: 72 Screens, Jaipur

4. Conventional Centre, Ahmedabad

Perforated screened walls in exposed concrete, along the perimeter allow natural light into all the pre function and service areas whilst mitigating the heat gain in response to the hot desert climate of the location. Temperatures in Ahmedabad city are in excess of 36°C for most of the year. Perforations in walls allow light and air to enter the room while minimizing the glare of the sun and the gazes of the passers-by. They also create a subtle play of light and shadow in the interior, emphasizing the characteristics of symmetry by forming interesting patterns.

Indian architectural element, which Morphogenesis managed to do in a cost-effective and eco-friendly manner.



Figure – 4: Conventional Center, Ahmedabad



Figure – 6 the British School, New Delhi

5. Pearl Academy of Fashion

The institute is located in a typical hot, dry, desert type climate on the outskirts of Jaipur. The adverse climate makes it a challenge to control the micro climate within the project thus incorporating various passive climate control methods becomes a necessity and also reduces the dependence on mechanical environmental control measures which are resource hungry. The architecture of the academy needed to be a confluence of modern adaptations of traditional Indo-Islamic architectural elements and passive cooling strategies prevalent in the hot-dry desert climate of Rajasthan such as open courtyards, water body, a step-well or baoli and jaalis (perforated stone screen).



Figure – 5 Pearl Academy of Fashion

6. The British School, New Delhi

The designs were also cited for their efforts to be inclusive of age and gender groups, creating healthier environments, being adaptive and incremental, and understanding interventions that define meaning of 'sustainability' at the local level, but with a contemporary outlook. The cement Jali at the British School in New Delhi was an interpretation of a traditional

Case study findings

Case studies	Pearl Academy of Fashion	The British School, New Delhi
Jali Pattern		
Location	Jaipur	New Delhi
%Void	50	30
%Baluster	50	70
Function of filters	Air, light, privacy	Air, light, privacy

Case studies	Ahmedabad Management Association, Ahmedabad	The Indian Institute of Management Ahmedabad

Jali Pattern		
Location	Ahmedabad	Ahmedabad
%Void	45	30
%Baluster	55	70
Function of filters	Air, light	Air, light, privacy

n of filters		
--------------	--	--

CONCLUSION

The contemporary architectural practices and ideologies are adapting traditional knowledge, and the basis of these adaptations is the regional context and the learning from architectural traditions. Traditional knowledge with contemporary techniques creates opportunity to promote traditional skills and techniques and help to revive architectural building traditions. Hence the study strongly concludes that there is continuity of architectural traditions in contemporary architecture.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to Ar. Priyamvada Chitale and Ar. Kavita Patil for their valuable guidance, comments, inspiration and encouragement throughout the process. I am really thankful to them.

Case studies	72 Screens, Jaipur	Conventional Centre, Ahmedabad
Jali Pattern		
Location	Jaipur	Ahmedabad
%Void	50	30
%Baluster	50	70
Function	Air, light, privacy	Air, light, privacy

REFERENCES

- i. *HCP Design, Planning and Management*
<https://www.hcp.co.in/project/ahmedabad-management-association>
- ii. *Sanjay Puri Architects,*
<https://sanjaypuriarchitects.com/contact-us/>
- iii. *Morphogenesis* —<https://www.morphogenesis.org>
- iv. “How to reduce building cost “by Laurie Baker
- v. *Perforated Screen Designer*
- vi. *Yatin Pandya, Footprint Earth*
- vii. <https://www.irjet.net/archives/V7/i5/IRJET-V7I5807.pdf>

Analysis of Open Spaces In High-Rise Buildings In Pune

Akshay Bafna, Ar. Anuradha Wanaskar, Dr Vaidehi Lavand, Ar. Ramiya Gopalakrishnan

SMEF'S Brick School of Architecture, Pune India

Email: akshaybafna100@gmail.com

Abstract: Due to rapid urbanization, people tend to migrate to cities. Increasing population, shrinking space and a desire to remain close to the core city, have led to the idea of high-rise building complexes. A challenging problem that arises in this domain is that these building complexes lack to provide livability for the residents due to a lack of open spaces. This study will focus on comparing the relationship between the housing layouts and spatial openness of high-rise residential building complexes in Pune. This research paper would help in understanding different approaches, needs and perspectives of residents while designing open spaces for high-rise building complexes.

Keywords – High-rise buildings, urban open spaces, spatial openness in a high-rise, residential open space, social interaction.

INTRODUCTION

Due to migration from nearby villages, Pune is witnessing immense population growth, leading to urban sprawl, housing demand, land cost increases. The only viable way to meet the needs of a growing population is to construct buildings with increased verticality. A challenging problem that arises in this domain is that these building complexes lack to provide livability for the residents due to a lack of open spaces.

1.2 Residential Open Space:

Residential Open Space Residential open space as a set of dwelling is related to form, shape, plan, structure, and functions of the built environment and has a positive impact on residential environment quality (Trancik 1986, Gehl 2011, Pakzad 2007).

1.3 Social Interaction:

Social interaction is a social action between two or more individuals, which includes both verbal and nonverbal communication, such as body language (De Jaegher 2010). Open spaces offer a sense of social place in high-rise apartments, encourage people to gain social engagement, and inspire others, and provide an opportunity to ponder individual and social values.

1.4 Problem Statement:

As the high-rise apartments in most cities are growing day by day, their capacity to provide livability in people's lives is decreasing.

1.4.1 Limitation of exterior public space in terms of social interaction:

There are open spaces between high-rise buildings and some of these outdoor public spaces are designed as gardens or seating areas. All residents have access to these areas, but their relationship with these areas has often been noted to be less than comfortable. As Newman (1976) argues, the communities require multiple families and individuals to share areas without the notion of territorial advantage associated with the front lawn of a house.

1.4.2 Lack of interior public space in terms of social interaction:

Because of the technological limitation and the economic status of intended residents, the design of early residential high rises focused on the construction of private living spaces, while public space was seldom valued (Li and Liu 2006). Today, potential tenants no longer rely on private living spaces alone but see public spaces as an important element in determining the overall living environment.

1.5 Although past studies have explored the relationship between high-rise communities and social interaction, little attention has been paid to factors encouraging social interaction in this living environment. These studies centred on the importance of the spatial, social and environmental aspects of populations, but did not provide a detailed analysis of the relationship between personal characteristics and the characteristics of their living environments and their effect on social interaction.

1.6 Aims and Objectives of the study:

This paper aims to identify the relationship between high-rise housing layouts and spatial openness. It will also try to understand the importance and need for open spaces in high-rise residential projects and their effect on the social well-being of the residents.

1. LITERATURE REVIEW

2.1 Types of Interior Public Space in High-Rise Buildings:

In a high-rise housing complex, the interior public space acts as a circulation space as well as a connection between apartments. It has a lot of potential for enhancing social interaction by providing more interior public space (Wang 2004).

2.2 Neighborhood Social Interaction:

In recent years, the value of neighborhood social activity has increased. Although community connections are considered poor in contrast to close relationships between friends and family, social contact in the local neighborhood is recognized as an important factor for enhancing social life.

2.3 Outdoor spaces of high-rise housing:

Public spaces in High-rise complexes are important spaces for residents to create social contact and recognition (Garling and Golledge, 1989). Residents in high-rise clustered housing have restricted access to open areas. They are private to the residents from this perspective. Within each housing complex, these spaces are accessible to all tenants and are open to the public. As a result, they are semi-public spaces that can function as activity centres, allowing for the most access and visibility (Archea, 1977).

2.4 Space layouts, design elements, and social activities in outdoor spaces:

Gehl (1987) has identified three types of activity in public outdoor spaces. They are necessary activities, optional activities and social activities. Each type of activity needs certain physical settings to promote their occurrence in spaces, and the physical environments required for various types of activity are substantially different from each other. Efficient public high-rise housing spaces can provide opportunities for occupants to have substantial interaction, and a sense of neighborliness can then be fostered.

2.5 High-rise apartment buildings have received a lot of criticism from experts across various disciplines. Gifford (2007) concludes that high-level living environments have both benefits and drawbacks, as they offer greater privacy and minimise unnecessary social contact, while at the same time reducing intimate social interaction and less care between residents. Previous studies have identified spatial layouts and the availability of facilities in communal spaces as important factors in the living environment in promoting social activities. Diversity, accessibility, quality and visibility of communal spaces can be seen as the main design variables affecting social interaction.

The above research findings have shown that the presence of public outdoor places of certain landscape elements promotes casual communication between people and then encourages social interaction. As a result, the use of elements in the detailed design of high-rise housing's outdoor spaces becomes crucial in the development of socially acceptable living environments.

2. 2.6 METHODOLOGY

A mixed-method approach is used to address the research query, including (1) A questionnaire to evaluate the personality attributes and experience of the apartment building and the neighborhood environment, (2) Qualitative interviews to gain an in-depth insight into the experiences of residents with their psychological and physical living condition and their social behavior in their neighborhood. The questionnaire was designed to gather information on personal attributes, including age, gender, employment status, length of residence and structure and homeownership etc.

3. RESULTS AND TABLES

The total number of residents identified was 200, including 120 males and 80 females, representing 60% and 40% of the total population identified. Among them, 40 (20%) were elderly; 50 (25%) were middle-aged; 100 (50%) were young adults; 10 (5%) were teenagers. The majority of respondents were teenagers, primarily because the author asked family members to share the survey with their friends.

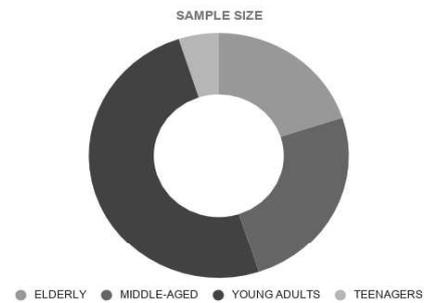


Fig 1: Charts showing sample size

3.1 Results of respondents' preference for social activities, indoor public space and high-rise residential buildings :

3.1.1 Social Interactions:

The results of survey participants on their preferences for social contact, 70% of high-rise residents were willing to communicate with their neighbors every time, 20% were willing to interact with neighbors most of the time, and only 10% were not willing to interact at all. In summary, most of the high-rise occupants wanted to know who their neighbors were, wanted to have some sort of familiarity with them, and wanted to have a social relationship with them.

PERCENTAGE OF PEOPLE WILLING TO INTERACT WITH NEIGHBOURS

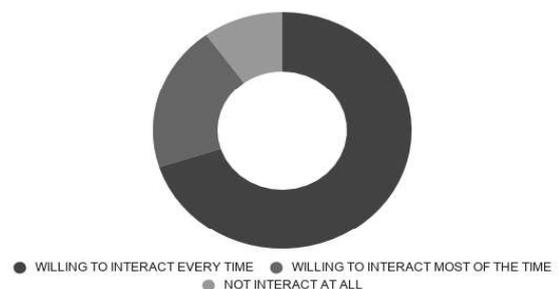


Fig 1: Charts showing % of people willing to interact with neighbours

3.1.2 Indoor and Outdoor Public Spaces:

There were 30% of high-rise residents who thought that their outdoor public space fulfilled their needs for day-to-day life and social contact, but there were also 60% of residents who felt that their outdoor public space did not meet their needs, and 10% felt that their needs had been fully met. 65% of high-level participants wanted to add extra indoor public space to increase social contact between neighbors, while 25% were unsure, and 10% did not want to add space. In summary, most participants thought that their outdoor public space meets their needs for day-to-day life and social interaction, but also needed more indoor public space to increase social contact with their neighbours and extend their living space.

PREFERENCE ON WHETHER THE OUTDOOR PUBLIC SPACE MEET THE NEEDS FOR DAILY ACTIVITY & SOCIAL INTERACTION

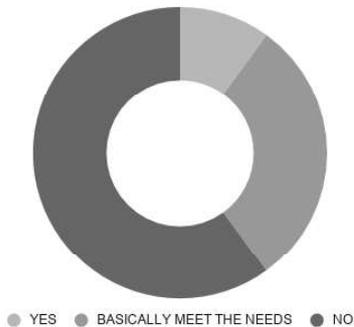


Fig 2: Charts showing a preference for the outdoor public space.

PREFERENCE ON WHETHER RESIDENTS WANTED TO ADD EXTRA INTERIOR PUBLIC SPACES TO IMPROVE INTERACTION BETWEEN NEIGHBOURS



Fig 3: Charts showing a preference for the addition of interior public space.

3.2 Results of respondents' preference for social interaction in different spaces of high-rise residential buildings:

The results of observation at the five different spaces of high-rise residential buildings are shown in Table 1. The quantity of social interaction in descending order was circulation space (50), scenic space (40), activity space (36), seating space (14), and other spaces (10). The percentage of social interaction in

descending order was circulation space (25%), scenic space (20%), activity space (18%), seating space (7%) and other space (5%). The findings indicated that the quantity of social interaction was much greater in circulation space than in the other four spaces. However, the percentage of social interaction was greater for scenic and activity spaces.

SPACES	QUANTITY	PERCENTAGE
CIRCULATION SPACE	50	25 %
SCENIC SPACE	40	20 %
ACTIVITY SPACE	36	18 %
SEATING SPACE	14	07 %
OTHER SPACE	10	05 %

Tab 1: Table showing a preference for social interaction in different spaces of high-rise buildings.

Circulation areas have been identified as common places for everyday social interaction. However, the widespread use of these areas for various types of interactions has been indicated as causing social irritation and reducing the privacy and protection of residents. This is linked to the analysis of Altman's Privacy Theory (1977), which notes that if a certain degree of privacy cannot be regulated or involuntary interactions take place, social contact may be reduced within the neighborhood.



Fig 4: Future Towers, Amanora Park Town.



Fig 5: Image showing High-Rise building in Pune.

4. CONCLUSION

The results of this study demonstrate the relationship between social interaction and the spaces used. Most high-rise residents believe that their public space does not fulfil their needs and they want to have extra outdoor public space for social interaction. This will help architects design potential high-rise buildings that will support social engagement with their residents.

5. ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Dr Vaidehi Lavand, Ar. Ramiya Gopal and Ar. Anuradha Wanaskar for their valuable guidance, inspiration and encouragement. Their keen indulgence in this work helped me to achieve an irreproachable destination.

6. REFERENCES

- i. Huang, S. L. (2006). A study of outdoor interactional spaces in high-rise housing. *Landscape and Urban Planning*, 78(3), 193-204. doi:10.1016/j.landurbplan.2005.07.008
- ii. Kavilkar, R., & Patil, S. (2014). Study of High Rise Residential Buildings in Indian Cities (A Case Study –Pune City). *International Journal of Engineering and Technology*, 6(1), 86-90. doi:10.7763/ijet.2014.v6.671
- iii. Nguyen, L., van den Berg, P., Kemperman, A., & Mohammadi, M. (2020). Where do People Interact in High-rise Apartment Buildings? Exploring the Influence of Personal and Neighborhood Characteristics. *International journal of environmental research and public health*, 17(13), 4619. <https://doi.org/10.3390/ijerph17134619>
- iv. Hasanvand, S., & Bemaniyan, M. R. (2014). The consideration of high-rise building role in the utilization of urban open space (Case study: Region 1 of Tehran metropolitan). *American Journal of Engineering Research (AJER)*, 03(04), 135-143. Retrieved from <https://www.ajer.org/>.
- v. He, Xinyi, "Study of Interior Public Spaces for the Promotion of Social Interaction in High-rise Residential Buildings" (2018).
- vi. Wang, Hua. Analysis of "Neighborhood Communication" and "Space Environment" in the Residential Community. *Architectural information*. Vol. 05, 2004.
- vii. Garling, T., Golledge, R.G., 1989. Environmental perception and cognition. In: Zube, E., Moore, G. (Eds.), *Advances in Environment, Behavior, and Design*, vol. 2. Plenum Press, New York, pp. 203–236.
- viii. Archea, J., 1977. The place of architectural factors in behavioural theories of privacy. *J. Soc. Issues* 33, 116–138.

- ix. Gehl, J., 1987. *The Life Between Buildings*. Van Nost.rand Reinhold, New York.
- x. Gifford, R. *The Consequences of Living in High-Rise Buildings*. *Arch. Sci. Rev.* 2007, 50, 2–17.
- xi. De Jaegher, Hanne, et al. "Can Social Interaction Constitute Social Cognition?" *Trends in Cognitive Sciences*, Vol. 14, No. 10, 2010, pp. 441-447.
- xii. Newman, Oscar. *Design Guidelines for Creating Defensible Space.*, United States, 1976.
- xiii. Li, Lei and Liu Yun. Advancing to the aggregation – Discussing the interior public space of high-rise residents. *Huazhong Architecture*. Vol. 23 (1), 2006; pp.81-82

The Surreal Beauty of Architecture

Appraising The Ideologies And Notions Of Antoni Gaudi by Traversing Through His Masterpieces

Authors - Alafiya Talib, Ar. Shilpa Dhawale (Guide)

Allana College of Architecture, Pune

alafiya.talib22@gmail.com

Abstract: ‘Beauty’ - a profound idea is entirely a subjective opinion based on a person’s ideals and beliefs. Aesthetics make architecture a visual art of designing structures and spaces with an essence which leaves a mark on the souls of people. The paper aims at understanding the conception and perception of surreal beauty in architecture by analysing the works of the famous Catalan Modernist architect, Antoni Gaudi. Being the pioneer of Art Nouveau style in Barcelona, Gaudi created masterpieces which became the symbols of his legacy. One such example, the Casa Battlo, has been studied in its entirety for this research paper. This is a case study performed by the researcher in her third academic year. Different research papers, books and articles have also been studied and analysed to consolidate the research before deriving conclusions.

Keywords – Beauty, Antoni Gaudi, Casa Battlo, notions, ideologies, perception

INTRODUCTION:

What is Beauty?

“Design is not making beauty; beauty emerges from selection, affinities, integration and love”, says Louis Kahn. ‘Beauty’ is a simple word with a profound meaning that goes beyond the physical appearance of a person or in terms of architecture, the ‘Aesthetics’ of a building. It is a subjective opinion and how one perceives it, is entirely based on their ideals and beliefs. The definition of ‘Beauty’ has varied through times, through cultures, through people; but what remains constant is how it makes one feel, which is, real and elated. ‘What is most beautiful is not the most useful’ – a myth believed by many, but what makes this myth an irony is ‘Architecture’. Gathering insight from Vitruvius ten books on architecture, many architects have followed his three criteria for a piece of architecture called the ‘Vitruvian Triad’, where beauty is also an important aspect.

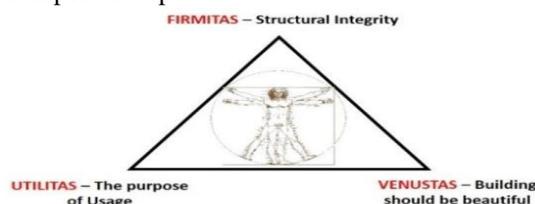


Fig-1 The Vitruvian Triad

Source – Author, www.pinterest.de

Architecture – An Exquisite Art

Architecture is a visual art of designing structures and spaces with an essence which leaves a mark on the souls of people. The reminiscence of the space lingers in our memories even after ages. In its most basic explanation, architecture is an easy equation, where, Art + Technology = Architecture. It is a unique blend of art that speaks meaning and technology that helps achieve beautiful structures that are beyond people’s desires. Hence, architecture cannot be defined as mere construction of buildings. It is a profession, a passion, a vocation and a calling.

Aesthetics and Architecture

Aesthetics can greatly help us getting back to the original fundamentals of architecture where beauty is integrated with function and structure. Aesthetics has always been an important element in architecture dating back to the earliest human civilization. From Indus Valley Civilization through to Industrial Revolution leading to various ‘Isms’ in architecture and up till Post-Modernism period – beauty in architecture has evolved with time to become finer and richer today. What greatly influenced this evolution was the progress in the society, its needs, cultural changes and most importantly its people. One such remarkable architectural style which changed the face of architecture was the Art Nouveau Style.

Art Nouveau – “The New Art”

Art Nouveau was a design style that became eminent in Europe and the United States in the late 1880s and early 1890s. It was a reaction against the 19th Century academic styles and an urge of the artists and architects to create a style for the world to come. In short, new art for a new age. The characterising features were a sense of dynamism and movement which were the result of asymmetry or curved lines, and the use of modern materials like iron, glass, ceramics and concrete, to create interesting forms and larger open spaces. A major philosophy that governed Art Nouveau was that beautiful things could benefit the people who saw them. Antoni Gaudi, a famous Catalan Modernist architect lived by this philosophy and has created masterpieces which became the surreal beauties of his

heritage. People either loved his work at first sight or loathed it for ages to come, but that never discouraged Gaudi from following his ideologies. The research thus focuses on understanding these ideologies and notions of Antoni Gaudi by appraising his magnificent structures.

MATERIAL AND METHODOLOGY

Antoni Gaudi – “God’s Architect”

A famous saying by Antoni Gaudi goes as, “The straight lines belong to men; the curved ones to God”. He was born to a Catalan family in Reus, near Barcelona in the year 1852. Gaudi was popularly called ‘God’s Architect’ who combined his passion for architecture, nature and religion, and brought buildings to life. Being the pioneer of Art Nouveau style in

3. **Casa Mila** – A sensational beauty, immersed in the fluid cavity of a gigantic body and rendering warm and hospitable vibes all around it – such was the aura of Casa Mila.
4. **Sagrada Familia** – The votive temple, with accentuated verticality, parabolic curves, inclined pillars, hyperboloid vaults and a ‘definitive transfiguration of the Gothic’ is an unfinished marvel in itself. It is a piece of art which could only be finished by Gaudi himself and remains still under construction.



Fig-2 Casa Vicens

Source – www.tripadvisor.co.uk

Barcelona, Gaudi has majorly contributed in giving this city a mesmerizing character by his magical touch. A few notable examples of his works are:

1. **Casa Vicens** – Undulating Polychromatic façades with Mudejar Stylistic and ornamental variations of Casa Vicens, gave the occupants a sense of well-being, beauty and a close relationship with the nature through its extravagant interiors and exteriors.
2. **Park Guell** – Beyond architectural heritage, the park showcase Gaudi’s flair for landscaping, his extensive knowledge of botany and his exemplary ability at design and planning.



Fig-3 Casa Mila

Source – www.mapsofworld.com



Fig-4 Park Guell

Source – www.spainattractions.es



Fig-5 Sagrada Familia

Source – www.mymodernmet.com

To better understand Gaudi and his affinity for details, a symbol of his legacy – ‘Casa Batlló’ has been studied in its entirety.

Casa Batlló – A Living Wonder

Casa Batlló is a living work of art commissioned by Antoni Gaudi in 1904 at Passeig de Gracia. At the start of 20th Century, Passeig de Gracia had become Barcelona’s most vibrant street. In 1903, Josep Batlló acquired the then Casa Batlló which was built by Emili Salas Cortes in 1877. At that time, Casa Batlló was a dull structure and greatly contrasted its neighbouring building, Casa Amatller designed by Puig i Cadafalch. Josep Batlló approached Gaudi who was at the peak of his career then. Batlló wanted to demolish the existing structure and construct from scratch, but Gaudi convinced him for a complete renovation instead. Two more floors – one storey and an attic were added and the façade, central patio well, ground floor and the main floor were entirely redone.

Extraordinary Exteriors

With respect to the original façade, Gaudi only preserved the location, size and shape of the windows. On the existing substratum, he overlaid a backdrop, 14.5m wide by 32m high, which resembled the impressionist paintings. He divided the entire façade into 3 sections – the bottom consisting of stone whose curved forms appear like bones and masks, the centre with ceramic and glass which glimmer like sea foam and the top is the ceramic roof which resembles the body of a large reptile. The entire façade is supposed to be ‘a symbolic hymn of the legend of Saint George, Catalonia’s patron saint, in his victory over dragon’ and also a symbol of ‘Carnival’.

Intricate Interiors

The interiors are detailed with equal intricacy as compared to the exteriors. The twisting flowing partitions and edges in

combination with colour manipulation and extensive variation of the scale makes the inside very dynamic. Within the 450 sq.m occupied by the main floor, Gaudi created spacious, welcoming and bright rooms, dominated by curvilinear patterns inspired from nature. The blue and white ceramic tiles of the patio, the custom made doors and windows, the sublime combination of volumes, colours, textures and materials are some of the peculiar features of the interiors.

4300 sq.m is the surface area of all the floors. Gaudi added an extra 1200 sq.m. The building occupies a small narrow plot further narrowed by two other residential buildings.

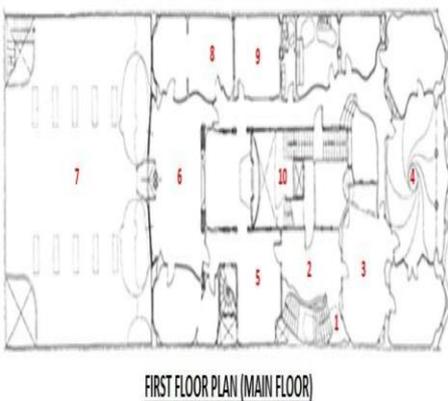
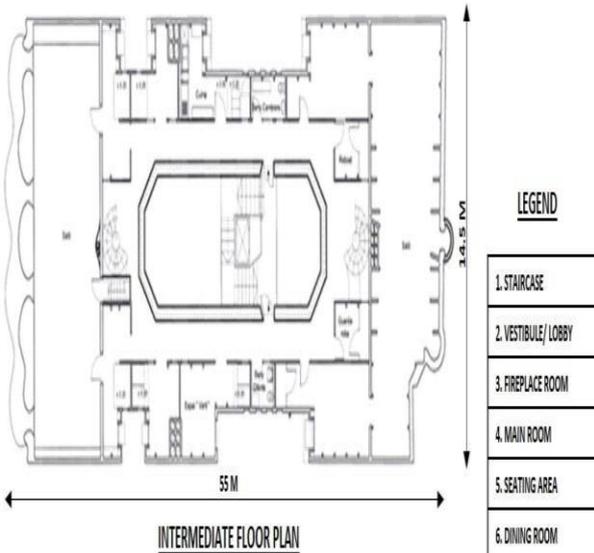


Fig-6 Floor Plans of Casa Batlló

Source – Author, en.wikiarquitectura.com

ANALYSIS AND INFERENCES

The Redefined Casa Batlló

Casa Batlló was not an original Gaudi creation, but a restoration of an already existing building. Gaudi wanted to get the most out of the site's surface area, so he converted a circumspect building built a quarter of a century before into a masterpiece which is now admired by experts and laymen alike. The structure absolutely has no right angles or straight lines highlighting Gaudi's way of working – one with the nature and its Creator.

A keen attention to the context was paid as well. The building soared 9 metres above the neighbouring terraces and the way

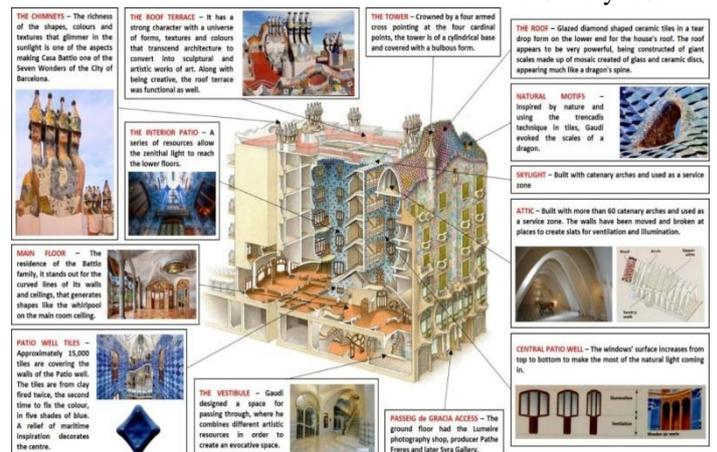


Fig-7 Isometric Cut Section through the Interiors of Casa Batlló

Source – Author, Rainer Zerbest, “The Complete Work of Antoni Gaudi” (Book), www.pinterest.es

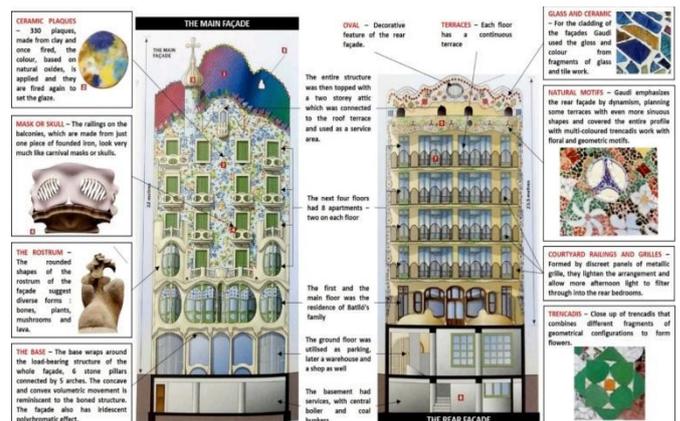


Fig-8 Front and Rear Façade of Casa Batlló

Source – Author, Rainer Zerbest, “The Complete Work of Antoni Gaudi” (Book)

Gaudi tackled it was splendid. He designed the roof with a steep slope and rounded it at the ends so that the visual continuity with the surrounding buildings would not be broken. Every detail added to the structure elevated its overall appeal. Be it the colourful ceramic plaques of the façade, the mask shaped balconies, the rostrum or the creatively designed roof; every feature contributed to the famous Casa Batlló we see today, adorning the street of Barcelona. The structure is packed with ‘imagination and creativity’ on the visual side and ‘Rationalism

and Biomimicry' on the constructive side.



Fig-9 Casa Battlo with the adjacent buildings

Source - Rainer Zerbest, "The Complete Work of Antoni Gaudi" (Book)

The Barcelona of Gaudi

The entire study showcases that Antoni Gaudi succeeded in drawing on profound and ecological meaning in architecture. His whimsical vision along with ingenious designs gave a touch of magic to the streets of Barcelona. Be it the soaring Sagrada Familia to the glistening, textured façade of Casa Batlló and the enchanting landscape of Park Guell, every structure proves as to why Gaudi gained the sobriquet "God's Architect". With his outstanding attention to every detail in the nature, his inspirations from both neo-Gothic and Orientalist aesthetics, and a lifelong commitment to the Catalan identity, Gaudi created his outlandish brand of the Modernista movement which transformed and defined the Barcelona Cityscape.

A Mad Man or a Genius!

For centuries, architects have tried to make buildings in a way so as to reflect the world in which they lived and Antoni Gaudi was no exception. His love for his native land and great pride in his Mediterranean heritage inspired his creativity, originality and an innate sense of art and design. But it is in details where his architecture truly shined. Each of his peculiar mediums – wood, wrought iron, ceramics and stained glass – depict a seamlessly intertwined story of life, death and the faith in between.

There is a deep pervasive sense of an intensely carnal sacrality in the works of Antoni Gaudi which activated a symbolic and expressive dimension. Gaudi's style was often admired by Surrealist and Abstract Expressionist painters and sculptors, but it also received major criticism. His works were majorly ignored from the 1920s to 1930s and were disregarded as being

que and excessively over expressive. The mere criticism never strayed him from his vocation, he rather called upon everything in his experience to nourish and perfect it. Later his work again gained popularity by 1950s and was championed by artists like Salvador Dali. Critics like George R. Collins and Roberto Pane created a renewed awareness for Gaudi's works and his style was rediscovered from 1950 to 1960.

Gaudi's works currently have become eminent around the world with 7 of his projects listed as UNESCO World Heritage Sites. The architect was indeed a genius, who, with his visionary ideas and unsurpassed attention to details constructed masterpieces, that even after a century never cease to amaze, inspire and impress its spectators.

CONCLUSION

Beauty and its perception has no bound as long as one strongly believes in their ideologies. Any structure that pleases and delights one is deemed beautiful and that which irritates and disgusts one is ugly. But these are just notions which should never stop one from perceiving their passion. Beauty stems from context, materials, spaces, ideas, etc. that take a building from what it is to what it could be.

ACKNOWLEDGMENT

I would like to express a deep felt gratitude to my guide and mentor Ar. Shilpa Dhawale for her valuable time, guidance, support, input and encouragement throughout the research process. Her meticulous and sharp insight helped me reach a level of finesse. Also a sincere thanks to my friends and family who kept me motivated always.

REFERENCES

- i. Maria Antonietta Crippa, "Antoni Gaudi – 1852-1926 – From Nature to Architecture", Taschen, 2003, Pages-20.
- ii. William Hardy, "A Guide to Art Nouveau Style", Pg.no. 35 - 41
- iii. Rainer Zerbest, "The Complete Work of Antoni Gaudi", Taschen, Pg.no. 208 - 223
- iv. Thomas Forkin, "Casa Batlló – Final Major Project", January 30, 2012, http://thomasforkinfmp.blogspot.com/2012_01_01_archive.html
- v. "Beauty in Architecture." Free Essays - PhDessay.com, 21 Jul 2016, <https://phdessay.com/beauty-in-architecture/>
- vi. Lexi Herrick, "What is the real definition of Beauty?", September 10, 2016, https://www.huffpost.com/entry/what-is-the-real-definition-of-beauty_b_8117790
- vii. "Antoni Gaudi – Essay." Free Essays - PhDessay.com, 6 Dec 2017, <https://phdessay.com/antoni-gaudi-essay/>
- viii. Christopher McFadden, "Antoni Gaudi: 'God's Architect' who brought Buildings to Life", February 24, 2018, <https://interestingengineering.com/antoni-gaudi-gods-architect-who-brought-buildings-to-life>

Investigative Study on Quality Of Ambient Light In Temples: Case Study of Temples In Pune District

Aniket Tayade, Ar. Sudhir Deshpande

SMEF's Brick School of Architecture, Pune, Maharashtra

Email ID: tayadeaniket392@gmail.com

Abstract: *The temple architecture includes the design of spaces that compliments to the journey of devotee's self-realization from outer world to the inner soul. Lighting creates a visual drama of patterns, forms, mysterious shadows through different elements. Therefore, the objective of this study is to analyze the quality of ambient light in the temples. It also identifies ambient lighting strategies in the temple design through case studies of Changavateshwara and Sangameshwar Temples. The data is collected through on site observational survey, photographic documentation and informal discussions with visitors. This study is also supported by analytical sketches, technical plans and sections of the temple. The data is analyzed through parameters like types of lights, orientation, intensity of light and incident surfaces. The findings decode the existence and quality of ambient light in the temple.*

Keywords: Devotee, Connect, Ambience, Space, Activity, Soul

INTRODUCTION

The monumental buildings and sculptures describe their existence in varied aspects. Light is one of such aspects that brings 'Life' in these monumental heritage buildings. Those include, The Pyramids in Egypt, Early Christian and Byzantine Churches, the medieval cathedrals, Islamic Mosques and many more. India is the country known for its religious and cultural beliefs. It is well known for the ancient Hindu '*Hemadpanthi*' architectural style temples.

Lighting plays an important role in temple architecture, because these temples had daylight as the only source of light at that time. The temple is strategically designed as a holy place (Choudhary, 2017). The orientation, volume, space configuration, scale of structure and the proportions of openings, hierarchy of spaces and our psychological transition are the factors that are present in every '*Hemadpanthi*' style of temple. Two types of lighting plays a role in ambience of the temple viz. (i) Natural light during daytime (ii) Artificial lighting by means of '*Mashals*', '*Diyas*/oil lamps, artificial lamps' used after sunset. The natural light brings liveliness into the temple space in a very sub tonal manner whereas the

light scheme in the night time creates a spiritual environment inside the temple spaces. The ambience of this light helps in mood creation of the devotee. The passive architectural strategies used in temple help in creating drama of light such as: *Jali* wall/window patterns, clerestory windows, skylights, double/triple height '*mandapa*' spaces. During the evenings/night time, the oil lamps are placed on the edges of the compound wall / plinth of the temple. During the special occasions / festivals the '*deepstambh*' is completely filled with oil lamps. A single '*diya/oil lamp*' placed next to the deity reflects the holiness of the deity. The incident light on various architectural elements creates interplay of lighting patterns of light, shades and shadows. There are various techniques through which the light is penetrated inside the temple.

LITERATURE REVIEW

The lights reflected from the walls that create mysterious shadows, controlled light entering through smaller niches/openings, light used as focal point, etc. The natural light is called as significant part of religious symbolism. (Dokras, 2020)

The temple architecture includes the design of spaces that compliments to the journey of devotee's self-realization from outer world to the inner soul. (Mukharji, 2001).

Giedion who was the Swiss art historian pointed out that light induces the sensation in the space in which the space is destroyed by darkness but the space with light is protected. (Mollela, 2002). Lighting also brings aesthetics to the temple in day time and in a night time also. "*More and more, so it seems to me, light is the beautifier of the building.*" -Frank Lloyd Wright

The holy environment of temple makes a positive impact on devotee's mind and body. The psychological and spiritual journey of the devotee begins when it progresses through the spaces of the temple, till it reaches the innermost shrine (womb). It is the innermost sanctum where there is complete darkness. This darkness changes the state of mind of the devotee. The eyes of the devotee become familiar with the darkness and there is no more connect to the worldly

thoughts. The connect with the deity ensures a self-realization and personal divinity to the devotee (Mukharji, 2001).

The ambient light in temple assists the devotee in detachment with external physical world and in attachment towards the supreme power i.e. deity.

MATERIAL AND METHODOLOGY

This study is based on the observations through case studies of two Shiva temples located in Deccan plateau of Maharashtra in Pune district viz. ChangaVateshwar Mahadeo Mandir, Bhiwadi built in 14th century and Sangameshwar Mahadeo Mandir, Saswad built in 17th century. These temples include small shrines and planned as a complex They include many cultural and allied activities into a complex. Therefore, the quality of ambient light is of utmost importance. This research is carried out through on-site observational survey, photographic documentations and informal discussions with the visitors in respective temple complexes. This research is also based on qualitative literature findings. The parameters considered for the study are the types of lights as Direct, Reflected, Refracted, Orientation of complex, light intensity, Incident surfaces. The photographic documentation includes images of the temple interiors, premises to understand spatial quality of ambient light. This study is also supported by analytical sketches, technical plans and sections of the temple.

ANALYSIS AND DISCUSSIONS

1. Changa Wateshwar Temple, Bhiwadi ,Saswad

This temple is situated at the foothills of Purandar fort at Bhiwadi near Saswad in Pune district. It was built in 17th century by Sardar Jaisaheb Raghvendra Purandare. The temple has 'Hemadpanthi' architectural style. It is completely built with Stone. It comes under Yadava Dynasty.



Fig 1: Changa Wateshwar Temple, Bhiwadi ,Saswad
 (Source : Balkrishna's Travellogue)

The temple is planned in a sequential way from Mandapa to Ardha Mandapa to Garbhagriha. The ambient light level is also reducing in intensity as devotee moves from Mandapa to Garbha griha. The open coolonades in the mandapa provides enough light penetration for public gatherings. Light is provided through side axial openings in Ardha Mandapa in a controlled manner to increase concentration of devotee towards deity. Garbhagriha is treated with very low light level only optimum light level at the deity's place by the use of oil lamps. Fig 1 and 2 shows the light intensity levels as described above. Fig 3 shows different types of lighting creating ambience in temple interiors of Changa Vateshwara temple.

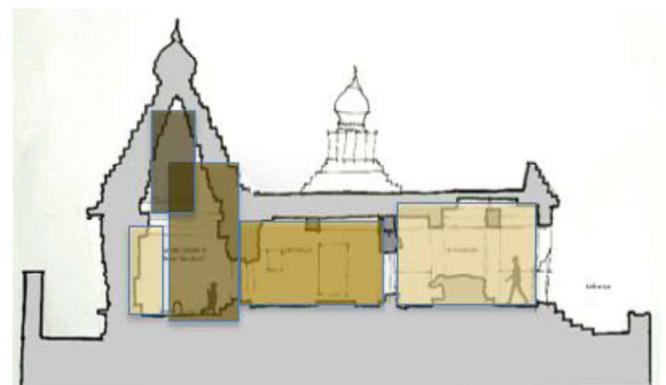


Fig 1: Section of Changa Wateshwar temple showing light intensity levels
 (Source: Author)

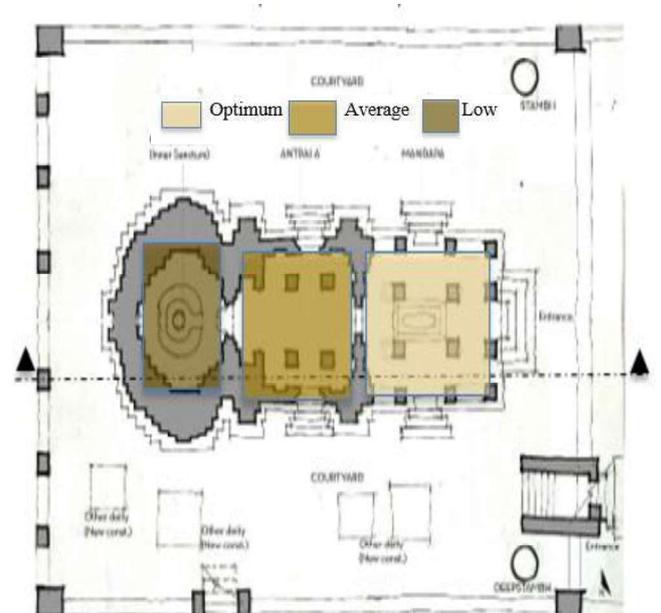


Fig 2: Plan of Changa Wateshwar temple showing light intensity levels
 (Source: Author)

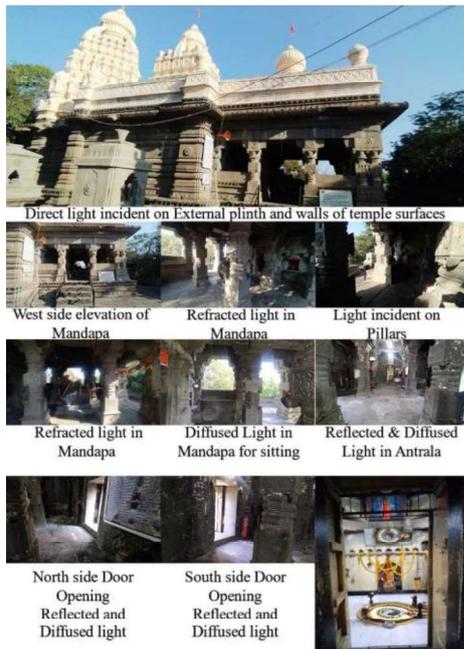


Fig 3: Image of Chang Wateshwar temple interiors
(Source: Author)

Table 1 shows the on-site observations of the temple based on listed parameters. The observations are documented in morning time period.

Table 1: On site Observation Analysis of Changavateshwara Temple

Sr.no	Parameters	Observations
1	Direct light	There is a 10-15 m buffer of trees on the east side. Therefore, the sunlight penetrates through tiny patches between the foliage of the tree.
2	Reflected light	There are three openings to the <i>Antrala</i> , the entrance to the <i>Antrala</i> on East side, and door openings on north and south side. The opening on East side gets a minimal amount of light due to the <i>Mandapa</i> space adjacent to it. The chamfered door way openings to the North and South direction, bring reflected light from opening incident on unpolished Stone flooring.
3	Refracted light	The light is incident on elements of the <i>Mandapa</i> like Pillars, stone seating, it then gets refracted on the plinth surface
4	Orientation	East facing entrance and East-West oriented
5	Light	The <i>mandapa</i> gets diffused natural

	intensity	light due to trees buffer at east. The canopy somehow helps cut direct glare. <i>Antrala</i> gets reflected natural light from unpolished stone flooring. It consists of artificial light too. The <i>garbhagriha</i> is completely dark so there is use of artificial lighting.
6	Incident surfaces	The external plinth in courtyard gets filtered and direct light.

Table 2 shows the analysis based on the parameters according to each space of the temple.

Table 2: On site Observation Analysis of Changavateshwara Temple – Area wise light intensity observation

Changa Wateshwar Temple					
Type of space	Direct Light	Reflected Light	Refracted Light	Intensity of Light	Remarks
External Courtyard	Green	Yellow	Green	Overlit	Glare with reflections through leaves. Due to this direct light, people come here to video shoot/photoshoot. Devotees sit in the open space which is shaded by tree.
Mandapa	Red	Yellow	Green	Diffused	No glare. Completely shaded due to trees. Devotees sit on the stone seating
Antarala	Red	Green	Red	Diffused	In the range between Diffused and underlit. Due to lack of natural light, provision of artificial lighting is done, which doesn't give the required indirect effect of light.
Garbhagriha	Red	Red	Red	Underlit	As it is completely dark, provision of artificial lighting is done.
	Green	Yellow	Red		
	Fullfill	Partially fulfill	Not fulfill		

2 .Sangameshwar Temple, Saswad

This temple is situated just 500m from Changa Wateshwar Temple. It was also built in 17th century. This temple is placed 10-15 m above the *Karha* river's water level as shown in fig 4. It comes under Yadava dynasty. The ambient light in the temple addresses intangible space perception of a devotee and creates divine architecture. Fig 5 and 6 shows the light intensity levels from Mandapa to Garbhagriha.



Fig 4: Sangameshwar Temple, Saswad
(Source: Google image gallery)

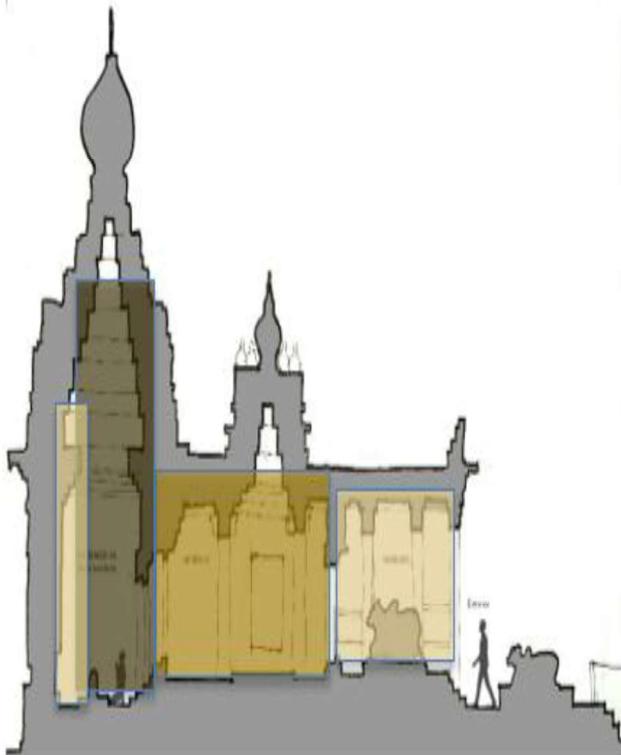


Fig 5: Section of Sangameshwara temple showing light intensity levels
 (Source: Author)

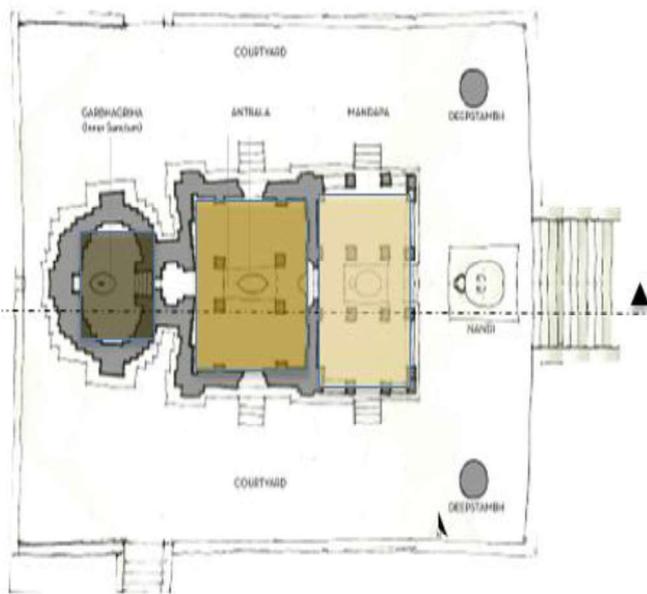


Fig 6: Plan of Sangameshwara temple showing light intensity levels
 (Source: Author)

Fig 7 shows the interplay of direct, reflected and diffused light on the floor and overall interiors of Sangameshwara temple.

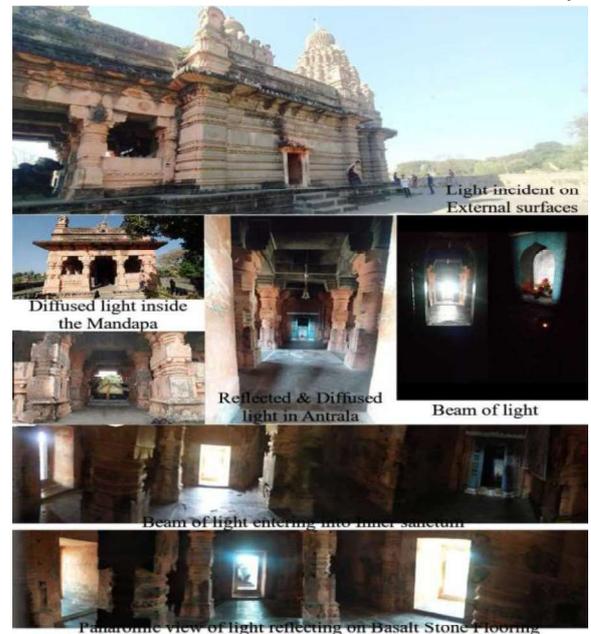


Fig 7: Image of Sangameshwara temple interiors
 (Source: Author)

Table 3 shows the on-site observations of the temple based on listed parameters. The observations are documented in morning time period.

Table 3: On site Observation Analysis of Sangameshwara Temple

Sr.no	Parameters	Observations
1	Direct light	The temple is situated at a height of 12-15 m above the water surface. This height helps in receiving direct light without any obstructions. The light is directly incident on external plinth surfaces. This light directly falls in <i>Garbhagriha</i> .
2	Reflected light	The light enters from East, North and South side into the <i>Antrala</i> . The interiors of receive reflected light from the stone flooring. The panoramic view shows that the light rays are collided on stone flooring and then reflected back into the space creating an illusion of light
3	Refracted light	There is a refraction phenomenon seen in <i>Mandapa</i> space as it is open from three sides – East, North and South. This phenomena creates a visual drama due to change in angle of incidents.
4	Orientation	East facing entrance. East-West oriented
5	Light intensity	The light intensity in the <i>Mandapa</i> is low as compared to <i>Antrala</i> , as it becomes entirely shaded. The <i>Antrala</i> is the space

		which is well lit without any artificial source of light. The <i>garbhagriha</i> is the space which receives a narrow beam of light falling onto the niche.
6	Incident surfaces	The external plinth in the courtyard is the surface onto which direct light is incident. The <i>garbhagriha</i> 's niche is the surface onto which the beam of light is incident.

Table 4: On site Observation Analysis of Sangameshwara Temple – Area wise light intensity observation

Sangameshwara Temple					
Type of space	Direct Light	Reflected Light	Refracted Light	Intensity of Light	Remarks
External Courtyard	Green	Red	Red	Overlit	The courtyard has no buffer where the direct light can be controlled. There are plantations on compound wall, so in future when they grow will shade the courtyard. Currently devotees don't sit here due to direct light.
Mandapa	Red	Yellow	Green	Shaded.	Due to the close placement of pillars, the light incident in Mandapa gets refracted. Devotees find it pleasant place to sit.
Antarala	Red	Green	Red	Well lit.	The collision of controlled light rays coming from east,north,south direction light up the space naturally. This is an indirect light.
Garbhagriha	Yellow	Yellow	Red	Dim lit	The mesmerizing phenomenon of an elevated Temple is observed here. The sun rays penetrate onto the niche of the garbhagriha.
	Green	Yellow	Red		Legend: Green: Fullfill, Yellow: Partially fulfill, Red: Not fulfill

Fig 8 shows the penetration of light inside the temple through direct, reflected and diffused light from temple interiors.

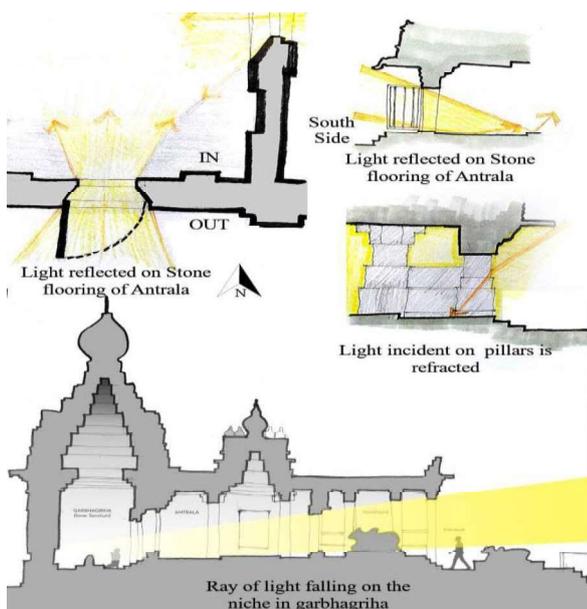


Fig 8: Penetration of light in temple interiors
 (Source: Author)

FINDINGS

From the tables above, it is seen that the spaces inside the *Changawateshwar* Temple are more enclosed than the *Sangameshwar* Temple. The *Sangameshwar* temple gets a controlled ray of sunlight into the *garbhagriha* due to its height. Due to green buffer and less as compared to other temple, the *Changa Wateshwar* Temple do not get ample amount of daylight. Therefore, there is a provision of artificial lighting. The ambient lighting in temples is not provided with higher intensity but created by the use of diffusion and reflection phenomenon. The utmost importance is given to image of the deity. The sequential pattern of light intensity is observed during the study. Also ambient lighting addresses the intangibility in space perception. It creates peaceful and self-realization emotions in the mind scape of the devotee.

CONCLUSION

The inferences and findings help to understand the quality of ambient light in the temples. It also contributes to a database for setting design parameters for new upcoming temples. Therefore, this study is a value addition in exploring the divine physical environment with the use of ambient light in the temple architecture.

ACKNOWLEDGEMENTS

Firstly, we would like to thank DY Patil School of Architecture, Lohegaon for shortlisting my abstract. Then we would like to acknowledge our faculty coordinators Ar. Vaidehi Lavand and Ar. Ramiya Gopal. Also the friends who helped us in this process of documentation.

REFERENCES

- i. Choudhary S. (2017), 'The Role of Five Elements of Nature In Temple Architecture', *International Journal of Scientific & Engineering Research* Volume 8, Issue 7, July-2017.
<https://www.ijser.org/researchpaper/The-Role-of-Five-Elements-of-Nature-In-Temple-Architecture.pdf>
- ii. Dokras, Srishti & Dokras, Uday. (2020). *Lighting in ancient Temples*.
https://www.researchgate.net/publication/343683004_Lighting_in_ancient_Temples/citation/download
- iii. Gunjal K (2018), 'study of architectural elements of spiritual spaces', thesis, college of Architecture, Gujrat University.
https://issuu.com/khushboogunjal/docs/final_draft.docx
- iv. Molella, A. (2002). *Science Moderne: Sigfried Giedion's "Space, Time and Architecture and Mechanization Takes Command"*. *Technology and Culture*, 43(2), 374-389.

Retrieved March 11, 2021, from <http://www.jstor.org/stable/25147909>
- v. Mukharji A. (2001), 'The holy light: a study of natural light in hindu temples in the southern region of tamilnadu, india (7 century ad to 17 century ad)', thesis, Texas A&M University
<https://core.ac.uk/download/pdf/6101658.pdf>

Pollinators And The City

Anushri Shetty¹, Snehal Gaikwad²

Academy of Architecture, Mumbai, India

Email: anushris16@aoamumbai.in; snehalg@aoamumbai.in

Abstract: *Increasing global urbanization has resulted in the decline of local biodiversity and suitable habitat for wild flora and fauna. Indigenous bees in particular are poorly understood and treated as pests. The lack of baseline information in India, encumbers the scientists who monitor their movements and fluctuations in population. In this study, melittological data has been compared and analysed to generate methods to integrate bees within the urban matrix in order to maintain the ecological balance of our metropolitan surroundings and build resilient cities. By comparing various biodiversity measures between open land and dense urban sites, through the lens of architectural mediation, a hypothesis was generated to provide and protect habitats of indigenous bee species. Nature based solutions to urban interventions such as pollinator pathways, biodiverse green roofs, etc. as potential avenues to provide patches of agreeable habitat to indigenous bees in highly developed regions have been discussed. Concerns regarding the phenomenon of nature deficit disorder have been addressed, furthermore implications for pollinator conservation and urban agricultural production are discussed.*

Key words – Pollinator conservation, urban biodiversity, indigenous bees, habitat loss, urban agriculture, food security

INTRODUCTION

Cities are areas of land that have been cultivated, manipulated, and architecturally redesigned for the benefit and use of human beings. Every city in its evolution was once a natural landscape, having been manipulated over time and will continue to evolve in design and function. Fast-paced development has meant many organisms have disappeared from these settings, unable to perform their lively functions in this changed landscape. The most widely and economically relevant ecosystem service that pollinators provide to humans is their ability to pollinate our food crops. Although agricultural areas are not urban, their massive landscape changes may be more extensive than even that in cities. With the loss of natural pollinators from these areas, we have replaced their service with that of the human-managed honeybees. Cities may be more appropriate and provide more potential for some pollinator populations than in other human changed landscapes. Pollinators are also responsible for 60-70% of flowering plant populations, securing a vital ecological role in sustaining plant communities.¹ Especially when considering native and endangered plants that face their own set of struggles to survive, pollination should be an

¹ "Pollinator conservation — the difference between managing for" 10 Nov. 2015, <https://www.sciencedirect.com/science/article/pii/S2214574515001650>

unthreatened service to protect plants. As there is little sign of city growth slowing down or of changes to natural resource needs well beyond city limits planners, local governments and citizens must start to include natural conservation from within urban boundaries as a method of saving biodiversity of pollinators and incorporating pollinator conservation initiative into sustainable ecological management in cities. Little is known about the populations of bees in urban areas, as there has been little attention paid to their function in cities. As urban agriculture has become important both socially and economically to urban communities, bees play a role in the function of businesses and organizational programs invested in urban food production. Pollinators are key shareholders in the effort to provide local food security in cities and seed saving efforts. As we explore new and innovative ways to green our cities, the service of pollination will go hand in hand in the success or failure of many of these efforts. Bees are often considered “keystone species”, meaning that they are a key indicator to the overall health of an ecosystem. Bees have a direct mutual relationship with plant populations, and they also occupy many ecological niches. This means that if there is high biodiversity and abundance of bees, it can be predicted that there will be high biodiversity and abundance of other organisms within that ecotype.

IMPLICATIONS OF BEE DECLINE

Hand-in-hand with our need for bees comes increasingly strong evidence that they are in decline. This decline appears to be mainly anthropogenically driven, with a number of factors playing major causal roles.

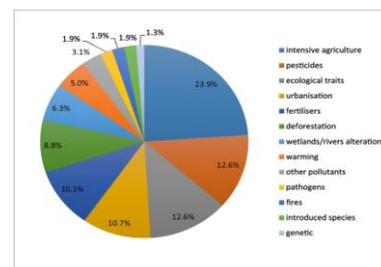


Figure- 1 Main factors associated with insect declines.
Source: Sánchez-Bayo and Wyckhuys, 2019 / *Biological Conservation*

Habitat loss (habitat degradation and outright destruction) appears to be the major causal factor in the decline of bees, as it is for the decline of biodiversity in general. Habitat fragmentation, a direct result of habitat loss, will impact on surviving populations, either through genetic

isolation and subsequent inbreeding or simply the inability of small habitat islands to support viable bee populations. Invasive and emergent species, be they plants, other free-living animals or parasites and pathogens, can significantly impact on bee populations in surviving habitats.

Climate change is likely to have a huge impact on remaining bee biodiversity in the future, as it has on other insects already, although as yet no studies have demonstrated a clear causal effect on bee population persistence. habitat loss, fragmentation, invasive species and climate change are not independent factors; they interact with each other and thus their impact on bee populations is unlikely to be simple to predict. The question of whether we are in the midst of a global pollinator decline has received much attention in the media as well as the academic literature, but is difficult to answer empirically due to a lack of pollinator monitoring programs and long-term data series. The need for establishing pollinator monitoring programs was recognized internationally in 1993 when pollinators were incorporated into the Convention on Biological Diversity, which has been signed by 168 countries.

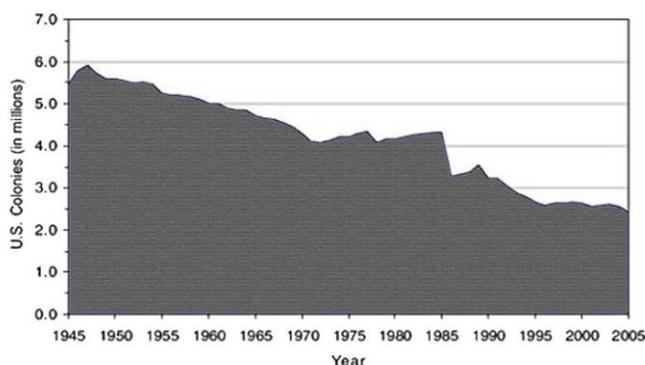


Figure- 2 U.S. honey bee colony numbers 1945-2005
Source: National Research Council 2007

However, India is far behind on the monitoring of the bee population. Global trends suggest a drop, however we do not have sufficient information with respect to the past populations to confirm. Since around 2002, farmers in Odisha have been noticing that fewer bees visit their fields each year. It was not just one single species of bees that began to disappear but several, many of which farmers knew were linked to the health of their fields.²

IMPLICATIONS ON FOOD SUPPLY

A decline of pollinators can seriously impact the food supply. Fruit production would be strongly affected as most fruits require insects for pollination. Propagation of many

vegetables would become problematic. However, a lack of pollinators would not lead to a complete penury of food. This is because not all plants require pollinators for seed production. For many plant species, the wind, and not bees or other pollinators, carry pollen from one plant to the next, ensuring seed production. Grasses, which include wheat and barley and the majority of grains, are wind-pollinated. Corn pollen is also carried by wind. In addition, some of the vegetables we consume have been bred to self-fertilize, where pollination occurs within the same flower in the absence of pollinators. Therefore, wind-pollination and self-fertilization will help maintain some plants and crops in the absence of pollinators.

Nevertheless, a lack of pollinators would strongly affect our diet and would limit the availability of various nutrients provided by many fruits and vegetables. By limiting alfalfa production, a lack of pollinators would also affect meat production and production of dairy products. Thus, a decline in pollinators would negatively affect human nutrition. The health of humans depends on the health of pollinators.



Figure- 3 Impact of bee decline on groceries
Source: Whole Foods

The dependence of humans on plants goes far beyond food production. Plants provide building material and are the original source of most pharmaceuticals. Most importantly, humans rely on healthy plants to provide oxygen. Humans breathe in oxygen and exhale carbon dioxide. Plants capture carbon dioxide from the atmosphere to produce oxygen. Without plants, the air would become filled with carbon dioxide and devoid of oxygen which would lead to the demise of animals, including humans. A loss of pollinators would not lead to the complete disappearance of plants on earth, as various plants are wind-pollinated and other plants rely entirely on self-pollination for seed production. However, it would shift the composition of plant communities with serious implications for the animals that feed on them or use them for shelter. These changes would have many ramifications, many of which are difficult to predict. Humans depend on plants and plants depend on pollinators. A balance must be maintained in order to sustain life on earth and protect human survival and health.

CASE FOR URBAN BEES

Studies suggest that urban bees have a higher survival rate, produce more honey, and are healthier than

² "Why are India's bees disappearing? A new study has some answers." 5 Jun. 2017, <https://scroll.in/article/839067/bees-are-disappearing-in-india-and-we-are-slowly-learning-why>.

rural bees. Furthermore, urban bees have a winter survival rate of 62.5 percent, compared to just 40 percent for their rural counterparts. Urban bees also produce, on average, 26.25 pounds of honey in their first year, while the yield for rural bees is only 16.75 pounds.³ In light of these facts, cities should capitalize on and invest in urban beekeeping. Cultivating beehives in an urban context will not only help cities develop economically, but will also have a positive impact on bee health and—by extension—the agricultural community.

Beehives located in cities produce healthier and more productive bees. The reason is that urban bees have access to greater biodiversity, resulting in a more varied diet and stronger immune systems. Although it might seem natural that hive's would thrive best in rural environments, modern mono-culture farming exposes bees to less diverse plant types and more pesticides. Urban apiculture is not only a great economic opportunity for developing cities, but it is a necessary investment for both bee health and agricultural stability. Supporting responsible development programs and laws can help cultivate urban beekeeping as the backbone of a sustainable urban economy.

LITERATURE REVIEW

India is far behind on the monitoring of the bee population. Global trends suggest a drop, however we do not have sufficient information with respect to the past populations to confirm. The National Beekeeping and Honey Mission (NBHM) was launched to alter this fact.

1. NBHM Guidelines released by the National Bee Board (NBB) of India

The NBHM is characterised by its three Mini Missions that focus on encouraging and training farmers and citizens currently residing in rural areas or agricultural land to shift to the allied activities of beekeeping. Special focus has been given to Research & Technology generation for different Regions/ States/ Agro- Climatic and Socio-Economic conditions. However, this scheme doesn't consider a very important part of beekeeping, the urban environment. India shows a 4.84% urban land expansion growth rate with 30% from population growth. Land starved cities like Mumbai shouldn't be excluded from this plan but must be integrated within the scheme. Sustainable Ecology & Environment has to be the central aspect of city development plans and prepared with peoples' participation. It is even more important that the government plays its part in order to educate people about food security and the importance of urban biodiversity, in these times of ecological disconnect.

³ "Why Cities Should Invest in Beekeeping | Smart Cities Dive."
<https://www.smartcitiesdive.com/ex/sustainablecitiescollective/why-cities-should-invest-beekeeping/1093071/>.

2. Sheila R. Colla, Erin Willis, and Laurence Packer - Can green roofs provide habitat for urban bees (Hymenoptera: Apidae)?

This report focuses on the use of green roofs as a potential avenue to provide patches of good-quality habitat in highly developed regions. It focuses on the survey of green roofs for bee diversity and abundance to determine their potential as quality habitats in an urban area for these important pollinators. By comparing various biodiversity measures between green roofs and ground-level sites, they show that green roofs provide habitat to many bee species.

3. Jennifer L. Hernandez, Gordon W. Frankie, and Robbin W. Thorp - Ecology of Urban Bees: A Review of Current Knowledge and Directions for Future Study.

This report is a comparative study of published studies of bee communities in urban and suburban habitats, which are fewer than those documenting bees in agricultural and wildland settings. Identified trends in urban areas included the following, negative correlation between bee species richness and urban development, increase in abundance of cavity-nesters in urban habitats, and scarcity of floral specialists. The review informs us that the future directions for studying urban bee ecology should incorporate landscape scale assessments, conduct manipulative experiments and actively design urban bee habitats.

METHODOLOGY

Multiple case studies on a macro as well as micro scale were done to realize the full potential of the project. An analysis of these case studies provided a framework for the design guidelines to be followed while proposing the design onsite. The macro level case study was analyzed through the lens of systemic change and creating long term changes. Hence policies of existing Urban beekeeping laws of various mega-cities were studied and compared, in order to build guidelines for Mumbai. Micro level studies were analyzed through the lens of human-bee interaction. In order to understand the impact humans have on the habitat of other species and how can one be made more conscious of our decisions. Design elements were identified from these case studies that would impact the human perception about bees. The aim to tackle nature deficit disorder is seen implicitly in this scale of interventions.

ANALYSIS OF MACRO INTERVENTIONS

Oslo, Norway: In 2015, ByBi, an environmental group based in Oslo, Norway, designed the world's first urban bee highway(a route filled with green roofs and flowers) that supports bees living in city environments. The bee highway works with businesses, schools, organizations and individuals residing in Oslo to build bee-friendly feeding stations and accommodations. The purpose of the project is to connect the

green zones in the urban environment, which include flower beds, plant corridors and green roofs. People are encouraged to plant nectar-bearing flowers for bees around the city.

Dusseldorf International Airport, Germany: Bees have been shown to be effective and versatile monitors of the environment that can be economically employed. Not only are they useful in rural settings but can be easily deployed to highly active areas such as large metropolitan airports. Their monitoring of pollution levels at airports would not replace but augment data collected by modern electronic detection devices. The additional data would be invaluable in helping researchers and policy makers form programs and practices to protect public health and improve quality of life for airports and neighborhoods that surround the airfields.

Utrecht, Netherlands: To fight the bee population decline, Utrecht has transformed over 300 bus stops into bee sanctuaries. These green hubs, or rather bee stops, are essentially bus stops with grass and wildflowers on the roof that aim to encourage pollination. The project, created by the Utrecht council together with Clear Channel, supports the city's biodiversity by attracting the insects as well as capturing fine dust and storing rainwater.

A common factor observed across all the macro interventions was the integration of a community effort with the ecological interventions. The interventions had a dual effect of not only bringing communities together but creating a positive impact on their environment.

A better solution outside of these existing systems, is to design a counter-system of connected ecological design. This means connecting fragmented landscapes, and therefore, native plants, and with them, their partners in native pollinators. By connecting these landscapes, created on deeper time by the interactions of millions of species, we are supporting and enabling the complexity of the planet.

This is a counterweight to the designed lack of biodiversity in large-scale agriculture.

The aim of creating Pollinator Pathways is to connect and expand fragmented landscapes. Connecting these landscapes strengthens their resilience.



Figure- 4 Pollinator Corridors smoothing the transition of Urban to Forested land.

ANALYSIS OF MICRO INTERVENTIONS

The analysis of the 'Vulkan beehive', 'Honey Factory' and 'Elevator B' demonstrated the integration of biophilic principles in the design to illustrate how architecture can respond to the declining number of honey bees. Drawing upon the principles of biophilic design and extinction of experience that emphasize the connection between people and nature, the conclusion of all three case studies highlights the following points.



Figure- 5 Vulkan beehive, Honey Factory, Elevator B from left to right. Source: Open source

All three case studies enhance people's connection to nature by creating an opportunity for them to positively engage with environmental processes. The Vulkan beehive provided some glimpses of the honey bee's presence for the public, the Honey Factory provided live demonstrations and promoted in a more personal interaction with urban beekeeping as a result and the 'Elevator B' project for the public to glimpse into the life of honey bees.

The physical engagement of people entering Elevator B and being able to be so close to honey bees is far more a stronger interaction of the honey bees than the engagement of Honey Factory and Vulkan beehives achieve.

Common observations across all micro interventions:

- The interventions did not require any changes in existing private sector owned infrastructure, but rather targeted public infrastructure and Urban landscapes.
- Biophilic design is used to create strong visual cues that help the public connect the form of the hive to its functionality.
- The interventions are placed in clear public view.
- Sufficient foraging space was available or created for the incoming bees.
- These micro interventions were the beginning of the urban beekeeping revolution eventually observed in all these cities.
- Interventions focused on connecting the public to the bees while ensuring the separation of spaces.
- Beehives were tied with existing markets or communities who would harvest the honey.

ANALYSIS OF URBAN BEEKEEPING POLICY

The fact that bees are battling for survival for more than a decade already has led to many awareness campaigns spearheaded by both small and large communities. With those awareness campaigns, government authorities have given this

vii. *Richard J. Gill, Katherine C.R. Baldock, Mark J.F. Brown, James E. Cresswell, Lynn V. Dicks, Michelle T. Fountain, Michael P.D. Garratt, Leonie A. Gough, Matt S. Heard, John M. Holland, Jeff Ollerton, Graham N. Stone, Cuong Q. Tang, Richard Brand-Hardy, Tom D. Breeze, Mike Green, Chris M. Hartfield, Rory S. O'Connor, Juliet L. Osborne, James Phillips, Peter B. Sutton, Simon G. Potts, Chapter Four - Protecting an Ecosystem Service: Approaches to Understanding and Mitigating Threats to Wild Insect Pollinators, <https://doi.org/10.1016/bs.aecr.2015.10.007>.*

viii. *Wild pollinator activity negatively related to honey bee colony densities in urban context Lise Ropars, Isabelle Dajoz, Colin Fontaine, Audrey Muratet, Benoît Geslin. Published: September 12, 2019 <https://doi.org/10.1371/journal.pone.0222316>*

ix. *Bromenshenk JJ, Henderson CB, Seccomb RA, Welch PM, Debnam SE. Bees as Biosensors: Chemosensory Ability, Honey Bee Monitoring Systems, and Emergent Sensor Technologies Derived from the Pollinator Syndrome. Biosensors (Basel). 2015;5(4):678-711. Published 2015 Oct 30. doi:10.3390/bios5040678*

x. *Kosut, Mary & Moore, Lisa. (2013). Buzz: Urban Beekeeping and the Power of the Bee. https://www.researchgate.net/publication/256461692_Buzz_Urban_Beekeeping_and_the_Power_of_the_Bee.99*

Impact of Illumination of Heritage Monuments on their Overall Footfall

Anvi Singh, Prof. Rahul Chutake

Student, BNCA, Pune | Associate Professor, BNCA, Pune

anvi98@ymail.com, rahul.chutake@bnca.ac.in

Abstract: Heritage structures encapsulate cultural aspects of regions while attracting tourists. Illuminating these monuments increases their visibility and provides an avenue for night tourism. Lighting caters to the hedonistic demands of tourists and boosts interest in monuments. This paper studies the impact of illumination of monuments on the footfall to three prominent monuments of Delhi - Red Fort, Qutb Minar and Purana Qila by analysing data of footfall before and after lighting and surveying residents to examine interest and awareness. It emerged that footfall to monuments is impacted not only by the lighting but by various extraneous factors.

Keywords: Heritage, Footfall, Monument, Tourism, Lighting, Delhi

1. INTRODUCTION

The incredible tangible and intangible heritage of India plays a vital role in the nation's overall growth and development. Heritage is one of the most significant and fastest-growing components of tourism, and if enhanced could become a considerable source of revenue.

In February 2018, 100 monuments all over the country were named "Adarsh Smarak" by the Government of India. The Ministry of Culture allocated a budget to provide world-class amenities at these sites. To encourage heritage tourism, it offered several incentives to states.

Keeping in mind the hedonistic aims of tourists, several amenities introduced prove to be detrimental to the monument in the long run. Often, the principal dilemma for heritage attractions is how to satisfy visitors' expectations and manage their impact without compromising the authenticity of the visitor experience. One of the most popular hedonistic applications in heritage is façade and decorative lighting. Lighting is done to recall the whole object image, as it is in the daylight city panorama and to potentially garner more footfall. The development of spectacular forms of illumination has become a strategy chosen by a growing number of cities and a vital part of regeneration strategy and place promotion. Illuminating a monument has a nuanced duality in terms of impact. It can be hypothesised that lighting impacts the image perception of a monument. However, in terms of sustainability, the impact of certain lighting systems (such as halogens) is severely detrimental. Excessive lighting is a burden to the environment as well as the economy.

Revenue is simultaneously a threat and a selling point of the lighting system that supersedes most conservation and

environmental concerns. Revenue contributes to the upkeep and maintenance of the monument. Not only does a proper lighting system allow for longer opening hours for monuments but it also opens the possibility of sound and light shows, a major tourism magnet.

The advent of several lighting proposals in heritage structures of Delhi, by the Archaeological Survey of India (ASI), makes the exploration of the relationship between lighting and footfall and by extension, revenue, an important study.

The abundance of heritage in Delhi alone isn't the sole factor that impacts footfall. With sweltering heat in the summer, visitors would prefer to visit heritage structures in the evenings, when temperatures are lower. The novelty of watching monuments glittering with bright lights could pose as an added incentive. However, a critical factor in the impact of illumination is the preparedness (or lack thereof) in the city for night tourism. Amenities such as street lighting in the vicinity, availability of vendors within the confines of the monuments and easy ticketing process increase the self-efficacy of a monument, making it more accessible and less daunting to visit at night.

A study of the impacts of the lighting of monuments may be



used to create a module for future proposals to follow.

2. MATERIAL AND METHODOLOGY

The objective of this study is to correlate the data of footfall to monuments (with existing lighting systems) with the interest and awareness of citizens with regards to the lighting of monuments. Three monuments out of the 5 Adarsh Smaraks of Delhi were selected for this study: Purana Qila, Red Fort and Qutb Minar. These monuments are nationally protected and have LED lighting systems implemented by ASI. Additionally, Purana Qila and Red Fort have light and sound shows in the evenings.

Figure1: Location Map of Illuminated Monuments, Delhi

Source: Author

The data collection for the research paper was done to answer the following key questions: What role does monument lighting play in enhancing the awareness about the monument? Does the lighting of monuments create interest to visit the monument, and what impact does monument lighting have on footfall during the daytime?

An online survey of 155 random Delhi-NCR residents was conducted using Google Forms. A structured questionnaire was designed to collect the required data. Most respondents were residents of Delhi during the implementation of monument lighting.

To analyse the passive registration of monument lighting and its implications respondents were asked if they cross any of the studied monuments on their regular commute to work/college/school and if they had visited the monuments at night. After establishing the level of passive registration, respondents were asked about their awareness of the lighting proposals (existing and new) in Monuments.

Questions were also asked to gauge the interest of respondents in visiting monuments with lighting. Further, respondents aware of the lighting were asked whether they had visited the monument since its implementation.

General unstructured interviews of monument staff and visitors were conducted at each monument. Eighteen monument staff were interviewed to discover their observed fluctuations in visitor footfall. Thirty visitors at the monuments- including Delhi residents, domestic and foreign tourists - were interviewed during the day time to gauge the awareness about the monument lighting system.

Apart from the above, secondary data of footfall to the three selected monuments was sourced from ASI archives of ticket sales. An analysis of footfall without considering lighting as a factor was done to observe the patterns and to determine

factors affecting footfall. The analysis of data was supplemented with media reports.

This study attempts to derive a one-to-one correlation between the illumination of the heritage structures and footfall in the same. However, footfall may be affected by extraneous factors to a higher degree. These include, but are not limited to weather, pollution (health advisories and media coverage regarding Delhi pollution), events (Republic Day, 26th January and Independence Day, 15th August), elections, political unrest (protests) and new policies (e.g. Demonetisation). (xiii) While lack of awareness about lighting in heritage structures can undeniably be a factor inhibiting night tourism, safety may be a greater challenge impacting footfall.

3. RESULTS AND TABLES

3.1 Primary Data Analysis

Due to lighting, there is a perception of an increase in awareness, footfall and interest in heritage structures.

3.1.1 Survey: Analysing Awareness

From the survey, it was found that about 53% of the respondents pass one or more of the studied monuments on their daily commute. 75% from that subset do so during the evening or night hours (when the lighting is functional) indicating passive registration.

A total of 99 respondents claimed to have visited Red Fort and Purana Qila at night. This can be attributed to the light and sound shows that have existed before the recent ASI lighting proposal's implementation.

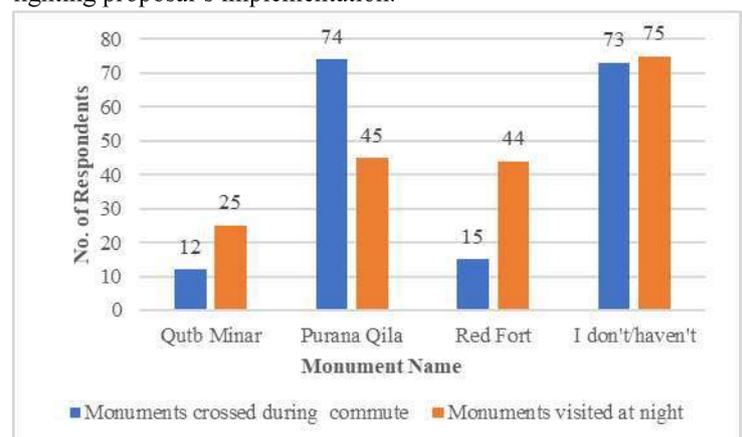


Chart 1: Monuments crossed during daily commute or monuments visited at night

Regarding awareness, 67% claimed to be completely or somewhat unaware of monument illumination. However, most respondents (42.6%) strongly agreed that lighting plays a role in creating awareness about heritage.

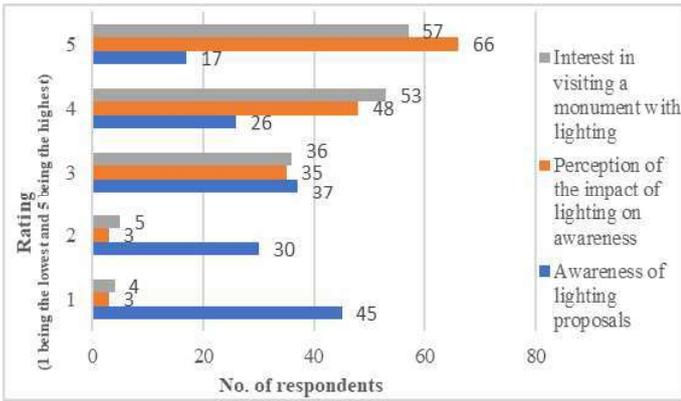


Chart 2: Rating of respondents on their interest, perception and awareness

3.1.2 Survey: Analysing Interest - Passive and Active

The survey indicated high levels of interest among respondents in visiting monuments with lighting (Chart 2). While a majority claimed to have not visited the monuments since the lighting, many others displayed an active and passive interest in doing the same.



Chart 3: Respondents visiting Monuments since the implementation of lighting

3.1.3 General Interviews (on-site): Monument Staff and Visitors

Interviews of monument staff and visitors suggested that there was little to no visible fluctuation in footfall to the heritage structures since the implementation of lighting. The interviews revealed that at Qutb Minar, most visitors were not aware of the lighting and an even lesser number knew that the monument remains open at night. However, at Purana Qila and Red Fort, the awareness about lighting was somewhat higher among the visitors.

3.2. Secondary Data Analysis (Footfall)

The lighting at the Red Fort, Purana Qila and Qutb Minar was implemented and opened to the public in August 2018, October 2018 and September 2019 respectively. Secondary data of footfall illustrates that illumination has not impacted the footfall significantly. It is noticed that there is seasonality in the tourists visiting these monuments. Generally, the first and last quarters of the Financial Year witness high footfall

owing to pleasant weather conditions. Although, it is difficult to observe any other clear patterns in the data, except for the general decline in footfall.

a. Red Fort

August and January are lean months for the visit of tourists to Red Fort. The increase in footfall is encouraging in June, September and March.

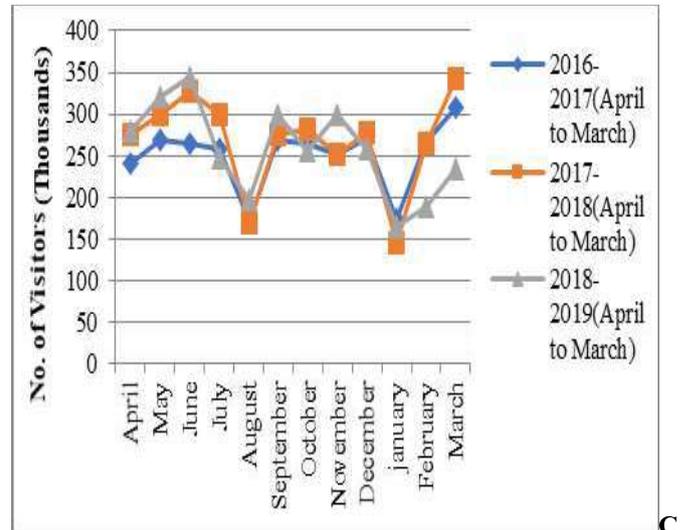


Chart 4: Monthly Footfall to Red Fort (2016-19)

b. Purana Qila

There is a consistent decrease in the tourist inflow to Purana Qila in the last three years. Nevertheless, the months of August and January are encouraging for this monument when more tourists flock to it.

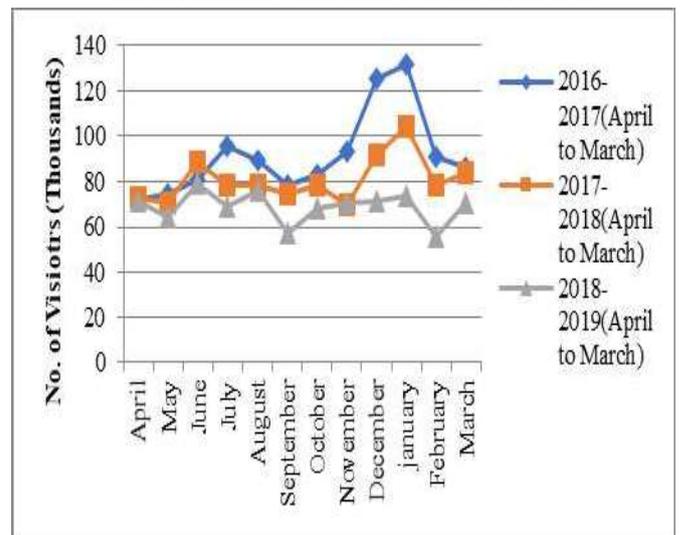


Chart 5: Monthly Footfall to Purana Qila (2016-19)

c. Qutub Minar

The last two years have not been very encouraging for Qutub Minar. The decline is quite significant in the year 2019-20. The data indicates that May and October are particularly popular months for visiting.

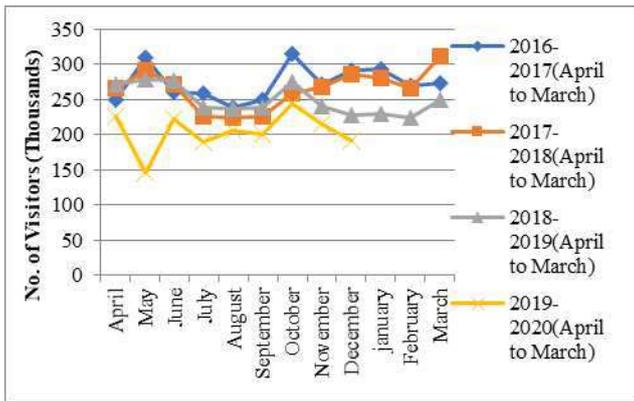


Chart 6: Monthly Footfall to Qutb Minar (2016-19)

4. CONCLUSION

Despite an overall increase in tourist numbers, the baffling reality of heritage tourism in India is a steady decline. There's a palpable interest in illuminated monuments that isn't being translated into real-time footfall numbers due to extraneous factors. At the current scale of these factors, illumination is not impacting footfall in any significant manner.

5. ACKNOWLEDGEMENT

I would like to extend my sincere gratitude to my guide, Prof Rahul Chutake for his guidance with this paper. My deepest thanks also, to my father, Dr Ajay S Singh who greatly helped with editing. Finally, I am grateful to ASI for providing me with the necessary data for this study.

REFERENCES

(i) Heritage Tourism in India: A Stakeholder's Perspective. Arun Sharma, Suman Sharma. 2017, *Tourism and Travelling*. https://businessperspectives.org/images/pdf/applications/publishing/templates/article/assets/9500/TT_2017_Sharma.pdf

(ii) *Cultural and heritage tourism: identifying niches for international travelers*. O'Leary, Joseph T and Morrison, Alastair M. and Alzua, Aurkene. 1998, *Journal of Tourism Studies Vol. 9, No. 2*, pp. 2-13. <https://www.cabdirect.org/cabdirect/abstract/19991804813>

(iii) Ministry of Tourism, Govt. of India. Ministry of Tourism, Govt. of India - Market Research and Statistics. Ministry of Tourism, Govt. of India. [Online] 2019. [Cited: February 26, 2020.] <http://tourism.gov.in/sites/default/files/Other/India%20Tourism%20Statistics%20at%20a%20Glance%202019.pdf>.

(iv) Ministries of Tourism and Culture meet the 15th. PIB. Delhi : Press Bureau of India, 2019. 15th Finance Commission. pp. 1-2. <https://pib.gov.in/newsite/PrintRelease.aspx?relid=192832>

(v) *Enlightened hedonism: Exploring the relationship of service value, visitor knowledge and interest, to visitor enjoyment at heritage attractions*. Stephen J. Calver, Stephen J. Page. 2013, *Tourism Management*, p. 1.

<https://www.sciencedirect.com/science/article/abs/pii/S0261517713000873>

(vi) *Heritage tourism: at what price?* Alan Fyall, Brian Garrod. 2010, *Managing Leisure*, pp. 213-228. <https://www.tandfonline.com/doi/abs/10.1080/136067198375996>

(vii) *Some aspects of architectural lighting of historical buildings*. Gorczevska, M. 2011, *Lighting in Engineering, Architecture and the Environment*, pp. 107-116. <https://www.witpress.com/elibrary/wit-transactions-on-the-built-environment/121/22059>

(viii). *Outdoor lighting design as a tool for tourism development. The case of Valladolid*. Giordano, Emanuele. 2017, *European Planning Studies*, Taylor & Francis (Routledge). <https://halshs.archives-ouvertes.fr/halshs-01577518/document>

(ix) *The lighting dimension of perceived tourist image: the case of Barcelona*. Coromina, Raquel Camprubi & Lluís. 2018, *Current Issues in Tourism*, pp. 2342-2347. <https://www.tandfonline.com/doi/abs/10.1080/13683500.2018.1508428>

(x) Ministry of Culture, Govt. of India. Culture Minister Shri Prahlad Singh Patel inaugurates the architectural illumination of the historic Safdarjung Tomb. NEW DELHI, INDIA : Press Information Bureau, July 2019. <https://www.facebook.com/IndianHeritage.GoI/posts/culture-minister-shri-prahlad-singh-patel-inaugurates-the-architectural-illumina/2358634007560386/>

(xi) R. W. Belk, S.M. Low, I. Altman. *Place Attachment: Human Behaviour and environment*. New York : New York: Plenum Press, 1992. pp. 37-62. https://books.google.com/books?hl=en&lr=&id=-nvBwAAQBAJ&oi=fnd&pg=PA1&dq=Place+Attachment:+Human+Behaviour+and+environment+belk&ots=oTo7C2eWgk&sig=VYvI9Ek17zU5gHZTI_X0A6fK3pQ

(xii) Chowdhary, Adrija Roy. *Is Delhi ready for night tourism?* *Hindustan Time*. September 29, 2019. <https://www.hindustantimes.com/india-news/is-delhi-ready-for-night-tourism/story-16pa0xc9QzR5Bi6Tok69cO.html>

(xiii) Lal, Niharika. Delhi Tourism takes monumental hit after cash crunch ASI says footfall down by 50-60%. *The Times of India*. January 13, 2017. <https://timesofindia.indiatimes.com/city/delhi/delhi-tourism-takes-monumental-hit-after-cash-crunch-asi-says-footfall-down-by-50-60/articleshow/56499615.cms>

Living Environments For Outstation Students

Aparna Kher

5th Year B.Arch, PVP College of Architecture

kher.aparna98@gmail.com

Abstract: The aim of the research is to come down to a set of parameters that could be the potential contributors of creating a homely environment in student accommodation facilities. These factors could prove to be useful for formation of guidelines for designing such facilities thereafter. The outcome of this research would be to find out what factors have the most impact on forming homely environments so that they can be adapted into future designs. The focus will be given to understanding the student-accommodation relationship across various parameters such as the feeling of privacy, security, convenience, customisation, sense of belongingness, etc.

Keywords: Living environments, sense of belongingness, outstation students, student accommodations, homeliness

INTRODUCTION:

Home, as an entity, can be interpreted in various ways and can have multiple perceptions. However, what can be unanimously agreed upon is the influence 'home' has on the psyche and overall development of a person. This idea of 'home' can comprise of different components for every individual. This particular research aims to look at student accommodations for undergraduate students living out of station. This particular niche is the most common type of student accommodation type and an under graduate course can be a very important transition in one's life. This phase of life that is the age between 18 and 23 is a transition into adulthood which brings about a lot of changes in an individual. The student learns, become responsible, independent and forms his/her identity during these years as a result to being exposed to a different environment where he/she has to stay away from their home.

A student coming from a different town goes through a lot of different changes as he/ she is faced with a completely new environment. An individual may be faced with new environments in terms of geographical location, unknown language, a different financial or cultural environment, etc. These changes pose various challenges which can affect the

mindset of a young adult. Facing such a new environment requires adjustment from the student's side so that he/ she may get adapted to the new situation. Students come across issues like cultural shock, homesickness, newfound independence and responsibilities, identity crises, social struggles, etc. while trying to adapt to their changed environments. These issues have a correlation with the environment that they are surrounded by during their college days and can impact their association with their accommodation facility.

When one experiences a different environment a lot of internal changes take place as a result of external differences in the context, culture and community. The mindset of the student can be impacted by the kind of environment he is surrounded by. Attitude towards academics, overall personality development, the kind of habits formed, attitude towards the society, behaviour, sense of belongingness to the hostel environment and the university are some of the aspects that are governed by the kind of environment that the student is surrounded by. Understanding these factors and learning about the responses of students towards their accommodation facilities can enable the study to analyse how and to what degree these accommodation facilities have an impact on the life of the student.

The focus will be given to understanding the student-accommodation relationship across various parameters such as the feeling of privacy, security, convenience, customization of the space, sense of belongingness, etc. Along with that, factors such as area of the space, physical context, spatial organisation, hierarchy of spaces, and provision of services shall also be taken into consideration. For enabling this study, the method chosen will comprise of case studies and interviews.

METHODOLOGY:

The study involves analysis of available material on this topic and identification of factors that impact the living environments of students. The methodology adopted for this research is two-fold. One part of the methodology involves analysis and

comparison of the various parameters suggested in various studies that have been referred for this research. These case studies have been selected as they all deal with hostel campuses that are associated with universities. They discuss various areas that are important in decoding the satisfaction of students regarding their accommodation. Factors from various categories have been discussed in depth in each of these studies. The selection criterion for these reference studies is that they all deal with satisfaction levels and impact of hostel facilities on the university students. They have also been chosen as they all belong to varying contexts in terms of their geographical location. Comparing these research studies gives a clearer idea about parameters that are more case-specific and parameters that are more universal in nature. The geographical location of the university, the courses it offers, the demographics of that region/ country, the overall economic background of the students taking admission in that university, etc help in deciding what parameters should be considered for looking at the perceptions of the students regarding their accommodations. It helps in shortlisting the parameters that are responsible for determining the satisfaction levels of students in that particular university.

The second part of the methodology is to put these parameters to test and get responses from students first hand. The institute chosen for this was College of Engineering, Pune. The girls' hostel new building was completed in 2014 and houses around 900 girls. The hostel campus includes the girls' hostel new building, the older dormitories for first year students, common mess for boys and girls, security guard's cabin, a gym, reading rooms, laundry, a rooftop recreational space. The campus of the hostel has facilities for girls' hostel, boys' hostel, a few common areas like open areas and mess and offices and residence of the hostel rector. A questionnaire was circulated to the girls residing in the new hostel building. The questionnaire consisted of questions to understand responses for various parameters. It started off by asking how many years has the respondent resided in the hostel building. It asked the respondents if they felt a sense of belongingness towards their hostel facility. It also asked the respondents whether they associate a feeling of homeliness with the hostel. The respondents were also asked to state their reasons for the same. A question asked them about their satisfaction with their size of accommodation i.e. their room size. Responses from this questionnaire were considered for testing the impact of parameters such as facilities, spatial configuration, etc. on the students and the results were thus analysed.

A few of the respondents were also interviewed in depth on the basis of the questionnaire and in-depth answers regarding the concerned parameters were obtained through these questionnaires.

RESULTS:

The literature reviews point to parameters that are overlapped in most of the case studies and hence are important for understanding student- accommodation relations. These parameters are spatial organization, on-campus location, provision of basic facilities such as water supply, sanitation and electricity, provision of adequate room sizes, etc.

Data collected from the site visit to COEP girls' hostel, Shivajinagar along with the questionnaire was analysed to understand the perception of students with respect to their accommodation facility. A majority of the girls (over 60%) who answered the questionnaire belonged to the fourth year of their engineering programme and have lived in the hostel during their course. About 33% of the girls have lives in the hostel facility for 4 years, about 26.7% for 3 years and 30% for 2 years respectively.

When answering the question about satisfaction with the hostel facility, 66.7% of the girls opted for 'no' as the answer. The interviews conducted in depth justify this answer as a lot of the girls raised issues like irregular water supply, improper maintenance of toilets, maintenance issues, etc. This points to the fact that provision of facilities becomes one of the crucial parameters to decide the impact of hostel environments on its students.

Even though two thirds of the interviewees were dissatisfied with their hostel, 56.7% of the total interviewees said that they felt a sense of belonging with their hostel. For girls who said yes, the reasons for the same were friendly roommates and seniors, sense of responsibility towards their temporary accommodation, duration of stay, etc. For girls who said no, the reasons were similar to that of the previous question, also supported by reasons of uncooperative roommates, infrastructural issues, etc. Another parameter uncovered here is of company. Most of the girls who were satisfied with their company in the hostel said that they felt a sense of belongingness with the space. However, lack of such company, or unpleasant experiences with it affect the sense of belongingness with the hostel.

The following question asked whether the students felt at home or homely in the hostel. 64.3% of the girls voted no. These answers were again justified by the aforementioned parameters

and certain issues with the facilities provided by the hostel. The next question asked if the girls were satisfied with the size of their rooms. 80% of them said yes. The girls in the hostel live in triple sharing rooms and toilets are shared by two rooms. Every room has three beds, three desks and three cupboards for storage. They also have a common closet. The space provided for per person in a room is roughly 7.5m². The respondents were satisfied with that size.

The last question asked whether staying in an on-campus hostel had improved the overall university experience. 68% of the respondents said that it had. This can be pointed out to factors such as common facilities and roommates.

CONCLUSION:

The analysis of the reference studies shows that irrespective of the context, factors like room size, provision of basic facilities, and distance from the university / lecture halls have an impact on the living environments and satisfaction levels. These parameters, when tested with the case of COEP Girls hostel were also proven to be true. Physical factors mentioned above have a considerable impact on the association of the students with their accommodation facilities. Consideration of social and management factors can help strengthen this study further.

The second part of the discussion that is whether these environments are homely, have mixed conclusions. While the students develop a sense of belonging with their hostel accommodation facilities due to reasons like duration of stay, bonds with roommates, etc these facilities do not evoke a homely feeling with most students. A small percentage of students voted yes for the criteria of homely feeling. Students do not seem to associate a homely feeling with their hostel facilities very easily.

It can be therefore established that provision of these basic facilities is essential to maintain a good hostel environment and provision of additional facilities such as recreational spaces, laundry, reading rooms, open spaces, etc, help in enriching the experience of hostel students in these temporary accommodations.

Universities could focus on the provision and improvement of these facilities and make the experience of the students worthwhile as there are benefits attached with this such as greater satisfaction levels, improved academic performance, etc.

ACKNOWLEDGEMENT:

I would like to thank my guide, Ar. Aanchal Vidyasagar for steering this research in the right direction. I would like to acknowledge the help provided by Mr. Mahendra Ranjekar, Chief Rector, College of Engineering, Pune hostel. I would also like to thank the girls' hostel staff for helping me out and showing me around the campus. I would like to acknowledge the co-operation of the interviewees who took the time to respond to the questionnaire.

REFERENCES:

- i. Ajayi, M. (2015). *Students' satisfaction with hostel facilities in Federal University Of Technology, Akure, Nigeria. European Scientific Journal.*
- ii. Amina Iftikhar, A. A. (n.d.). *A Qualitative Study Investigating the Impact of Hostel Life. International Journal of Emergency Mental Health and Human Resilience, 17, 511-515.*
- iii. Dhamija, A. (n.d.). *Student Housing: Home away from home.*
- iv. Economics, S. S. (n.d.). *Education Landscape in Pune.*
- v. Fatemeh Khozaei, N. A. (2010). *The Factors Predicting Students' Satisfaction with University Hostels, . Asian Culture and History .*
- vi. Future, R. t. (n.d.). *COEP Girls Hostel. Retrieved from Rethinking the Future.*
- vii. Norazah Mohd Suki, I. A. (2015). *Students' Attitude and Satisfaction Living in Sustainable On-Campus Hostels . Malaysian Journal of Business and Economics , 35-47.*
- viii. SAPFI, C. &. (2019). *The Herald of a New Chapter. CBRE and SAPFI.*
- ix. Shahid Bashir, I. H. (2012). *Students' Perception on the Service Quality of Malaysian Universities' Hostel Accommodation . International Journal of Business and Social Science .*
- x. Wakefield, C. a. (2019). *Student Housing Universe in India. Cushman and Wakefield & SAPFI.*

Contribution of Market To Urban Areas

Author: Apoorva Jagtap

Co-author: Ar. Mukta Latkar Talwalkar

Bharati Vidyapeeth (deemed to be) University, Pune India

Email: apoorvapjagtap@gmail.com, mlt@bvco.in

Abstract: Markets are inseparable elements of the model of the city: compact, complex, and efficient and with social cohesion. No other format could truly reproduce what the market offers. Apart from offering traditional products and old working ways, the markets have been evolved and tend to incorporate the wide variety of service in order to face an increasing competitive environment. This paper focuses on the markets in urban areas, their social contribution and importance. It highlights the contribution of such spaces and how they affect social life and quality of life in urban areas and their development. And by analysing different market places and their case studies, books and research work this can be achieved.

Key words – Market, Social life, Urban areas, Public space, Economy.

INTRODUCTION

The public market is the world's oldest retail trading format. Its ancient origins lie in the sale or barter of surplus produce, once agriculture had changed society's basic hunter-and-gatherer pattern. After animals became domesticated and crops harvested, there was not only food for the farmer's household, but, climate and weather willing, extra produce and all goods for trade. Around the world, for centuries, the buying and selling of food took place in public marketplaces open to all. Markets have a very long history and have been key focal points in the centers of the urban areas. Markets were known since ancient Babylonia, Assyria, Phoenecia, Greece, Egypt and the Arabian times, in the form of stoa, bazaar, marketplace etc. **Stoa** in Greek architecture is a freestanding colonnade or covered walkway; also, a long open building, its roof supported by one or more rows of columns parallel to the rear wall.



Figure 1: Site plan of the agora of Athens (Ching, 2017)

Stoas were both ornamental and practical. They served as promenades sheltered from the heat of summer and the cold winds of winter, as judicial and shopping centers, and as boundary markers. Greek city planners came to prefer the stoa as a device for framing the agora (public market place) of a city or town.

Markets represent important public spaces and spaces of exchange. Markets became an important feature of rural life. At the same time, they also became vital centers of social and community life; places where people would meet and exchange not only goods, but information and stories too. Along with encouraging social and cultural aspects, it helps community cohesion. Its physical location and physical form add to the grain of the layout, if designed in tune with spatial concept of the overall development. Location of market plays a vital role in various aspects, like social, economical, availability of products, footfall etc.

Human beings are social creatures, they enjoy leaving home and benefitting from the social contact shopping offers and they like to browse, graze, touch, feel, and test what they are going to buy. No other format could truly reproduce what the market offers.

1. Markets meet the all the demands and needs of its customers.
2. Markets support sales of local products.
3. Markets provide space for social and cultural activities and interactions.
4. Markets provide social services.
5. Markets promote healthy lifestyles and eating habits.
6. Provide Economic Opportunity.
7. Link urban and rural areas.
8. Create active public space.

Markets and social life: Markets can contribute to the social cohesion of a neighborhood – an important goal in itself. But this social integration can also enhance political and popular support for the market and lead to increased market trade, thereby adding to this economic success of the market. Market contributes to the fulfillment of the population's expectations of the neighborhood and creates a space for social and cultural interaction and exchange. Markets contribute to the social cohesion of a neighborhood by improving livelihood and dynamism, promoting community

cohesion, enhancing the way that people identify with the neighborhood and the market and live together, and contributing to the overall sense of well-being of residents.

MATERIAL AND METHODOLOGY

This research is based on visual methodology and literature study along with case studies. The literature study is based on secondary sources like books, research papers and articles, case study, Pictures, internet sources and journals; to understand the current situation, what markets serve to the urban areas and how they improve the social life of the urban areas.

LITERATURE STUDY:

Markets are key sites of sociability. Markets provide different social functions like the formation of social ties, social mixing across groups and social inclusion. Social interaction can range from a very minimal connection, such as a greeting between acquaintances or between shoppers and traders, to extended conversations between those who have met up in the market, or extended interactions between stallholders and the customers they serve. It is a public space where marginalized groups come to spend time, thereby providing opportunities to escape isolation in the home or elsewhere, while also providing an economically inclusive space. The major interaction in market happens in following ways:

Trader - Trader interaction: While working together or having their shops around traders tend to form special relation with each other. The social atmosphere and vibrancy of a market were greatly enhanced in markets where traders had strong connections between themselves. They also have their own association to take decisions about the market; even they help each other in any possible way.

Trader - Buyer interaction: It is the most obvious and common interaction happens in the market given that traders represent the visible centre of the market community, how they conduct themselves strongly affects the way a market feels to those who visit. Certain relationships gets build between the shopkeepers and the customers who are regular, this mostly occurs in the fruit and vegetable and other food traders (as opposed to stallholders who worked markets on a one-day-a-week basis).

Buyer - Buyer interaction: Market serve as a great social platform for different group of people in a different manner. People make friends develop certain relations while shopping together. Markets which have café/restaurants and good

seating space in them tend to have better social interaction. (Storr, 2008)

1. Case study: Baltic station market

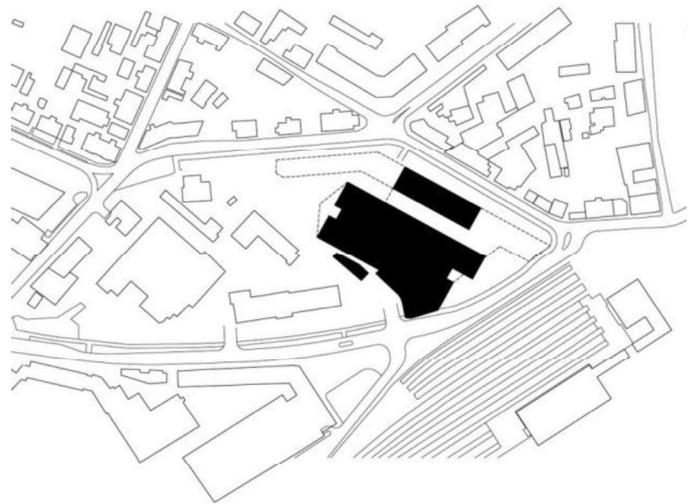


Figure 2: Baltic station market, Site plan (ArchDaily)

The Baltic Station Market is located in north Tallinn between the city's main railway station and the popular residential district of Kalamaja. The aim of the design was to create a contemporary and diverse market, while also preserving the historic character of the market with all of its hustle and bustle and chaotic nature, the pre-existing context was added to attract the widest target audience possible - from rail passengers to local residents, young people to tourists, and everyone who happens to be passing through the area. The interior market is laid out over three floors within the reconstructed buildings and between them.



Figure 3: Baltic station market, Ground floor market (ArchDaily)

Ground floor: The main objective of the market's ground floor is to convey the hustle and bustle. The desired environment is created through the massing of various market forms, brought together on the ground floor. Typical functions of a market – stalls for meat, fish, and dairy – stand side by

side with the farmers market, vegetable stalls, and a street food avenue in the central building. Combining these functions creates an entirely new way to experience the Baltic Station Market.

First floor: The first floor is mainly dedicated to the essentials of the former market – antiques, second-hand goods and clothing. The market serves as a great public space for social interaction and economical aspect.

Underground floor: On the underground floor, there is a supermarket, a sports club, and various services.

The outdoor market stand wooden kiosks, designated for smaller businesses, such as bakers, sweet shops, spice shops etc. The squares are connected by ramps and terraces, lined with cozy areas for eating and sitting, a children's playground, and terraces for cafés and restaurants, the desired environment is created through the massing of various market forms, brought together for better interaction and social activity.

1. Case study: Crawford Market



Figure 4: Crawford market, Site plan (udri)

Crawford market is very famous household market (vegetable, fruits, poultry, flowers etc.) in South Mumbai. Founded in 1871, the market was initially known as 'Mahatma Jyotirao

Phule Market' completed in 1869 and businesses commenced in 1871. Crawford Market was the main wholesale market till 1966, Spanning around 72000 sq. yards, (www.mumbai.org.uk). This market is also famous for its splendid architecture. Norman and Flemish styles are seen in the market including some Gothic features. The place is also designed in such a manner so that it receives ample sunlight during the day.



Figure 5: Crawford market, View (udri)

Clock tower and frieze at the entrance of the market are one of the main features of the market with intricate Victorian carvings allow lots of tourist interaction. Built in 1871, this market was designed and conceptualized by William Emerson. The market first got electricity in 1882, and became the first market in India to receive electricity. The market has better rail and road connectivity, its location and availability of different types of products at one place helps in better footfall.

RESULTS AND OBSERVATIONS

Markets have often been the most socially diverse public places in a community, bringing people of different ages, genders, races ethnicities, and socioeconomic status together around the experiences of food, shopping, music and conversation. The market functions not only as a space of social interaction and social mixing but also space of economics, place which connects rural to urban and promotes better and healthy life. It facilitated the creation of social bonds. Markets operate as social spaces in a number of different ways for different social groups. This varied across the different sites, and also between different social groups. The social life of traders themselves played a significant role in helping to create a vibrant atmosphere in markets, the interactions between traders and shoppers are also crucial component of the social life and interactions in the market, particularly for people who regularly visit markets. In these respects, the markets also functioned as sites of social bonding. They are flexible spatial and temporal public spaces. As sites of interactions of flows of people, goods and

information, marketplaces facilitate an improvised and spontaneous synergy of people and communities, which is at the core of everyday life of the city. In a market we feel the pulse, the energy, and the potential that cities offer – an urban quality that appeals both to tourists and to local residents. It is like heart beat of the city.

CONCLUSION

Markets are vital part of the urban areas, not just a place for commerce but as public gathering places for people from different ethnic, cultural, and socioeconomic communities. As one of the few places where people comfortably gather and meet, markets are our neighborhoods' original civic centers.

ACKNOWLEDGEMENT

I would like to express my deep and sincere gratitude to Ar. Mukta Latkar Talwalkar, Professor Bharati Vidyapeeth (deemed to be) University, College of Architecture, Pune, for giving me the opportunity to do research and providing invaluable guidance throughout this research. Her vision, sincerity and motivation have deeply inspired me and helped me to achieve this.

REFERENCE

- i. *jidipi*: <https://architectures.jidipi.com>
- ii. *ArchDaily*: <https://www.archdaily.com>
- iii. *Britannica*: <https://www.britannica.com>
- iv. *udri*: <http://www.udri.org/>
- v. *Caramaschi, S. (2014). Public markets: rediscovering the centrality of markets in cities and their relevance to urban sustainable development. Vol. 191. Rome: WIT Pres.*
- vi. *Ching, F. D. (2017). A Global History of Architecture. New Jersey: Wiley.*
- vii. *Costa, N. (2015). Urban markets: Heart, Soul and Motor of the Citie. Barcelona: Institut Municipal de Mercats.*
- viii. *Jon Stobart, V. D. (2015). Introduction: markets in modernization: transformations in urban market space and practice. 43 (3).*
- ix. *Neil Tomlinson, V. A. (2018). Contemporary Market Architecture, Planning and Design. Australia: The Image Publishing Group Pvt. Ltd.*
- x. *Sophie Watson, D. S. (2006). Markets as sites for social interaction. Great Britain: The Policy Press.*

The Study of Acoustical Traditional Japanese Landscape Elements by Recommending Design Interventions For Pune-Okayama-Friendship Garden, Pune, India.

Apoorva Patil , Ar. Sanjita Maindargikar

Dr. D.Y Patil School Of Architecture, Pune

Email: apoorva.patil1303@gmail.com, sanjita@dypatilarch.com

Abstract: *Urbanisation is taking over, resulting in a drastic shift in the population from rural to urban areas. Per medical records, stress has increased extensively among adults, children and the elderly. Urban Development and the lifestyle accompanying it has negative health effects which pose as a major challenge for the global society. The aural effect has an impact on the quality of the natural and green spaces and affects our well-being. One such example that further validates the importance of green spaces is Pune-Okayama-friendship garden. Pune-Okayama-friendship garden possesses a natural flow of water from a canal that spreads across the garden. The observations made, are based on the analysis of how sound is used to enrich tranquillity in four gardens based out of Japan. Readings made with the use of SPL meter in specific spaces of the Pune-Okayama-friendship garden support the comparative study.*

Key words: Sound scape Design, urban lifestyle, tranquillity, Japanese gardens

INTRODUCTION

As per medical records, stress has increased extensively among adults, children and the elderly. Urban Development and the lifestyle accompanying it have negative health effects, which pose a major challenge for the global society. Although some amount of stress is inevitable in an individual's life, an ample amount of it could lead to adverse health effects like depression, cardiovascular disease, chronic fatigue, insomnia etc. For gardeners, landscape architects, and designers worldwide, Japanese gardens have always been sources of inspiration. Gardens originally influence the Japanese garden tradition in China. It has a long history with several unique designs, including the karesansui dry landscaped garden, the kaiyū-shiki-teien stroll garden and the cha-niwa-teien tea garden. The Japanese sense of aesthetics is characterized by asymmetry, symbolism, geometry, meticulous detailing and the use of natural materials and is a diverse practice. For several hundred years, Japanese gardens' green and natural habitats have been a significant part of the urban fabric. These gardens provide a contrast to modern life's pressures and the

increasingly densified communities that frequently surround them. Soundscape research adopts a comprehensive understanding of the sound environment, including problems as well as positive experiences focusing on the qualitative and subjective perception of sound environments; it is a wide and interdisciplinary field. In the current research, one of the available methods called Soundscape behaviour was applied to study sonic experiences in the

Pune- Okayama- friendship garden. The paper suggests that the notion of the soundscape in a garden plays an important role in visitors' overall experience. The goal was to substantiate Soundscape behaviour in the Pune- Okayama friendship garden as a design tool and to increase the understanding of peaceful soundscape design. Analysis of four traditional Japanese gardens in terms of soundscape forms the foundation of the research. The objective of the paper is to describe and recommend a few design interventions in terms of elements to be provided in the Pune-Okayama-Friendship garden for enhancements of the soundscape by studying the case studies briefly and the existing aural environment of the garden.

MATERIAL AND METHOD

The present research is focused on empirical material collected in the Pune- Okayama friendship garden using an on-site analysis. The material was collected during the visits made to the garden. A profound and detailed study was done involving five literature reviews in order to understand Japanese gardens in-depth in terms of soundscape landscape. Most of the gardens studied have existed for several hundred years, during which time the gardens and their soundscapes (not least the soundscapes surrounding the gardens) may have changed to various degrees. It should be noted that the aim of the study is not to contribute to historical perspectives as to how gardens in Japan were developed at various times or areas. Instead, tradition is used as a sense in which general understandings of soundscape landscape can be taken from, which can then be extended to other (contemporary) gardens and green areas. It could well be that some of the results encountered in the gardens were not the consequence of their designer's deliberate actions. This does not, however, make it any less important for the purposes of the review. Field notes were collected from the Pune- Okayama friendship garden in the form of digital recordings and SPL readings, which were

the principal material of study. To evaluate and structure the content, the design tool Soundscape behaviour was subsequently applied. Excerpts from the field notes as well as photos, images, field recordings and sound pressure level (SPL) readings were taken in the gardens to support the findings. Sonic sensations are explored and validated by on-site data obtained to improve generalisability. The present study uses a comparative approach between a traditional Japanese garden studied in the literature review and the Pune-Okayama friendship garden. A thorough study of the design principles used in a traditional Japanese garden and its impact on the sonic experiences was also taken into consideration. The gardens selected were situated in Kyoto, which is renowned for its many high-quality gardens. Based on the general perception, notable characteristics and soundscapes, each garden is briefly tabulated. The Soundscape Action instrument was used to interpret the study material and present the findings as a structure.

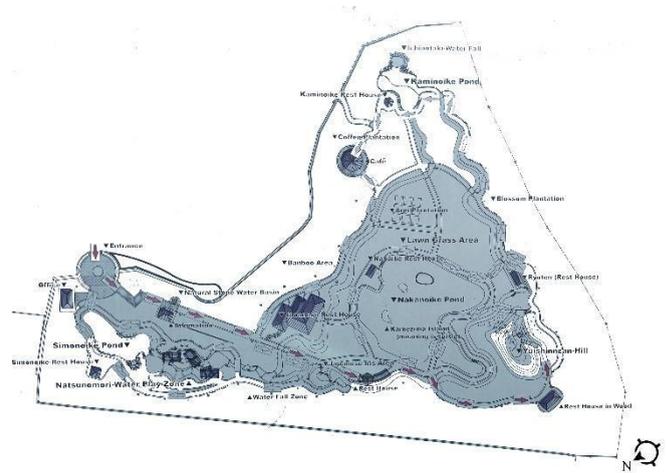
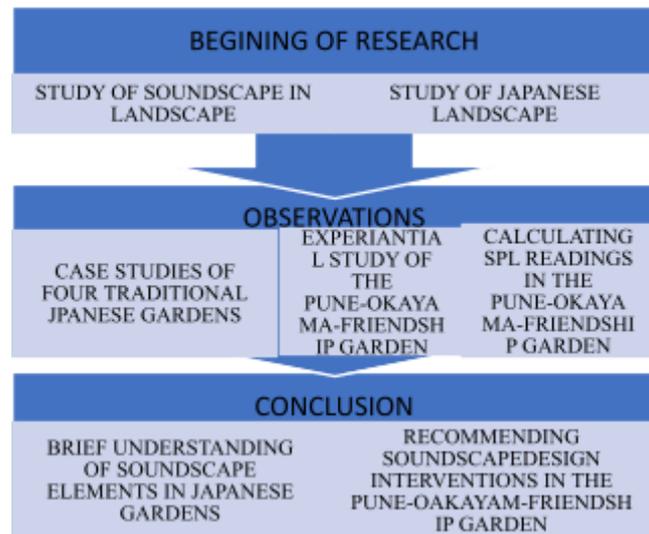


Figure 1: Site plan of the Pune-Okayama-friendship garden



Flowchart 1: Process of Research

RESULTS AND TABLES

The name of the garden is ‘Pune – Okayama – friendship garden’ and is located on Sinhgad Rd, Pune. The garden is also known as ‘Pu La garden’. The layout of the garden is based on the renowned garden ‘Korakuen Garden’ in Japan, Okayama.

The studies have been tabulated in Table: 1 and Table: 2. A thorough analysis of observations further led to the design interventions in the Pune – Okayama – friendship garden. The Table:1 discusses the four chosen Japanese gardens on the basis of location, landscape elements, spatial planning, and spatial experiences. The observations drawn are on the basis of the previously mentioned criteria and thus a brief understanding and analysis was done. The gardens were chosen based on four literature reviews on the gardens in Kyoto. The study of gardens helped in understanding the traditional Japanese gardens better, and thus move on to study the Pune – Okayama – friendship garden situated in Pune.

The data collected in Table:2 is in the form of field notes taken during the visit. It was then recorded and calculated using a SPL meter app found on Appstore; iOS which is accurate. The study's Soundscape Actions are a series of case studies that show how landscape architects and other professionals could approach soundscape design in Japanese gardens. The Soundscape Actions are a set of techniques that have the ability to enhance the quality of experience in landscapes and other urban (green) spaces. It should be remembered, however, that since each case is different, the effects of Soundscape Actions will vary, and not all of them will always result in a change. The research looked at the potential for both negative and positive health effects when it came to tranquil soundscapes in Japanese gardens. The report did not measure health effects directly, but rather drew on previous studies to speculate on the consequences.

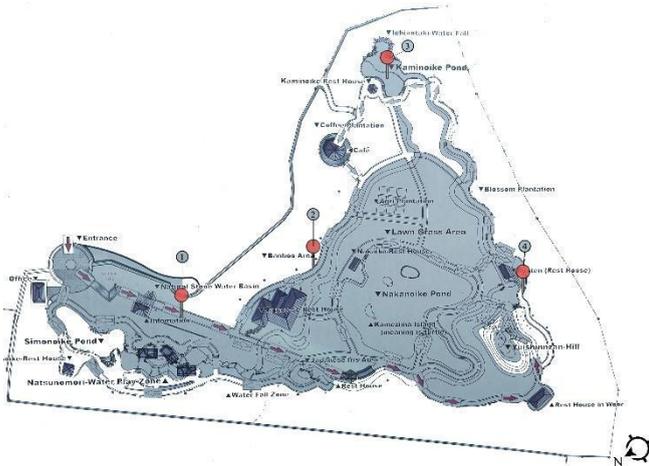


Figure 2: Site plan with design interventions.

The design interventions are based on the understanding of the soundscape elements used in the gardens analysed in Table:1. They are introduced taking into consideration the current and the missing soundscape features in the Pune – Okayama friendship garden.

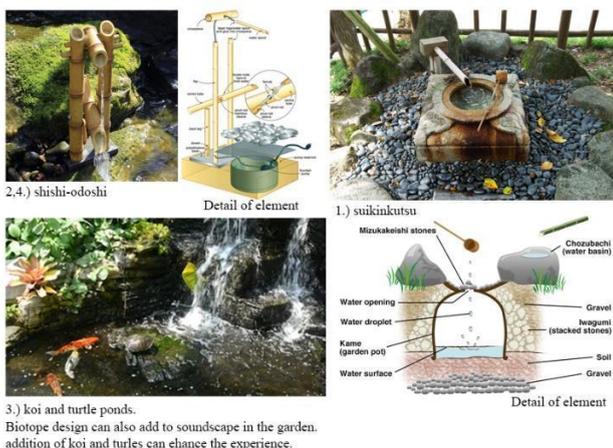
Name of the garden	Geographical location	Space- planning	Landscape Elements	Observations	Analysis	Spatial Experiences
<p>1. Konchi In</p>	<p>Nanzanji-Fukuchi-cho, Sakyo-ku, Kyoto-city</p>	<ul style="list-style-type: none"> Around 1630, Kobori Enshu (1579-1647) designed this garden. The idea of the garden was to express the idea of boat with white sand in front of the garden Enshu planned the garden with minute details and has a shrine, praying places, etc. planned. 	<ul style="list-style-type: none"> A water stream at the entrance. Stone pathways, stone lanterns, gateways and different species of trees planned keeping the seasonal changes in mind. Concepts of longevity on happiness with parsimonious simplicity. 	<ul style="list-style-type: none"> This example demonstrates how sound can be used to lift the spirit temporarily in order to create a sense of calm. Stone pathways that produce a different sound while walking. Rustling of trees. The occasional ringing of bells from the shrine. 	<ul style="list-style-type: none"> The introduction of some scenic elements from the surrounding landscapes are "borrowed" and integrated into the garden design. The concept of seasonal planning enables for different shading patterns which adds to the soundscape of the garden. 	<ul style="list-style-type: none"> The word 'shakkei' refers to a technique in which scenic elements from the surrounding landscapes are "borrowed" and integrated into the garden design. The idea of a one-point perspective in this garden by an eye stop that is provided by a lantern in the centre of the yard. The large groups of rocks on both sides, combined with the smaller rock settings in the centre, give the impression of great depth.
<p>2. Nanzen In</p>	<p>Japan, 〒606-8435 Kyoto, Sakyo Ward, Nanzanji-Fukuchicho, 8-6</p>	<ul style="list-style-type: none"> At the foot of Kyoto's eastern mountains, Nanzen-ji is the name of a temple and the surrounding temple complex (Higashiyama). It was built on the grounds of Tenn Kameyama's detached palace during the Heian period (794-1185). We walk into a giant mountain gate which is a key feature of Zen gardens. A building named the Hojo can be found after passing through the Sanmon Gate and walking towards the back of the complex. 	<ul style="list-style-type: none"> A sanmon, or "mountain gate," is the massive gate that greets you as you enter the Nanzen-ji complex. A building named the Hojo can be found after passing through the Sanmon Gate and walking towards the back of the complex, the Hojo, which was once the abbot's residence, is now the main building and a National Treasure. It's one of Kyoto's most famous places to see fall colours, particularly in the autumn. The Nanzen In garden is said to be a real Kamakura period style representation. The garden also features a pond in the shape of a dragon. 	<ul style="list-style-type: none"> shakkei Small pond garden. Lush mountain woodlands surrounding Waterfall that supplies fresh mountain water to ponds Fish ponds 	<ul style="list-style-type: none"> Use of materials like wood for traditional spaces like tea room introduced the visitors to a different acoustical experience. Strategical planning of landscape and softscape created a tranquil experience for the visitors. 	<ul style="list-style-type: none"> its pond and its pretty paths give free rein to all kinds of creativity. The extensive use of wooden floors is another noteworthy feature. The sound of the wooden floors on the verandas varies from garden to garden, depending on the construction.
<p>3. Saihoji</p>	<p>54 Matsugijogatanicho, Nishikyo Ward, Kyoto, 615-8286, Japan</p>	<ul style="list-style-type: none"> One of Kyoto's Unesco World Heritage Sites is Saihoji also known as Kokedera (moss temple). Kokedera is a Japanese word that refers to the temple garden's approximately 120 different types of moss. Visitors to the temple will walk through this beautiful garden outside of the winter months, which has inspired subsequent Japanese garden design. 	<ul style="list-style-type: none"> Known as the moss garden 120 types of moss. Different species of trees to create a forest look. A water body. During the rainy season (mid-June to mid-July), and in the fall, when the red and orange of the maple leaves contrast beautifully with the lush green of the velvety moss, the garden undergoes a transformation. 	<ul style="list-style-type: none"> Woodlands are a popular sight in Japanese gardens wind carries noise, woodlands can help to minimise noise. 	<ul style="list-style-type: none"> The wind reduction is especially critical along garden walls, where micro-metological turbulence can have far-reaching negative effects. Absorbing Characteristics (of Materials). Moss, including organic dirt, grass, and other soft ground covers, has a strong ability to withstand ambient noise, which it shares with other soft ground covers. 	<ul style="list-style-type: none"> Out-of-bounds areas are marked with rope along the lawn. The Golden Pond, a pond located within this grove, is the focal point of the moss garden. It is linked by small wooden bridges that have become overgrown with moss (see the 1st 3 pictures of the top). This focal point is surrounded by three smaller islands, and the surrounding pond forms the shape of the character, which means heart. I wished we could have used a drone to get a birds eye view.
<p>4. Katsura Ryoku</p>	<p>Katsuramisano, Nishikyo Ward, Kyoto, 615-8014, Japan</p>	<ul style="list-style-type: none"> The garden is a stroll garden, which means that you can enjoy it by walking through it, with fresh and enticing vistas appearing around every corner. The compound contains four tea-houses and many larger structures, each of which represents the pinnacle of Japanese architecture and carpentry. 	<ul style="list-style-type: none"> Topographical mounds One of four Imperial properties in Kyoto Tea-house with wooden verandahs. Stone pathways Stone lanterns. Pond. 	<ul style="list-style-type: none"> Gravel paths can also be found in Japanese gardens. The sound of wood thumping becomes a defining feature. 	<ul style="list-style-type: none"> If it has been proposed that topographical features in some Japanese gardens be used to reduce the acoustic effect of waterfalls within the gardens. Depending on the layout, the sound of the wooden floors on the verandas differs between gardens. The squeaking sound is an especially memorable effect. Topographical features, such as the distinctively shaped peaks, provide clear views of the landscape while also being visually striking in their own right. 	<ul style="list-style-type: none"> This particular garden is one of the four Imperial gardens in Kyoto and has a elegant and simple planning. There are four tea houses that provide a shading place in extreme climates. The pathways are shaded with strategical planting of trees that gives the visitor a promenade through a tranquil experience.

Table 1: Comparative study between the gardens.

Name of the elements / space	Image of the element / space	SPL readings (In dB)		SPL observed in traditional garden (based on the study of traditional gardens)	Experience of the space	Graph	Observation	Synthesis
		Min	Max					
1. Outside the garden. Date: 02/03/2021 Time: 11:49 am		71.4 dB	76.0 dB	60 - 62 dB	<ul style="list-style-type: none"> The garden is adjoining Singad road. Street is busy with constant vehicular movement. 		<ul style="list-style-type: none"> The busy street gives no sense of calmness. Due to constant vehicular movement, the street is always loud. 	<p>Constant vehicular movement</p>
2. Pathway to the garden gate Date: 02/03/2021 Time: 11:45 am		51.9 dB	65.8 dB	38 - 43 dB	<ul style="list-style-type: none"> Immediately after entering the garden, there is a sudden change and it is peaceful. The canopy of the trees cover the pathway to the garden's entrance. 		<ul style="list-style-type: none"> The change in sound level gives an immediate relief to the user. Due to many trees, there is a lot of chirping of birds and the micro sounds like the buzzing of the insects create an impactful acoustical experience. 	<p>Shaded pathways with birds chirping were the cause of the sound</p>
3. Entrance of the garden Date: 02/03/2021 Time: 11:43 am		45.5 dB	51.7 dB	38 - 43 dB	<ul style="list-style-type: none"> After crossing the entrance gate, we come across an open space which acts like a walling space or a resting place. This space is surrounded with trees and provide natural shade. 		<ul style="list-style-type: none"> Rustling sound of the trees along with the micro sounds like birds also play a key role in the soundscape of the garden. The visitor feels relaxed after entering this space and it acts like a breathing space. 	<p>Rustling sound of the trees plays the role of the soundscape</p>
4. Dried leaves on the pathways Date: 02/03/2021 Time: 11:25 am		47.9 dB	64.7 dB	---	<ul style="list-style-type: none"> There is a pathway that leads us to the garden which is covered by bushes on one side and trees on the other. This pathway also acts like a surprise element as the site has a natural contour and the visitor unravel's the garden as he walks up the contour. 		<ul style="list-style-type: none"> The crackling sounds of dried leaves acts as an interesting feature while making way to the garden. Strategical planting of trees with consideration of seasonal changes can create different experiences all year long. 	<p>Pathways, with trees on both side result in the pathway being covered with dried leaves. Thus resulting in a different sound.</p>
5. Wooden Bridge Date: 02/03/2021 Time: 11:27 am		47.0 dB	62.3 dB	---	<ul style="list-style-type: none"> The bridge links the spaces in the garden as the garden has a natural flow of water. Thumping sound produced while walking on the wooden bridge unknowingly adds to the experience. 		<ul style="list-style-type: none"> Use of various light materials produce sound. Such events require the user to take part in creating the experience without the visitor's intention. This feature is commonly seen in the soundscape of a traditional Japanese garden. Water features are one of the important features in a Japanese garden. Using water sounds and appropriate places creates a sense of coolness and calm. 	<p>Wooden bridges is the soundscape element</p>
6. Level drops in water stream Date: 02/03/2021 Time: 11:39 am		52.7 dB	61.5 dB	46 - 54 dB	<ul style="list-style-type: none"> There is a stream running through the garden. Level drops at certain places create splash sounds. We feel calm and cool after hearing the sound of water while strolling in the garden. 		<ul style="list-style-type: none"> Added sounds from the carp fishes also play a role in the soundscape of the garden. Natural habitats and ecosystems have positive effect on the soundscape. Spaces can be planned taking into consideration the mating seasons of the animals for a different experience. 	<p>Water fall and koi ponds are the primary source of sound in this experience</p>
7. Insects buzzing Date: 02/03/2021 Time: 11:32 am		48.4 dB	53.6 dB	---	<ul style="list-style-type: none"> Due to the natural stream, there are insects that buzz and add to the incident. These sounds are heard near streams and bushes. 		<ul style="list-style-type: none"> Seasonal insects create a different soundscape in the garden. 	<p>Seasonal insects create a different soundscape in the garden</p>
8. Highest point of the garden Date: 02/03/2021 Time: 11:33 am		46.7 dB	54.4 dB	---	<ul style="list-style-type: none"> A mound is artificially created in the garden to enjoy the panoramic view of the garden. This point acts as silent spot due to its height. 		<ul style="list-style-type: none"> Land masses can be formed to create strategic topographical patterns such as mounds and/or valleys, which can be used to filter out noise. 	<p>Schematic sketch to show reading location</p>

Table 2: Data collection of Pune – Okayama – friendship

Figure 3: Design interventions



Based on the analysis of the garden in interest and the traditional Japanese gardens, four design interventions were synthesised.

I. Shishi-odoshi refers to Japanese devices such as the kakashi (scarecrow), naruko (clappers), and szu that are used to scare away animals that pose a threat to agriculture. It is synonymous with szu in a narrower context. At spots 2, there is an existing bamboo garden, introducing this element will enhance the experience.

II. Suikinkutsu is a Japanese garden ornament and musical instrument. It consists of a buried upside down pot with a hole at the end. Water drips from the top hole into a small pool of water within the pot, making a fun splashing sound that reverberates throughout the room. It is usually placed at the entrance where the visitors are supposed to wash hands before entering. This is proposed at the entrance of the garden.

III. The appearance of song birds and other animals in biotopes and natural habitats may have a positive impact on the soundscape. Both carp fish and turtles can make quite a splash, which entertains visitors and can encourage a more

active “listening” to the environment (as opposed to passive “hearing”).

CONCLUSION

As per medical records, stress has increased extensively among adults, children and the elderly. It has a long history with several unique designs, including the Konchi in, the Sahoji moss garden and the Katsura Rikya stroll garden. Soundscape research adopts a comprehensive understanding of the sound environment, including problems as well as positive experiences focusing on the qualitative and subjective perception of sound environments; it is a wide and interdisciplinary field. In the current research, one of the available methods called Soundscape behaviour was applied to study sonic experiences in the Pune- Okayama- friendship garden. The paper suggests that the notion of the soundscape in a garden plays an important role in visitors' overall experience.

REFERENCES

- Cerwén, G. (2019). *Listening to Japanese Gardens: An Autoethnographic Study on the Soundscape Action Design Tool*. *International journal of environmental research and public health*, 16(23), 4648.
- Sowa, H. (2012, July). *The Study on the Soundscape of Three Japanese Gardens*. In *Proceedings of the 2nd International Conference, Archi-Cultural Translations through the Silk Road*, Nishinomiya, Japan (pp. 14-16).
- Cerwén, G. (2017). *Sound in landscape architecture* (Vol. 2017, No. 91).
- Cerwén, G. (2020). *Listening to Japanese gardens II: expanding the soundscape action design tool*. *Journal of Urban Design*, 25(5), 607-628.
- Cerwén, G., Kreuzfeldt, J., & Wingren, C. (2017). *Soundscape actions: A tool for noise treatment based on three workshops in landscape architecture*. *Frontiers of Architectural Research*, 6(4), 504-518.-

A Study of Biophilic Design to Build Educational Spaces for Autism

Author 1: Arunima J. Karukayil Email: akarukayil@yahoo.com

Author 2: Prof. Prathama Jhaveri Email: prathama@dypatilarch.com Associate Professor
D.Y. Patil School of Architecture, Lohegaon, Pune.

Abstract: Autism Spectrum Disorder (ASD) is a complex developmental disorder that involves persistent challenges in social interaction, verbal and non-verbal communication and restricted or repetitive behaviors. Autism is a lifelong condition and there is no cure for it. In the case of facilities for children with autism, the line between healthcare environment and educational environment becomes obscure.

Recent research has shown that the educational environments have a profound effect on learning and performance among autistic children (Msotafa, 2008). Universal design was formalized in the 1960's with the thought of making places accessible for those with physical disabilities. It is now time to think along the lines of inclusive design to address a wider range of needs and experiences. We have not been very successful as a nation to provide for better living and public spaces for autistic patients.

The basic objective of this paper is to study the specifications of an educational center for autism and to survey if biophilic design approach is beneficial for the development of autistic children. This research paper is divided into two parts. Part one focuses on interviews with parents and caregivers of autistic children and case studies on autism centers and schools for the better understanding of the requirements for designing the same and to study methods of incorporating biophilic design in educational spaces specific to autism. The second part shall focus on evaluation and presentation of these case studies and to suggest a new set of standards for designing an educational space for autistic people with a biophilic approach. The conclusions shall be used to re-think educational and awareness centers for children with autism and shall encourage people to broaden their views about universal design.

Keywords: Autism, architecture, biophilic design, spatial needs, sensory environment, educational environment.

INTRODUCTION

According to the Rehabilitation Council of India, 1 in 100 children are suffering from autism and these are the statistics of the cases that have been recorded. In India we have accepted physical disabilities and almost all building designs have special considerations for people with physical disabilities but what about them with mental disabilities or disorders? Any kind of mental disorder or even developmental disorder is still considered as a taboo. Autism Spectrum Disorder is a developmental disorder. A person experiencing

the same faces challenges in his or her day-to-day activities like social interaction, verbal and non-verbal communication and restricted or repetitive behavior. It is one such disorder which is by and far the most challenging developmental disorder which has been overlooked by the architects as a condition that influences building design. (Msotafa, 2008)

Recent research has shown that educational environments have a profound effect on learning and performance among autistic children. (Msotafa, 2008) Every patient with autism behaves differently and might not have the same issues but a school that helps and guides them through their initial years will make a huge difference in their lives.

WHAT IS AUTISM?

Autism Spectrum Disorder (ASD) is a complex developmental condition that involves persistent challenges in social interaction, speech and non-verbal communication and restricted or repetitive behaviors.

The effect of ASD and the severity of the symptoms are different in each person. ASD is usually first diagnosed in childhood with many of the most-obvious signs presenting around the age of 2 or 3 years. (J. Nathan Copeland, 2018) Autism is a lifelong condition. However many children diagnosed with ASD go on to live an independent, productive and fulfilling life if they are provided with the required guidance and help in the early stages of their lives. How about instead of considering autism as an obstacle we architects are supposed to tackle, we focus on finding the means to build spaces that can be occupied by all groups of people. As architects in what way can we help build a better world for them? There are various interior elements that are added to their educational spaces to make them feel comfortable. How about we incorporate these additions into our designs and help them feel calm and concentrate more on daily basis. One such technique is Biophilic Design.



Figure SEQ Figure * ARABIC 3 shows the entrance to the Lindens Center for Autism

METHODOLOGY

To support the study propounded in this paper, the following steps were observed to achieve the stipulated aim:

1. General overview of applying Biophilic Design Patterns as a concept for autistic schools.
2. Literature study on biophilic design, autism and their architecture.
3. Defining Biophilic Architecture and its considerations.
4. Defining the benefits of applying Biophilic Design Patterns as a concept for autistic schools, helping students receive a calm and focused learning environment.
5. Consulting parents, teachers, caregivers and therapists to understand an autistic child's behavior, their comfort and expectations from a space designed for them.
6. Critical study of existing structures and their impact on Autistic children.

This paper aims to determine how Biophilic Design can help benefit the growth and development of autistic children in an educational setting with an objective to study the specifications of an educational center for autism and to survey if Biophilic Design approach will improve their progress and evolution. This paper limits itself to explore and analyze only about the behavioral aspects of autism in respect with educational and rehabilitation spaces while excluding any detailed study about autism itself as it is a very vast subject. The paper aims to describe multi-sensory areas, rehabilitation spaces, classroom spaces, circulation areas etc. in regards with Biophilic Design Patterns and how they profit these children in an educational setting.

The term 'Biophilia' is defined as an innate and genetically determined affinity of human beings with the natural world according to a theory of the biologist E. O. Wilson. Biophilic Design is a concept used in the building industry to increase occupant connectivity to the natural environment through the use of direct or indirect nature and space and place conditions. (Biophilic design-Wikipedia, the free encyclopedia , n.d.) This concept of design has many health, environment and economic benefits.

THE PATTERNS OF BIOPHILIC DESIGN

Science has very well notified us that Biophilic Design Patterns are not formulas, but are meant to apprise, guide and abet the designer as any other tool in their toolkit would. These patterns are defined by Terrapin Bright Green in their publication called The 14 Patterns of Biophilic Design with the intention to articulate connections between natural and man-made environments and how individuals react and benefit from it.



Figure SEQ Figure * ARABIC 1 explains Autism Spectrum Disorder in brief

❖ Nature in the Space

This focuses on the direct, physical and momentary presence of nature in a space or place. Plants, water bodies, sounds, scents and other natural elements are contained within this category.

1. Visual Connection with Nature- A view to elements of nature, living systems and natural processes.
2. Non-Visual Connection with Nature- acoustic, tactile, natural fragrances and gustatory stimuli that produce an intentional and positive reference to nature.
3. Non-Rhythmic Sensory Stimuli –any random and fleeting connections with nature that could be examined statistically but may not be predicted precisely.
4. Thermal & Airflow-Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments.

5. Presence of Water -A condition that enhances the experience of a place through seeing, hearing or touching water.
6. Dynamic & Diffuse Light –controlling intensities of light and shadow to create conditions like those that occur in nature.
7. Connection with Natural Systems - creating awareness of the natural process like seasonal changes

❖ Natural Analogues

Natural Analogues concentrates on organic, non-living and indirect recreations of nature like natural patterns, shapes, colors, sounds, etc.

8. Biomorphic Forms & Patterns- Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.
9. Material Connection with Nature- Materials and elements from nature that, through minimal processing, reflect the local ecology or geology and create a distinct sense of place.
10. Complexity & Order -Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.

❖ Nature of the Space

Nature of the Space deals with our inborn and acquired desire to be capable of seeing beyond our immediate surroundings that seem unknown and slightly dangerous with revelatory moments but includes elements of safety.

11. Prospect -An unhampered view over a distance.
biological responses to the 14 patterns of Biophilic Design

Refuge –meltdown spaces or hiding spots where one can withdraw themselves from the main flow of activity and is protected from behind and overhead.

12. Mystery- partially obscured views or other sensory devices that lures people to travel deeper into the environment.
13. Risk/Peril - An identifiable threat coupled with a reliable safeguard.

(William Browning, 2014)

BENEFITS OF BIOPHILIC DESIGN FOR AUTISM CENTRES OR SPECIAL SCHOOLS:

- Reduces muscle tension.
- Lowers blood pressure and stress hormones.
- Improves concentration.
- Improves creativity and productivity.

- Increases physical activity.
- Improves adaptability, alertness and overall mood of a person.
- Lowers tension, anxiety, anger or confusion.
- Helps in increasing social and communicational interactions.
- Improves self-esteem.
- Impacts restoration and stress management.

(Ghaziani)

BIOPHILIC DESIGN PATTERNS & BIOLOGICAL RESPONSES

The table illustrates the functions of each of the 14 Patterns in supporting stress reduction, cognitive performance, emotion and mood enhancement and the human body. Patterns that are supported by more rigorous empirical data are marked with up to three asterisks (***) indicating that the quantity and quality of available peer-reviewed evidence is robust and the potential for impact is great, and no asterisk indicates that there is minimal research to support the biological relationship between health and design, but the anecdotal information is compelling and adequate for hypothesizing its potential impact and importance as a unique pattern.

14 PATTERNS	STRESS REDUCTION	COGNITIVE PERFORMANCE	EMOTION, MOOD & PREFERENCE
Visual Connection with Nature	• Lowered blood pressure and heart rate (Brown, Barral & Gidycz, 2012; van der Berg, Harju, & Slaats, 2007; Kawanishi & Miyazaki, 2008)	Improved mental engagement/ attentiveness (Boksem & Vissel, 2006)	Positively impacted attitude and overall happiness (Bartlett & Petry, 2010)
Non-Visual Connection with Nature	• Reduced systolic blood pressure and stress hormones (Park, Tsunetsuga, Kasetani, et al., 2009; Hartig, Engle, Langer et al., 2003; Ortega-Sanchez, Bonoan, Perez et al., 2004; Brck, Simons, Lovell et al., 1991)	Positively impacted on cognitive performance (Muller, Chik & Chikara, 2012; Lindholm, Healy, & Lundström, 2004)	Perceived improvements in mental health and tranquility (L. Kawanishi, Nagai, et al., 2012; Adcock, et al., 2011; Tsunetsuga, Park, & Miyazaki, 2010; Kim, Lee, & Park, 2007; Stapleton & Scarth, 2008)
Non-Rhythmic Sensory Stimuli	• Positively impacted on heart rate, systolic blood pressure and sympathetic nervous system activity (L, 2009; Park et al., 2008; Kato et al., 2008; Eusebio, et al., 2001; Ulrich et al., 1991)	Observed and qualified behavioral measures of attention and exploration (Oldhafer et al., 2011)	
Thermal & Airflow Variability	• Positively impacted comfort, well-being and productivity (Kawaguchi, 2006; Hunt & Wilson, 2005; Wegl, 2009)	Positively impacted concentration (Hartig et al., 2003; Hartig et al., 1991; K. Fujita & Kajino, 1989)	Improved perception of temporal and spatial pleasure (alliesthesia) (Pruitt, et al., 2004; Carlini, 2012; Zhang, Arora, Hwang & Han, 2010; Arora, Zhang & Hwang, 2006; Zhang, 2003; Se-Gar & Seager, 2002; Heschong, 1979)
Presence of Water	• Reduced stress, increased feelings of tranquility, lower heart rate and blood pressure (Mason, Ware, & Nelson, 2010; Phrasid, Fisher, Wells et al., 2010; Richardson & Hessel, 2008)	Improved concentration and memory restoration (Hartig et al., 2004; Soderman & Vesseli, 2009)	Observed preferences and positive emotional responses (Hartig, et al., 2001; Barua & Petry, 2010; White, Smith, Humphries et al., 2010; Korman & Hamel, 2008; Soderman & Vesseli, 2009; Heschong & Otero, 1995; Hano & Alvarado, 2003; Ulrich, 1988)
Dynamic & Diffuse Light	• Positively impacted circadian system functioning (Figueroa, Brown, Pritch, et al., 2011); (Baker & Baker, 2000)	Enhanced perception and psychological responsiveness (Mearns et al., 2010; Hartzel et al., 2010)	
Connection with Natural Systems	• Increased visual comfort (Figschell, 2012; Kim & Kim, 2007)		Enhanced positive health responses; Shifted perception of environment (Bartlett et al., 2008)
Biomorphic Forms & Patterns			Observed view preference (Hessell, 2012; Japs, 2007)
Material Connection with Nature		Decreased diastolic blood pressure (Heschong, Miyazaki & Sato, 2007)	Improved comfort (Heschong, Miyazaki & Sato, 2007)
Complexity & Order	• Positively impacted perceptual and physiological stress responses (Dulacross, 2012; Japs, 2007; Taylor, 2006; S. Nadel, 1986)	Improved creative performance (Bundgaard et al., 2012)	Observed view preference (Dulacross, 2012; Hagen, Laine, Taylor et al., 2005; Hagen, Parcells, & Taylor, 2005; Taylor, 2006)
Prospect	• Reduced stress (Kahn & Shepley, 2010)	Reduced boredom, irritation, fatigue (Chandler & Conn, 1991)	Improved comfort and perceived safety (Hwang & Bryn, 2007; Wang & Taylor, 2006; Pathrick, 2005)
Refuge		Improved concentration, attention and perception of safety (Suh & Shepley, 2010; Wang & Taylor, 2006; Wang & Taylor, 2005; Pathrick, 2005; Ulrich et al., 1993)	
Mystery			Induced strong pleasure response (Belderson, 2011; Salaspin, Bentley, Langer et al., 2011; Kim, 2009; Blood & Zlotnik, 2001)
Risk/Peril			Resulted in strong dopamine or pleasure responses (Muller et al., 2013; Wang & Tain, 2011; Zaid et al., 2008)

© 2014 Terrapin Bright Green / 14 Patterns of Biophilic Design

Figure SEQ Figure * ARABIC 2 shows a table illustrating

INTERVIEWS (a summary)

For better understanding the behavior, space and place requirements of kids with autism and to know their opinion on integrating Biophilic Design Patterns in designing an educational center for autism, detailed interviews of two occupational therapists and a special educator were conducted. The list of questions included known causes of autism, general age of visible symptoms, if parents have started accepting that their child needs special care, variations of the situation in rural India, specific architectural features in educational settings if any and their opinion on biophilic design creating beneficial impacts in the child's development and growth as well as the idea of inclusive schools. After the interview the following things were inferred-

- Autism is a developmental and behavioral disorder with no specific cause, causes could be pre-natal or post-natal.

- Most children start showing symptoms at the early age of 2 or 3 years, but as autism is the sudden regression it could also happen to older children.
- Early intervention and education is very beneficial as they are taught motor movements and daily activities from an early age.
- Most parents have started accepting that their kids need help, they have their initial stage of denial but soon start seeking help.
- Rural parts of India are still suffering, though government has organized ‘Sarva Siksha Abhiyan’ under which the teachers of government schools are taught to identify children with special need and bring them to notice for them to get the required help, but we are still a long way from managing it perfectly.
- There are various kinds of special furniture and room settings that are used for autistic kids and though the teachers and therapists were not familiar with the term ‘biophilia’, they have been incorporating nature inside their classrooms in form of grass carpets, neutral tones, sounds or rippling water or rusting of grass etc. for a long time now as they say it is an important part of sensory integration. Hence all of them completely agree to the benefits of biophilic design patterns and want architects and engineers to start incorporating the principles at their designing stages.

CASE STUDIES (a summary)

1. BANCROFT SCHOOL FOR AUTISM, NEW JERSEY.

The Bancroft School, The Lindens Center for Autism and Campus Residences, the 80-acre Bancroft Campus at Mount Laurel, New Jersey has been designed to serve the extraordinary needs of special education students, their families and the region's special needs community. The campus is among the first of its kind in the nation designed to accommodate children living with autism. The credit for this project goes to New Jersey based KSS Architect's' partner Merilee Meacock.

The power of Biophilic Design to specifically help students with autism flourish, transforming the learning environment and experience from frustrating to positive is revolutionary. Meacock explains that as students suffering with Autism are more sensitive to temperature, noise, texture, acoustics etc. these factors become stressors that affect their learning experience. As designers or architects we know and understand the impact of a built environment on human

behavior. She describes how Biophilic Design principles can be channeled to address the difficulties of students.



Figure SEQ Figure * ARABIC 8 shows the multi-sensory feature incorporated in the room



Figure 4 shows the interior of a classroom at Bancroft



Figure 5 shows the use of wooden roofs and neutral tones at Bancroft



The have mainly used natural materials, due to motor skills challenges, finishes chosen had to be highly durable and easily cleaned. Hence wood was chosen for the ceiling material with vinyl flooring. Bancroft's planning lavishly leaves space to navigate, orient and transition. Biomorphic patterns (color coding, roof gable shapes and both micro and macro scale details) were used to help provide clear, multi-sensory way-finding and easy circulation. Water is also an important element for biophilic design. Meacock also motivates designers to consider soft spaces in the building. They would basically be flexible areas outside the classrooms where students can work on other exercises. (Architects, n.d.) (The Bancroft School, n.d.)

2. THE GARDEN SCHOOL, LONDON

In his article, Oliver Heath, architect, interior designer and a biophilic expert tells us about a project he worked on, namely 'The Garden School, Hackney, London.' He explains how the school challenged him to transform an unused gym into a safe and recuperative space for pupils with autism. To reduce stress of the students the school asked Ar. Heath to design supervised surrounding for children to experience nature within the built space. He explains how virtual references to natural forms and patterns are favored and tactile stimulations

could be used to lower stress and to energize or relax and calm students down. This is of great importance for students with special needs.

The gym after transformation could be divided into three parts:

The seats adjacent to the windows offered safe views onto the playground with plenty of sunlight. Heath explains how reforming the amount of sunlight coming in can escalate the speed of learning and improve attendance. Therefore it has a positive impact on both students and the teachers.



Figure SEQ Figure * ARABIC 6 shows the window seating and how children would feel safe from the outdoors while being able to enjoy it

The built-in hexagonal cubicles would promisingly provide a place for the children to rest, relax and restore their mental and physical strength. It could also form a hiding place for kids when they feel over whelmed by their surroundings. Tactile and visual references of nature were made with the help of textured carpets with varying pile heights, wallpapers with images of woodland sceneries and furniture made with plywood. This was usually preferred to reduce stress and to improve concentration.

- Multi-sensory features are placed at one end of the room that children can interact with. Touching each of these surfaces triggers natural sounds and lights for example sounds of leaves in the wind or the sound of water etc. this form of connection with nature can help reduce blood pressure and would help improving creative performance.

(Heath, 2014) (Design)

RECOMMENDATIONS FOR SCHOOL DESIGN USING BIOPHILIC DESIGN PATTERNS

- Increase views onto nature by using large clear glass windows, this way the students are protected inside the classroom space but are connected to the nature
- Incorporate indoor plants and live walls, it is known to increase the oxygen levels and helps in escalating concentration.
- Incorporate natural elements like wooden furniture, cork tiles, sea grass rugs, fragrant flowers or oils for smell etc. when

primary or direct use of natural elements are no possible, nature can be brought into the space by the use of natural textures, patterns, colors and images in floor and wall coverings as a secondary alternative to the real thing.

- Sensory pathways can use all natural materials like leaves, pebbles, clay, sand etc

CONCLUSION

For the designers, developers, planners and architects to acknowledge the significance of an inter-relationship to the natural environment in all their building projects, and to put them in a comprehensible, logical and organized format is the vital objective of Biophilic Architecture. This paper rightly justifies the need and importance of incorporating Biophilic Design Patterns while designing any school or educational centers for autism and also states their benefits. Through the case studies it is evident that the principles when applied in real life projects works wonders for the children studying in those spaces. It is high time that we take the needs and requirements of people with mental of developmental disorders into consideration while designing any space as we do for people with physical disabilities. It is also importance that we start making more and more people aware about these disorders and train people to behave and treat them equally.

REFERENCES

- i. Architects, K. (n.d.). Bancroft, Mt. Laurel Campus. Retrieved from kssarchitects.com: <https://kssarchitects.com/design/our-work/mount-laurel-campus>
- ii. Biophilic design-Wikipedia, the free encyclopedia . (n.d.). Retrieved from Wikipedia, the free encyclopedia : https://en.wikipedia.org/wiki/Biophilic_design
- iii. Design, O. H. (n.d.). the Garden School, Hackney. Retrieved from www.oliverheath.com: <https://www.oliverheath.com/portfolio-item/garden-school-hackney/>
- iv. Ghaziani, D. R. (n.d.). School design with children: promoting mental health and wellness in schools by incorporating biophilic design. Leicester, England.
- v. Heath, O. (2014). The Garden School, Hackney. Retrieved from www.interface.com: https://www.interface.com/EU/en-GB/campaign/positive-spaces/hackney-garden-school-en_GB
- vi. J. Nathan Copeland, M. M. (2018, August). What Is Autism Spectrum Disorder? Retrieved from <https://www.psychiatry.org>: [https://www.psychiatry.org/patients-families/autism/what-is-autism-spectrum-disorder#:~:text=Autism%20spectrum%20disorder%20\(ASD\)%20is,are%20different%20in%20each%20person](https://www.psychiatry.org/patients-families/autism/what-is-autism-spectrum-disorder#:~:text=Autism%20spectrum%20disorder%20(ASD)%20is,are%20different%20in%20each%20person).
- vii. Msotafa, M. (2008). An Architecture for Autism: Concepts of Design Intervention for the . International Journal of Architectural Research 2(1), 190-211.
- viii. *The Bancroft School*. (n.d.). Retrieved from www.bancroft.org: <https://www.bancroft.org/childrens-services/the-bancroft-school/>
- ix. William Browning, C. R. (2014). *14 patterns of Biophilic Design Improving Health & Well-Being in the Built Environment*. Terrapin Bright Green LLC.

The Role of Bylaws In Architectural Pedagogy.

Atharvi Paras Netragaonkar

V.I.T.'s PVP College of Architecture

Email: atharvi.netragaonkar1@gmail.com

Abstract: The architecture that we practice today is the result of what we have been taught and what we observe. The role that architectural pedagogy plays in shaping an architect is extremely crucial. Bylaws in architecture is a field which is often debated in terms of its inclusion in the curriculum. The intent that this research aims to achieve is that whether the educational curriculum of architecture undergraduate course shall include building bylaws and regulations as a tool for guiding and designing spaces and furthermore, a way to impart these bylaws without hampering the creativity of students in architecture.

Key words – shaping architects, bylaws, pedagogy, debated, undergraduate, tool, hampering creativity.

I. INTRODUCTION

Bylaws are an integral part of architectural profession as well as education. The intent of bylaws is simply to help and regulate ground rules wherein one can establish smooth and organized development in and around the city. Although bylaws have been criticized by professionals as well as associates by concluding on the fact that these rules somewhere or the other hamper the creative thinking and solutions as they have restrictions in order to maintain the language of the built fabric, while some claim that these rules not only help in efficient development of cities but also act as a tool for designing habitable and architecturally rich cities. The debate further lies if the bylaws should be included in the curriculum in the architecture pedagogy in order to provide exposure to the students to the professional world and in no way to hamper the creativity and imagination of these budding architects.

To understand the relevance of bylaws in the field of architecture one must try and study the bylaws and the responses by architects in terms of the proposals and then study whether they are necessary and contextual, as well as important for the budding architecture students to learn. Due to an increase in the demands and needs in the urban as well as the rural areas of the country, there is a huge development which is happening. In order to study and understand this development it becomes very crucial to analyse the ground rules or the framework by which this development is carried out. The study thus focuses on the understandings one receives by analyzing these bylaws which either act as a tool for designing or are obstacles in the creative solutions of architects.

Architectural Pedagogy has been evolving from years together, to study and formulate the curriculum it becomes extremely critical to understand the mindset of the students and the way they perceive our teachings. As a result, this study will not only help the students of architecture but can be further analyzed in depth to help the faculty as well as the society in which we can strengthen the pedagogy in architecture.

II. LITERATURE REVIEW

The literature that was studied and referred during the understanding on Bylaws was of selected on the intent of analysing the relevance of bylaws from varied perspectives and hence articles which are also criticizing the bylaws are to be taken into consideration. There are total 5 research papers and articles which were read and reviewed to understand the topic from various perceptions and perspectives.

The following are the articles / research papers which are reviewed below

1. Importance of Building Bylaws in Architecture Pedagogy.

Ar. Yogita Nagpure, Ar. Ashwini Sulekar, Ar. Mayur Survase International Journal of Research in Civil Engineering, Architecture and Design.

The research paper summarizes that if the bylaws are adopted properly and diligently, they will lead to the most civilized and efficient development and will raise a step forward for growth and enlargement of habitat. Bylaws are different for different areas. The paper further focuses on the need of bylaws in educational system. It is necessary for the bylaws to be in place especially in India due to the fast-paced growth of population and an increase in the need for shelter, industries and other land uses. It may happen that due to this fast need of resources, in absence of bylaws, uncontrolled urbanism is a resultant one can expect.

To avoid these unwanted changes and growth in the city, bylaws act as a tool for designing. The aim of this research was to throw light on the fact that how the building bylaws help in overall development of the built and unbuilt environment, and to use the building bylaws as rules and regulations and fundamentals for architectural works.

- Hypothetical pedagogy's
- Responsive Pedagogy's
- Interviews
- Factual data collection

The bylaws governing the built mass today will not work unless and until they suffice the need of all people. They currently work only for the rich and the cars. These guidelines have to take care of all the stake holders of the city. If these guidelines are only for the poor, they won't work, if they are only for the mediocre, they will not work. If they are for the rich, they won't work.

2. The Ridiculousness of the Building code.

WordPress blog.

The following article sarcastically passes some remarks on the building codes by which the writer tries to express at most criticism towards the building codes based on the following pointers. There is a debate which says that the building bylaws have to be standardized and commonly implemented on country's as well as cities.

It makes design more expensive for installation. A lot of time is consumed for the ways in which the code asks one to execute his or her design with material specifications. Stating all the facts about the international building code they are further perceived and portrayed in a critical way. To see this side of the building code it becomes important.

- Criticizing the codes
- Focusing on the pointers.
- Observations
- Interpretive Explanation
- Sarcastic comparisons

The building bylaws guideline is a enormous book. It is humanly impossible for someone who is an architect or a layman to read this large book with various heads.

According to the analysis done by the writer, the building codes are difficult to grasp. He says it would be great if he has a guide to know how to read building bylaws is offered with the codes.

2. Building Bylaws

Sangeeta Gangwar

MUNICIPAL BUILDING BYE-LAWS AND RESTRICTION IN DESIGNING OF BUILDINGS

The growth of civilization has also resulted in more and more laws, regulations, and restrictions and of course their violations as well. There are laws and laws, all around such as constitutional, civic laws, traffic laws, marriage laws,

financial laws, personal laws etc. while some of the laws are essential for the humanity, there are other which held ion the proper and planned growth of civilization in general, in the olden days human beings had been wandering from place to place in search of livelihood but the modernization have put an end to all such adventures. The aim is to focus on the building bye-laws such as F.A.R., setbacks etc. which are very specific to the city of Delhi.

The following article concludes with the questions such as:

What is the importance of Building Bylaws?

Why building bylaws is important for human life?

What is the general principal of building bylaws?

Building by-laws are made to ensure orderly development of localities in urban areas so that every house is assured of good ventilation and no building affects the lighting and ventilation of neighbors. There has to be laws or regulations binding on the prospective builders, if not, the building constructed will be:

1. Un-scientific
2. Unhealthy

4. Importance of Building Bylaws or Building Regulations

Guneet Singh Khurana

Architectural Design, architectural needs, architectural safety design, Architecture, art and architecture, Building bye-laws, building codes, building design, comfort, components of architectural site planning, concepts of energy efficiency, Design, energy efficiency, Future of Architecture, green revolution, if no setbacks?, importance of bye-laws, modern architecture, modern architecture syllabus, national building code, objective of bylaws, objectives of architecture, planning at urban level, purpose of architecture, scope of architecture, setbacks, zoning bye-laws.

A Building Bye-law is a local law framed by a subordinate authority for the betterment of the society. Building Bye-Laws channelize to achieve the policies and concepts outlined in the City Master Plans by the town planning departments, in order to give a specific ARCHITECTURAL CHARACTER to a city.

Building Bye-laws are an integral part of many organizations yet they are often misunderstood because there are different procedures and policies concerning how bye-laws can be established or governed by an organization. The town planning scheme controls the uses of land, roads, market areas, commercial places and surroundings, etc.

- ☐ The aim of this analysis was to make the reader aware of the current implementations and the town planning schemes which are present, and to make it easier to pre-plan the building activities.
- Give guidelines to the designing Engineer or Architect.
- ☐ Prevent haphazard development without any resemblance to the development of the area as a whole.
- ☐ Give safety (to humans who work & most importantly live in the buildings) against health hazard, noise, structure failure and fire.

5. Impact of Building Bylaws on Housing: A comparative study of development control rules of Jaipur and Pune

K.B Vaghani, Dr. N.C. Shah.

Institute of Town Planers, India Journal.

The mentioned research paper is a comparative analysis of the impact of different bylaws in different contexts, cities of Jaipur and Pune.

The development plans of two different cities are based on the scientific and rationale reasons which further are meant and formulated to satisfy or meet the functional needs of the respective cities.

The selection of cities of Jaipur and Pune have been tried to establish due to parameters and some common links like population density and potential for development. This research studies housing and habitat as it's the major land use in each city and bylaws having a huge impact on the same. The study is further classified into 5 broad categories such as duplex bungalows, low rise, high rise etc.

The intent of the study was to understand the area calculations and distributions of land in terms of accommodating maximum number of occupants. The conclusions and inferences of this study were easily visible, that the governing or authorized bodies can increase the allocated area for each housing typology in order to attain an optimum or maximum number of accommodations without any wastage of space and land. On analysing these facts and the intent of studies and collection of the factual data, the research focuses on the Housing development of 2 very prominent cities on India. The impact of building bylaws is significant on housing as parcels of land are sold on available FSI on that parcel of land. DCR of Pune city are favorable in case of detached bungalows, duplex bungalows and row houses as more numbers of dwelling units can be accommodated in Pune than Jaipur by applying its own DCR. Its effect is up to 31.25 percent for detached bungalows and 25 percent in case of duplex bungalows and row houses type development.

The research methodology that is used to analyse the data in this research paper is as follows

- Fundamental studies
- Collection of Facts
- Analysing existing scenarios.
- Comparative analysis of 2 cities.

With this analysis that the paper has put forth one understands that if there were no bylaws for Housing as a typology, we would face a major disturbance in the built fabric of the city. Not that these bylaws are solving all the concerns but what we further need to focus on are the ways in which we can improve the rules and guidelines and work towards making them better.

III.

IV. MATERIAL AND METHODOLOGY

The research methodology consists of analyzing designs of students of a semester based on approach that each student adopted in coming up with design proposals based on the guidelines that each group of students were allotted with. The sampling of these students is based on their subgroups which are formed within the class. Three subgroups have been selected and three students from each are selected as samples or case studies in order to understand students' approach towards design and technology. The interview of the respective guides would help us further analyze the faculty's point of view towards the inclusion of building bylaws in architectural pedagogy.

The study thus involves the way in which architecture as a profession is taught in the universities as well as included in the curriculum. To further understand the role of bylaws in the architectural pedagogy it becomes important to study the precursors of each working studio in different colleges and universities. Therefore, to streamline and analyze the role of bylaws in the architectural pedagogy one must study the guidelines on which the studio classwork is based. Moreover, to tangibly look into this, the studio briefs of 5 renowned colleges in the city and university of SPPU were collected and analysed of semester VII. For the study these 5 colleges would be referred as College A, College B, College C, College D and College E.

College E was provided with a studio framework and references of habitat's which have been designed in different timelines and needs.

V. FINDINGS AND ANALYSIS

The data that was collected from these 5 colleges of architecture in Pune is restricted to the project of housing in the fourth-year studio semester VII. The briefs were analysed on the following parameters

The briefs of these 5 colleges are analysed on the basis of 2 broader categories.

A. Macro level guidelines

Site area, Built up, F.S.I

B. Micro level guidelines

Open space, parking logistics, density and unit sizes.

All these parameters and comparisons of the figures that different universities give are a tool with which one can understand the way in which bylaws are introduced and exposed to students. The following chart below is a comparative analysis of the exposure the colleges from Pune university gives is evidently visible. The table also shows if the students are given freedom to creatively come up with design solutions or have the guidelines as guiding factor for tackling design solutions in the most effective way.

	College A	College B	College C	College D	College E
SITE AREA	24,300 SQ. M.	40000 SQ. M.	37,900 SQ. M.	30,000 SQ. M.	Variable for eachone
BUILT UP	25,749 SQ. M.	Variable for eachone	57,987 SQ. M.	60,000 SQ. M.	Variable for eachone
F. S. I.	1.1	Variable for eachone	2	2 TO 3	Variable for eachone
OPEN SPACE	10 %	30 %	10 %	10 %	10 %
PARKING	Calculated as per norms	Variable for eachone	Given to each student in the brief	Variable for eachone	Variable for eachone
DENSITY	Given to each student in the brief	Variable for eachone	Given to each student in the brief	280 DPH	Variable for eachone
UNIT SIZES	Given to each student in the brief	Variable for eachone			

Figure 1. Comparative Analysis of briefs.

The table is also subjected to each college level policies and their studio conducting strategies which cannot be generalised as these policies are decided by the faculty teams as well as the academic coordinators for benefitting the study and designing skills of a students. To understand the architectural pedagogy, the research further leads to these individual college level policies.

College A divided the students in groups which were according to the site, and then were given with brief which had all the necessary values according to the building codes. The students were also explained on the way calculations of parking logistics should be done and concluded on the calculations on housing.

College B is focusing on a way in which there are some concrete rules with respect to Housing studio and some are left up to the students wherein they can take some decisions on their own. The debate further lies on which guidelines to concretely give and which to leave up to the students.

For College C, the design policy was such that the sites were different of all students but they need to be under one Rurban area. Each student had to select a potential land parcel of the given area in the village.

College D had divided the students in 4 groups according to the sites which came under one region. So, there were some common parameters and rules which were to be followed by all and very few were left upon the students. The way of calculating logistics was also explained and thus acting as a guide for students.

College E happens to have a studio in which each individual selects his/her own different site depending upon their own concerns and focus areas. And as these sites are different the guidelines also differ for each project. It mainly depends on the inputs one gets by their guides.

V. CONCLUSION

Through all this study we understand that the intent of guidelines being a tool for designing and development has to be told and explained to students in a way in which their design solutions are not completely governed by these rules and bylaws but also there is a tolerance and a freedom for the students to work creatively in these budding ages wherein they can learn and understand the amalgamation and perception of the rules and regulations when in profession. Hence, the solution is that, we need to formulate a method in which we introduce and expose students to rules and regulations in a way in which they understand the gravity and depth of these guidelines. The idea of introducing bylaws should start when the students reach at a stage where they can think maturely and when the complexity of the project rises. Understanding and then designing architecturally should involve the following parameters; *Context Climate, Chronology, Culture, Craft, Construction, Community and Constitution*. Constitution with respect to architecture as a profession, would be a subject which would be holistic to the entire process of design and is formulated for the fraternity and the end users of this service. When we imbibe all these values in students, the architects of tomorrow would be strengthened to work for benefit of the society. Thus, the effect of this analysis is such that one finds and justifies whether the current trends and standards in architectural pedagogy are fair in order to deal with the issues which are in the near future for the budding architects. The research thus not only focuses on the approaches of students but also the faculty members that are involved in teaching. To further more understand and modify the architectural

pedagogy, the students, the faculty, as well as the professionals' needs to proactively be involved in this process.

V. ACKNOWLEDGEMENT

Firstly, I would like to thank and offer my sincere gratitude to my research guide Ar. Shekhar Garud, who has always supported me throughout my research on this topic with his enthusiastic approach to doing more, encouragement and knowledge.

Then, I would like to thank all the research faculty of PVP COA, who gave us the opportunity to present our research topic too a few of the best experts available in and from outside the city. I would also like to thank them for arranging guest lectures of experts which of course helped us in our research. I would also like to thank my friends and colleagues for their cooperation, inputs and support throughout the year. Lastly, I am extremely thankful to Prerana Godambe for her help and constant support to me in completing my research.

VI. REFERENCES

i. Ar. Yogita N., Ar. Ashwini S., Ar. Mayur S. (2016). *The Importance of Building Byelaws in Architecture Pedagogy. International Journal of Research in Civil Engineering, Architecture and Design, Volume-4, (Issue-1), 176-182.*

ii. Vaghani, K. B., Shah, N. C., & Chauhan, K. A. (2010). *Impact of Building Byelaws on Housing: A Comparative Study of Development*

Control Rules of Jaipur and Pune. Institute of Town Planners, India Journal, 7-2.

iii. Killip, G. (2005). *Built fabric and building regulations. Background material F, 40.*

iv. *The Ridiculousness of the Building code -*
<http://blog.buildllc.com/2011/03/theridiculousness-of-the-building-code/> - 6th January 2019.
Ridiculousness of the building code. (2019, January Sunday,6). Retrieved from blog.buildllc.com: http://blog.buildllc.com/2011/03/the-ridiculousness-of-the-buildingcode/486-491 -

v. Francis D.K.Ching, Steven R. Winkel, *Building Codes Illustrated, Wiley*

vi. Banerjee Rashmi (Banerjee, June 2015). *Impostance of Building Code. e Int. Journal of Engineering Research and Applications*

vii. Eran Ben Joseph, "Innovating regulations in Urban Planning and development", *Journal of Urban Planning and Development ASCE/December 2005/Pg. 201.www. bmtpc.org*

viii. "Standardized Building Bye-laws and Development Control Rules for „B" and „C" Class Municipal Councils of Maharashtra 1978". *Published in govt. gazette*

ix. Ar. Mahendra H. Sonawane, Dr. Vasudha A. Gokhale (January 2016), *A Critical View on Pedagogical Dimension of Architectural Education in India Int. Journal of Engineering Research and Applications*

x. *Collection of 5 studio briefs of Housing Studio of semester VII of colleges affiliated to SPPU.*

Daylighting – Innovative Techniques

Avanie Gangwal

DY Patil School of Architecture Pune India

Email: avaniegangwal30@gmail.com

Abstract: *Daylighting has been a part of built form throughout architectural history. In architecture, not only can natural lighting create a dynamic image to visitors, but sufficient lighting can also help save energy. As sustainability becomes a core principle for designers, daylighting comes to the fore as an alternative to artificial, energy consuming, light. In this paper the objective is to study the importance of natural light in the built environment and identify different innovative ways of making light intervene in the configuration of architectural spaces.*

Key Words: Natural light, innovative techniques, implementation, Sustainability

INTRODUCTION

“No space, architecturally, is a space unless it has natural light”
– Louis I. Kahn

Light is essential factor in architecture. Light as the medium that reveal space, celebrate the property of certain material and itself can also be tested as the material. Like other material, light have to be crafted into desired shapes for its functionality. Light source is the raw material. ‘Materiality’ of light is the intensity and orientation. Daylight is the controlled admission of natural light, direct sunlight, and diffused sunlight into a building to reduce electric lighting and saving energy. By providing a direct link to the dynamic and perpetually evolving patterns of outdoor illumination, daylighting helps create a visually stimulating and productive environment for building occupants, while reducing as much as one-third of total building energy costs.

Types of Daylighting are:

1) Passive daylighting is a system of both collecting sunlight using static, non-moving, and non-tracking systems (such as windows, sliding glass doors, most skylights, light tubes) and reflecting the collected daylight deeper inside with elements such as light shelves.

2) Active daylighting is a system of collecting sunlight using a mechanical device to increase the efficiency of light collection for a given lighting purpose.

From Ancient time to early modernism, natural light is considered as the main light source. Both Pantheon in Ancient Rome and the Phillips Exeter Academy Library by Louis Kahn are identical on all sides and formed with simple geometry. Natural light penetrates from high angle to highlight the interior

space. It gives the sense of time progressing as the focus is changing over time.

METHODOLOGY

This paper will include the study of natural light, its importance and various techniques used to bring in light into the building. This study would also focus on the importance of orientation of a building in order to ensure maximum availability of useful natural light and the benefits of it. Study will also focus on how all these can contribute in making the building more sustainable. This would include various techniques and their function used in different parts of the building for getting maximum usage of light.

WHAT IS PASSIVE DAYLIGHTING?

Passive daylighting strategies promote the quantity and even distribution of daylight throughout a building by collecting natural light and reflecting it into darker areas of the building.

Architects use windows, skylights, clear doors, light tubes, mirrors, light shelves and other reflective surfaces to collect and direct light to key areas in the room. For example, if a waiting area is located in a dark corner with no nearby windows, architects can redirect light from other well-lit parts of the room using passive reflecting elements. Beyond adding windows or skylight to a space, it involves carefully balancing heat gain and lose, glare control, and variations in daylighting availability.

There are also a number of health and wellness benefits when you allow more natural light into your building. Exposure to natural light improves:

Mood, Employee and visitor satisfaction, Student performance and learning, Healing (especially in hospital environments), Productivity, Cognitive function, Circadian rhythms.

Many reasons can justify considering daylight as a light source in both residential and commercial buildings, although some of the reasons may apply more to one building category than the other. Among the reasons are:

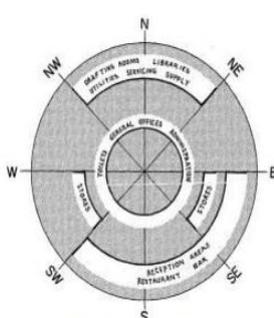
- Quality of the light.
- Importance of daylight as a design element.
- View (daylight apertures provide visual communication channels to the outside).
- Use of day lighting apertures as fire exits in emergencies.
- Energy conservation resulting from the use of daylight as a primary or secondary illuminant.

- Energy consumption and peak demand cost savings resulting from the use of daylight.
- No cost change in construction.
- Opportunity to develop integrated structural and mechanical systems.
- Psychological and physiological benefits not obtainable with electric lighting or windowless buildings.
- The genuine desire to have natural light and sunlight in a room or space.

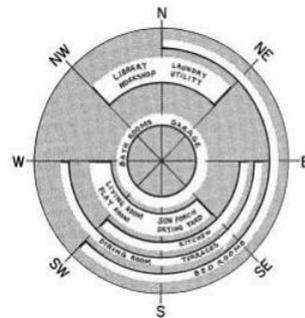
The quality of daylight as an illuminant is an important reason to use daylight in a building. Daylight the combination of sunlight and sky light-is the one light source that most closely matches human visual response.

ORIENTATION OF BUILDINGS AND DAYLIGHT

The importance of orientation in a building must be considered at the outset, when the architect is planning the location of the building on the site, the aim being to ensure the maximum availability of useful natural light and sunlight to the interior. The amount of sunlight received by a building depends on both the building's shape and orientation. The several simple diagrams of building shapes exploit sunlight to the maximum when they are properly oriented.



Suggestive Orientations for the rooms of and offices and stores



Suggestive Orientations for the rooms of Residence

Owing to the different climates, various sites, and variations of individual tastes or requirements, it is difficult to present a standard of orientation for natural lighting, but diagrams of appropriate orientations for various rooms in different building types are proposed in the following figures;

NATURAL LIGHTING FOR SUSTAINABLE ARCHITECTURE

Natural lighting is an important tool in attaining sustainability. Production of electric power can be linked with other environmental issues such as the impact on water quality, increased production wastes, and increased industrial zones. Therefore, reduction in the use of artificial lighting is vital.

Natural Lighting Strategies:

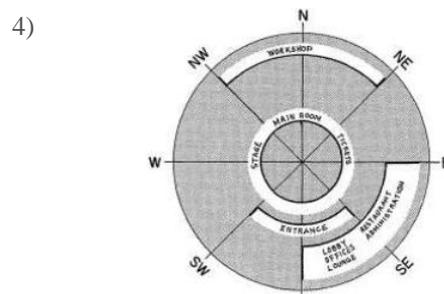
1) **Window orientation to maximize the benefits of day-lighting.** This strategy aims at utilizing sunlight through the size and location of windows. Day-lighting refers to

capturing diffused light without compromising comfort and function. This strategy also enhances the quality of light, depending on the nature of the room involved. Some of the trade-offs in using day-lighting are reduced insulation value and good views. But these discomforts can be reduced by using roof overhangs and by avoiding locating windows on the east and west side of the structure.

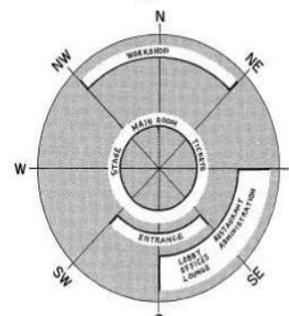
2) **Use of clerestories.** This strategy has been long used in Egyptian architecture. A clerestory is a part of the roof where a windowed section is provided. This ancient natural lighting strategy is suitable for open plan homes where the ceiling follows the roof line. They can be used to increase direct solar gain when oriented towards the equator. When facing toward the sun, clerestory windows and other windows may admit unacceptable glare.

3) **Consider skylights.** Though this natural lighting strategy is viewed as a potential source for excessive heat gain, as well as heat loss in the winter, proper installation can reduce these discomforts and enhance its main benefits.

Tubular skylights aid in providing natural lighting on areas where windows are not possible because of the elevation or the room's layout. There is an alternative to a skylight which is a roof lantern that sits above the roof as opposed to a skylight which is fitted into the construction of the roof.



Suggestive Orientations for the public buildings



Suggestive Orientations for the public buildings

5) **Opt for retractable awnings.** This strategy solves the concern with controlling the intensity of natural lighting. Retractable awnings are far superior to other light diffusing strategies in windows such as tinting, blinds and fixed awnings. It provides reduction of heat gain during warm seasons, and insulation during winter.

6) **Atrium.** An atrium is a large open space located within a building. It is often used to light a central circulation

or public area by natural daylight admitted through a glass roof or wall. The main function of an atrium is to provide a visual experience and a degree of contact with the outside for people in the working areas.

7) **Fibre Optic Concrete Wall.** Another method of daylighting a space is to make a secure structural concrete wall translucent by embedding optical fibre cables into it. Daylight (and shadowy images) can then pass directly through a thick solid-concrete wall allowing natural daylight into the space.

Compelling Benefits:

- 1) **Reduced energy consumption.** The lessened dependency on artificial lighting can help reduce the use of electricity by as much as 10%.
- 2) **Reduction of mildew or mold built-up.** Most diseases, especially chronic respiratory problems are often associated with bacterial and fungal built up in damp areas such as basements and bathrooms. Natural lighting can naturally lessen the production of harmful organisms and sunlight is considered to be one of the best natural disinfectants.
- 3) **Healthy dose of vitamin D.** Ample amount of sunlight can prevent vitamin D and B1 deficiency that may cause diseases such as rickets and beriberi.
- 4) **Improved performance due to change in working environment.** Many case studies have been conducted that show a significant improved performance on employees where natural lighting have been encouraged in their work environment.
- 5) **Increased visual appeal in interiors.** Natural illumination is still the best type of lighting system used in interior design and can be a challenging, yet rewarding task to successfully incorporate it into a structure or building.

ADVANCE TECHNOLOGY AND THOSE DEVELOPED IN THE LAST DECADES

Innovative daylighting systems are designed to redirect sunlight or sky light to areas where it is needed with excessive luminance and glare. These systems use optical devices that initiate reflections, refractions, and / or use total internal reflection of sunlight and sky light. Advanced daylighting systems can be designed to actively track the sun or passively control the direct sunlight and sky light.

Innovative daylighting systems are designed to redirect sunlight or sky light to areas where it is needed with excessive luminance and glare. These systems use optical devices that initiate reflections, refractions, and / or use total internal reflection of sunlight and sky light. Advanced daylighting systems can be designed to actively track the sun or passively control the direct sunlight and sky light.

These types are classified according to the following:

- 1) **Shading Systems Using Diffuse Light:**
- 2) Louvers / Blinds
- 3) 2-3-2-1-b- Automated Blinds.
- 4) 2-3-2-1-c- Optical shutters.

5) 2-3-2-1-d- Holographic Optical elements (HOE) Shading systems.

- a) Louvers / Blinds
- b) Automated Blinds.
- c) Holographic Optical elements (HOE) Shading systems.

2) **Shading Systems Using Direct Sunlight:**

- a) External Light Shelves
- b) Internal light shelf (redirecting daylight)
- c) Angular selective Skylight

3) **Non-Shading Systems Using Diffuse Light:**

- a) Anidolic ceiling.
- b) Zenithal Light guiding glass with (HOEs.) Holographic Optical elements.

4) **Non-Shading Systems Using Direct Sunlight:**

- a) Laser-cut panels
- b) Prismatic panels

5) **Other Systems:**

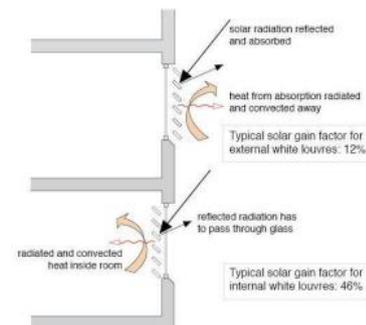
- a) Light pipes (duct / well).
- b) Switchable Electrochromic or gas chromic window coatings.

SHADING SYSTEMS USING DIFFUSE LIGHT

1-a Louvers / Blinds

Louvers and blinds are classic daylighting systems that can be applied for solar shading, to protect against glare and to redirect daylight. They can be used in all orientations and at all latitudes and can be added to a window system whenever necessary. Louvers and blinds may obstruct, absorb, reflect and/or transmit solar radiation (diffuse and direct) to a building's interior.

These types



are classified according to the following These types are classified according to the following

1-b Automated blinds

Window treatments are specially designed to include motors that perform the same functions you would have performed manually. The motors that move the drapes or shades are concealed within the valance at the top of the window treatment. Wall switches, infrared remote controls, or electrical relays are used to trigger operation.

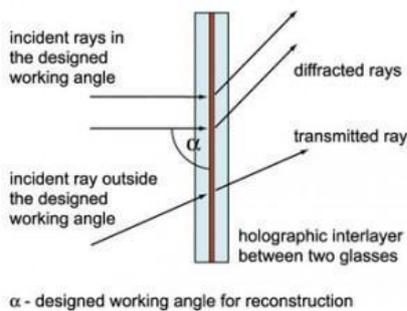
Window treatments are specially designed to include motors that perform the same functions you would have performed manually. The motors that move the drapes or shades are concealed within the valance at the top of the window treatment. Wall switches, infrared remote controls, or electrical relays are used to trigger operation.

1-c Directional Selective Shading System using Holographic Optical elements (HOE)

Directional selective shading systems reject incident light from a small angular area of the sky vault. Thus, the system can redirect or reflect incident beam sunlight while transmitting diffuse light from other directions. This selective shading provides daylight to building interiors without seriously altering view from windows.

Components:

Holographic diffraction gratings embedded in a glass laminate can be used in two different ways to provide shading control for large glazed areas – Transparent shading system and Sunlight Concentrating system. In both designs, the whole shading element has to track the sun’s path to achieve optimal shading, so a single-axis tracking system is necessary.



Application:

The holographic optical elements are designed for use as a transparent shading system, which allows penetration of diffuse light for illumination purposes and good view out while blocking the intense rays of the direct sun. These elements are most applicable where a large glazed area is desirable but where glare or overheating from direct sun may be a problem.

Maintenance:

The maintenance of the glass elements themselves involves infrequent cleaning in most environments. However, past experience has shown that maintenance of electromechanical systems to reliably operate a large number of movable glass panels is likely to be difficult.

Usage:

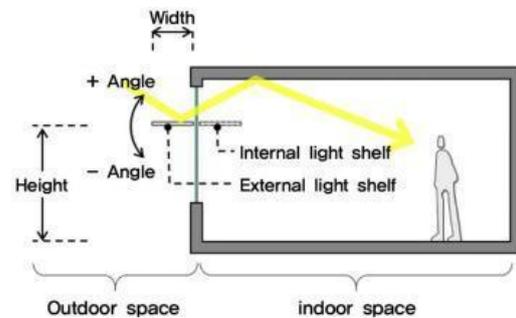
Holographic directional selective shading systems of various designs may be used in any climate, but the greatest impact will be achieved in buildings with large glazed facades under sunny conditions. The transparent shading system is particularly useful where architectural requirements favour a transparent solar control solution rather than a conventional blind system.

SHADING SYSTEMS USING DIRECT SUNLIGHT

2-a External light Shelves

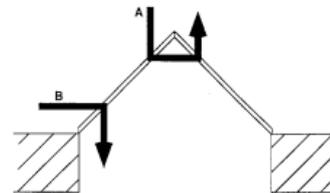
An external light-shelf is simply a horizontal or tilted plane inserted within a window to effectively divide it in two. It is an opaque element

with a highly reflective upper surface and diffusing white under-surface. They are used to improve a lighting by reflection and provide a virtual sky to spaces during overcast sky and for obstructive building.



2-b Internal Light Shelves

In many cases daylight distribution in a typical side lit room is very uneven, with very high level of daylight in the window zone and very low level in the rear zone of the room. It is usually placed in a nearly horizontal position between lower and upper part of the window. Light, which is reflected to the ceiling, increases the daylight in the rear part of the room.



2-c

Angular Selective Skylight

The angular selective skylight incorporates a pyramid or triangle configuration of laser-cut panels within the transparent skylight cover to provide angular selective transmission.



Fig (i)

Fig (i) - The skylights used at the Waterford School in Brisbane, Australia, use laser-cut acrylic panels to achieve angular selective transmittance. Light from high sun angles is reflected while diffuse, low angle skylight and sunlight penetrate the skylights.

(High-elevation light, A, is rejected and low-elevation light, B, is deflected to the interior)

Location in Window System:

Skylights are installed in the roof of a building.

Application:

Angular selective skylights are especially suited for natural lighting of ventilated or airconditioned buildings with extensive floor area and low-angle roofs, such as supermarkets and schools.

Energy Savings:

Energy savings can be significant since angular selective skylights can reduce overheating. Electrical lighting use can also be reduced compared to buildings with no skylights or buildings that use smaller skylights to control overheating.

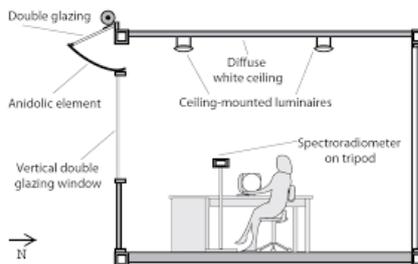
NON-SHADING SYSTEMS USING DIFFUSE LIGHT

3-a Anidolic ceiling

Anidolic ceiling systems use the optical properties of compound parabolic concentrators to collect diffuse daylight from the sky; the concentrator is coupled to a specular light duct above the ceiling plane, which transports the light to the back of a room. The primary objective is to provide adequate daylight to rooms under predominantly overcast sky conditions.

Components:

It consists of daylight-collecting optics coupled to a light duct in a suspended ceiling.



Location in Window System:

This system is designed to be located on a vertical facade above a view window.

Application:

Used in densely built-up urban as well as rural areas. It can be used in both clear and cloudy skies as long as proper shading is provided to control sunlight.

Cost:

It requires additional first costs.

NON-SHADING SYSTEMS USING DIRECT SUNLIGHT

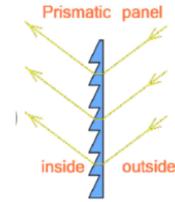
4-a Laser-cut panels

The laser-cut panel is a daylight-redirecting system produced by making laser cuts in a thin panel made of clear acrylic material. It may be used in fixed and movable arrangements within a window system.

4-b Prismatic Panels

Prismatic panels are thin, planar, sawtooth devices made of clear acrylic that are used in temperate climates to redirect or refract

daylight. When used as a shading system, they refract direct sunlight but transmit diffuse skylight.



Components:

A linear prismatic panel consists of an array of acrylic prisms with one surface of each prism forming a plane surface known as the prism backing. There are two refracting angles.

Location in Window System:

The systems can be applied as fixed or mobile systems, positioned in the vertical plane of the facade or on the roof, between the glazing panes (fixed configuration), on the exterior or interior side of the glazing unit. When used in façades and in order to maintain the view to the outside, its use is more appropriate at the top of the windows.

Physical Principles and Characteristics:

The main function is to achieve deep penetration of natural light. The prismatic panel uses both reflection and refraction to enable the controlled use of daylight in buildings.

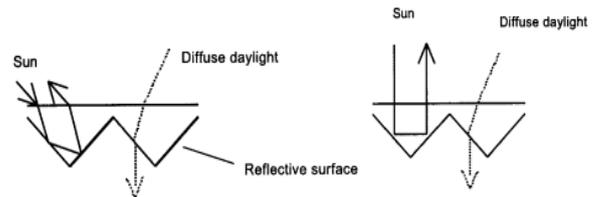
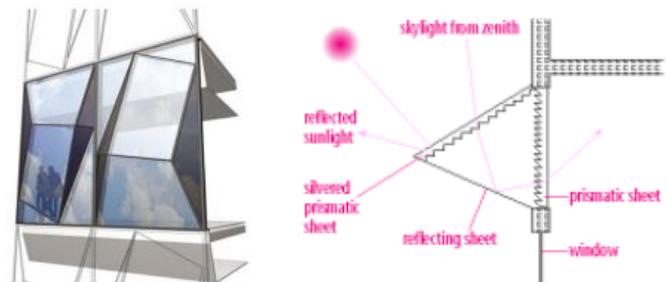


Fig (ii)

Behaviour of direct and diffuse components of daylight in a fixed prismatic sun-shading device (left) and in a movable prismatic sun-shading device (right). The phenomenon of total internal reflection is used to reflect the sun's rays.



Advanced Daylighting elements utilized are:

- Daylighting Monitors.
- 2-3-3-2 Super windows.
- 2-3-3-3 Spectral glazing for better daylighting.
- 2-3-3-4 Angular selective solar control.
- 2-3-3-5 Optical daylighting system.
- 2-3-3-6 Dual light shelf design.
- 2-3-3-7 Exterior redirecting:

- 2-3-3-7-a- Exterior reflectors.
- 2-3-3-7-b- Anodlic mirrors.
- 2-3-3-7-c-Prism Panels.
- 2-3-3-7-d-Light shelves.
- 2-3-3-8Interior louver systems:
- 2-3-3-8-a- Prismatic Acrylic Louvers.
- 2-3-3-8-b-Curved Metallic Louvers.
- 2-3-3-8-c- Folded Metallic Louvers.
- 2-3-3-9Integrated in vertical double glazing:
- 2-3-3-9-a- Symmetrical metallic profiles.
- 2-3-3-9-b-Asymmetric metallic profiles.
- 2-3-3-9-c-Curved acrylic strips.
- 2-3-3-9-d-Prismatic acrylic panels.
- 2-3-3-9-e-Laser – cut acrylic panels.
- 2-3-3-10Integrated in horizontal double glazing :
- 2-3-3-10-a- Asymmetric metallic profiles.
- 2-3-3-10-b-Glass or acrylic capillaries.
- 2-3-3-10-c-Glass webbing.
- 2-3-3-11Light pipe , step index fiber

- 1) Daylighting Monitors.
- 2) Super windows.
- 3) Spectral glazing for better daylighting.
- 4) Angular selective solar control.
- 5) Optical daylighting system.
- 6) Dual light shelf design.
- 7) Exterior redirecting:
 - a) Exterior reflectors.
 - b) Anodlic mirrors.
 - c) Prism Panels.
 - d) Light shelves.
- 8) Interior louver systems
 - a) Prismatic Acrylic Louvers.
 - b) Curved Metallic Louvers.
 - c) Folded Metallic Louvers.
- 9) Integrated in vertical double glazing:
 - a) Symmetrical metallic profiles.
 - b) Asymmetric metallic profiles.
 - c) Curved acrylic strips.
 - d) Prismatic acrylic panels.
 - e) Laser – cut acrylic panels.
- 10) Integrated in horizontal double glazing:
 - a) Asymmetric metallic profiles.
 - b) Glass or acrylic capillaries.
 - c) Glass webbing.
- 11) Light pipe, step index fibre.

CONCLUSION

- 1) The following points can be concluded from the previous results, the comparisons between different methods to calculate the daylight factor, and the theoretical analysis of sustainability term:-
- 2) The realization of the sustainability concept in the design process preserves the electrical power for the future generation which is the common trend of architecture in the whole world to reserve the non-renewable resource, make use of the renewable natural especially daylight.

- 3) The entering of the daylight in the early stage of the design process help the designer to make use of much daylight, directing & choosing the places, and the dimensions of the openings and windows.
- 4) The more awareness of the architect is important as sustainability concepts in the design processes which contribute to a strong continuous architecture for many years.
- 5) The using of modern techniques and architecture processing that would increase the daylight rate in the space are very important to reduce the energy consumptions with the use of natural ventilation reducing thermal loads transmitted through openings.
- 6) With properly installed and maintained day lighting systems, natural light has proved to be beneficial for the health, productivity, and safety of building occupants.
- 7) More awareness is important as sustainability concepts in the design processes which contribute to a strong continuous architecture for many years.
- 8) The use of modern techniques and architecture processing that would increase the daylight rate in the space reduces the energy consumptions with the use of natural ventilation reducing thermal loads transmitted through openings.

ACKNOWLEDGMENT

My heartfelt thanks and gratitude are to the following people who have taken time, effort and interest in helping me to compile this research paper.

My special thanks to Prof. Nishigandha Sakhardande, all the faculty and staff of the college who have always co-operated and guided me.

REFERENCE

- i.<https://hmcarchitects.com/news/passive-daylighting-systems-could-transform-the-architecture-of-natural-light-2019-05-24/>
- ii.<https://antonioloweinteriors.com/daylighting-methods-in-architecture-and-which-are-present-in-the-building>
- iii.<https://www.wbdg.org/resources/daylighting>
- iv.<https://planlux.net/sources-of-natural-light-daylighting-strategies/>
- v.https://www.youtube.com/watch?v=9COuk4dbrKc&ab_channel=NZEBIndia
- vi.<https://nzeb.in/webinars/technology/daylight-technologies/>
- vii.<https://www.onegreenplanet.org/lifestyle/natural-lighting/>
- viii.*Book: Daylight in Buildings – A source book on daylighting system and component*
- ix.<https://greenhome.osu.edu/natural-lighting>
- x.<https://blog.veluxusa.com/commercial/5-innovations-commercial-daylighting>

Need of Open Green Spaces In New Delhi to Mitigate Air Pollution

Bharat Kumar Rolaniya, Ar. Soumyashree Pattnaik

LSAD, Lovely Professional University Punjab India

Email: bharatrolaniya@gmail.com

Abstract: *New Delhi, with 16.3 million people making its mark in the world because of its air pollution. Tons of particulate matter (PM 10 and PM2.5) and other gaseous pollutants are producing with in the city from industries and automobiles. Delhi is exceeding its maximum limit of PM 10 and other suspended particles resulting in smog. As the air pollution increasing, it is posing threats to the health and the other day to day activities. It is also responsible for multiple health issues like respiratory problems and even heart attacks and strokes. Air pollution is eating up Delhi, deteriorating the quality of life and it seems impossible to cure, like an epidemic. However, there may be some cure to it. The paper focuses on understanding the role of open green spaces in reducing air pollution and also what all relevant research works done in this field. This helps one to establish the understanding about how this simple idea works? And how effective is it? There are open spaces in Delhi but the question remains, are they not green enough? This is where the paper will reveal the need for open green spaces in the city.*

Key words: Air Pollution, Open Green Spaces, Urban Forest, Health

INTRODUCTION

Delhi is the second largest metropolitan in India, and its population has increased from 9.4 million in 1991 to 13.2 million in 2001. Increasing population and their anthropogenic activities are contributing to air pollution. Industries and automobiles are recognized to emit most of the carbon in Delhi. India accounts for the highest level of particulate matter <math><2.5\mu\text{m}</math> in diameter and Pm2.5 among 13 out of the world's 20 cities, with Delhi at the top position (Malhotra, 2013). The World Health Organization released an urban air database in September 2011 reported that Delhi has exceeded the maximum PM10 limit by almost 10-times at 198 $\mu\text{g}/\text{m}^3$. (Rizwan, Nongkynrih, & Gupta, 2013).

Cavanagh investigated that excess mortality and morbidity in the urban population is because of high levels of particulate matter (PM). (Cavanagh, Zawar-Reza, & Wilson, 2009). Air pollution is responsible for causing serious health hazards, environmental hazards such as smog, acid rain, and property damage, etc. ((Central Pollution Control Board), n.d.). Ultra-fine particles' toxicity in air pollution is mostly due to exposure to inhalation through the respiratory system with the possibility that these particles cause significant health effects (Chen et al., 2016).

This paper focuses on air pollution mitigation through open green spaces but the question is do vegetation in open spaces really mitigates air pollution? If it does than New Delhi needs to redefine the open green spaces in the city. It has 22 % green cover, and the green space per person is about 20 m² but the rapid urban growth contributes to the city's remaining green and open spaces being used for various purposes. The scale of urban green and open space is, therefore, decreasing at an alarming rate. (Kumari, 2019) Hence, the big question remains that does New Delhi need open green spaces?

OBJECTIVES

- To study the pollution profile of New Delhi
- To justify open green spaces with respect to air pollution mitigation.
- To analyze availability of open green spaces in New Delhi.
- To link outcomes from research study with case study of New Delhi.

METHODOLOGY

This research is formulated based on the Research done in the relevant field till so far. Research criteria are decided keeping three input parameters constant for the final accumulation of the data.

- **Air pollution**, what causes it? Its effects and mitigation factors.
- **Open green spaces**, their efficiency in making the air quality better and its relevancy with the chosen case study.
- Determining availability of open green spaces with respect to **case study of New Delhi** and finding solutions from acquired information from the work done previously. By inferring the gathered data, the analysis will be formulated which will help understand the need and shortcomings clearly.

AIR POLLUTION

Air pollution is caused by air pollutants consisting of different gases and particulate matter (PM10 and PM2.5). Air Pollutants can be categorized on the basis of its physical state of matter, source of origin, method of origin and chemical composition. Primary air pollutants are Sulphur dioxide (SO₂), carbon monoxide (CO), lead (Pb), ammonia

(NH₃), etc and secondary air pollutant are ozone, Peroxyacetyl nitrate (PAN), smog, etc. ((Central Pollution Control Board), n.d.) Particulate matter is another air pollutant probably most hazardous of all as it has the risk of cardiopulmonary health effects (*WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide, and sulfur dioxide*, 2005). Residential and other energy production stations emit PM₁₀, whereas vehicles, industries, wood burning, etc. attribute in PM 2.5 emission. (Shah, Balkhair, & Group, 2011) Common air pollutants include particulate matter, sulphur dioxide (SO₂), ground-level ozone (O₃), nitrogen dioxide (NO₂) and carbon monoxide (CO According to the World Health Organization some cities exceeded their Air quality guideline in year 2005, catering 89 per cent of the world's population. (Brauer et al., 2012) Delhi has the largest group of small-scale factories in India, which together with other industrial units contribute to 12% of air pollutants (Rizwan et al., 2013).

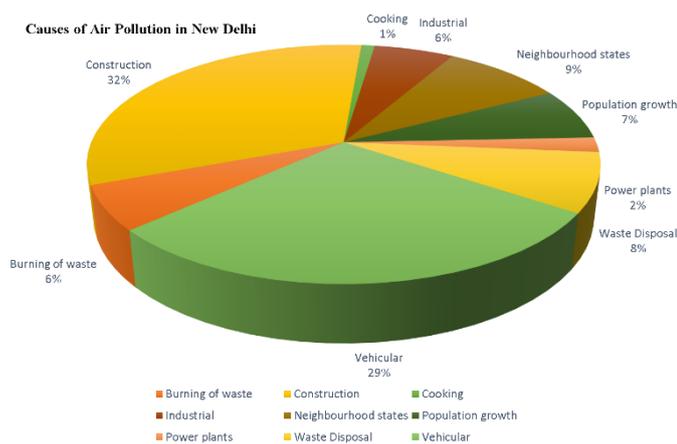


Figure1. Causes of air pollution in New Delhi

Source: (Floor & Colony, 2019)

Redeveloped by author

A 1997 report by the Ministry of the Environment and Forests of India analyzed the environmental situation in Delhi with regard to complaints regarding worsening conditions. (“White paper on pollution in Delhi with an action plan,” 2016). It was estimated that every day in Delhi about 3000 metric tons of air pollutants are released (Rizwan et al., 2013). Delhi air pollution has affected the air quality (Floor & Colony, 2019). (Floor & Colony, 2019). In urban and industrial areas, vehicular emission, suspended dust particles and production process exceeded its particle limit. Long-time contact inhalation in the presence of small particles increases threat to human health as it reaches deeper into the lungs (Dockery, 1993; Kampa & Castanas, 2008)

OPEN GREEN SPACES

Green areas are open spaces, usually covered by natural or cultivated vegetation (Rakhshandehroo, Johari, &

Yusof, 2017). There are two main categories of open space (external environment); green space and grey space. It can be defined as part of open space, taking into account the minor differences in the description of green spaces. (Olsson, 2012). The International Congress of Modern Architecture (CIAM) strongly supported the provision of urban open spaces as a fundamental principle of modern urban planning, referring to open spaces as the city's lungs (Banerjee, 2007). several studies conducted on open green spaces like urban parks contribute to the reduction of air pollution. Seven studies have investigated the reduction of air pollution in urban parks (Paoletta, 2011). Five studies suggest that urban parks remove particles including PM₁₀ (Freer-smith & Taylor, 2000; Paoletta et al., 2011). While four of the studies found that parks lowered other pollutant rates, including NO_x and SO_x. (Paoletta et al., 2011; Yin et al., 2011). Five of the papers covered eliminating CO₂ from urban parks, promising to serve as ‘carbon sinks’. (Davies, Edmondson, Heinemeyer, Leake, & Gaston, 2011; Jo, 2002; Kordowski & Kuttler, 2010; Makhelouf, 2009; Paoletta et al., 2011)

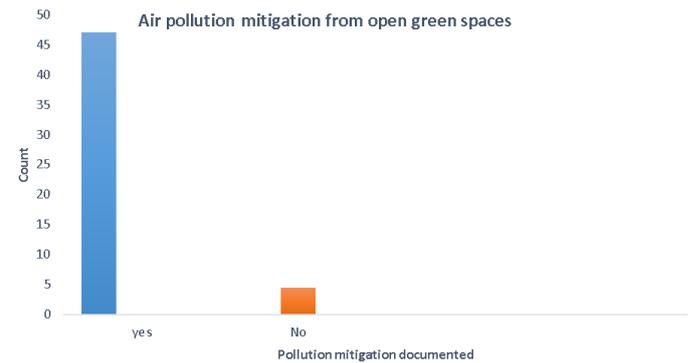


Figure 2. Studies reporting pollution mitigation from green space

Source: (Tara Zupancic, Claire Westmacott & Mike Bulthuis, 2015)

redeveloped by author.

Mohammad in his study on per capita availability of open green spaces in New Delhi and it turns out to be 20 sq. meter per person (Kumari et al., 2019). But New Delhi is still a victim of Air pollution because of some possible reasons like improper management of open parks and other green spaces, knowledge gap among people that what kind of vegetation should be used, etc. Researchers suggest that pollution removal varies among cities depending on the amount of tree cover, with increased tree cover leading to greater total removal. Urban vegetation plays a vital role in controlling air pollution and it is considered as one of the major benefits that urban green can provide (Paoletta et al., 2011). It is all disproportionally related, with an increasing population there will be decreasing open green spaces (Kumari et al., 2019).

In 2009, Cavanagh analyzed the role of the urban forest in mitigating air pollution (Cavanagh et al., 2009). Research

studies in this field suggest that trees in open spaces mitigate air pollution by absorbing certain air pollutants from the atmosphere (Baró et al., 2014). New Delhi is currently struggling with air pollution caused by various types of air pollutants especially particulate matter (PM10 and PM2.5) ((CPCB), Floor & Colony, 2019; Malhotra, 2013) Urban forests play a key role in reducing airborne particulate matter (Baró et al., 2014; Cabaraban & Nowak, 2013; Tallis, Sinnett, & Freer-Smith, 2011). Further, more insights about the type of vegetation described in terms of relative tree cover (i.e. leaf area index, leaf area density, etc.), Size of trees and its foliage density effect pollution mitigation rates especially for PM, O3, NO2, and SO2. (Baró et al., 2014; Cabaraban et al., 2013). One study estimates that street-level reduction of as much as 40% for NO2 and 60% for PM10 can be achieved using green walls and indicates that the potential benefits of green air quality infrastructure have been significantly underestimated. (Science, Mackenzie, Whyatt, & Hewitt, 2012). Lowering of the pollution level in households is associated with the nearby availability of green space. (Greenness, 2013)

Tiwary notes that smaller trees are still successful in removing PM10 due to their higher density of leaves (Tiwary et al., 2009). The related PAHs and heavy metals will also be eliminated from the air by plants scavenging particulate matter. Plants scavenging particulate matter. Plants are therefore necessary to decrease the rates of such contaminants in urban areas in the air. (Dzierzanowski, Poppek, Gawrońska, Saebø, & Gawroński, 2011)

suggests that 72% of the pollution in Delhi is emitted by vehicles alone (Tara et al., 2015). Air pollution is getting no better in New Delhi, it is increasing and catalyzing health issues, loss of ecosystem, uncomfortable conditions, etc. (Kampa & Castanas, 2008).

Ministry of Environment & Forests initiated some of the action plans to mitigate air pollution (“White paper on pollution in Delhi with an action plan,” 2016) but it has not turned out to be that effective. People are less aware of how to deal with air pollution in terms of mitigating it (for eg. Mismanagement of open spaces, haphazard use of open lands, etc.). World Health Organization (WHO) has set a minimum limit for the per capita green space in urban areas as 9 Sq. meter for healthy living whereas, Delhi is having 20 Sq. meter but the fast urban growth leads to utilize remaining green and open areas of the city for different purposes (Kumari et al., 2019). Hence, resulting in less open green space. Kumari in her study analyzed that per capita open space for 50 out of 64 wards is very less. (Kumari et al., 2019)

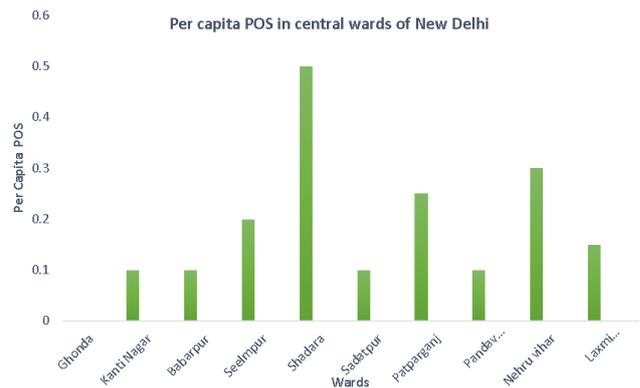


Figure 4. Per capita POS in central wards of New Delhi
Source ; (Kumari, Tayyab, Hang, Khan, & Rahman, 2019) redeveloped by author

The inferences out of previous studies on open green spaces suggest that if green open spaces are redefined then air pollution can be mitigated to a handsome amount. A case study on removal of air pollution revealed that open greens spaces (eg. Urban Forest) were estimated to remove 711,000 metric ton air pollution per annum. Integrated study on the Effects of trees suggests that urban tree canopy cover is a good approach to improve air quality index and to meet clean air standards. (Å, Crane, & Stevens, 2006). In 2016 Wissal Selmia examined that the amount of air pollution removed was about 0.03% of the emitted CO, 6.60% of the emitted PM10, 1.50% for the emitted PM2.5 and 50% for the emitted SO2. (Selmi et al., 2016 In Los Angeles an estimation through modeling study sates the reduction PM10 by urban forest (Mcpheerson, Simpson, Xiao, & Wu, 2011). A study conducted in China showed that trees completing an open green space in the city center removed 772 tons of PM10 in one year (Yang, Mcbride, Zhou, & Sun, 2005) In similar

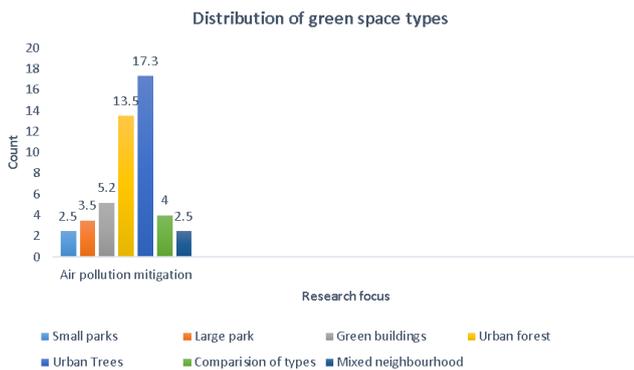


Figure 3. Distribution of green space types
Source: (Tara Zupancic, Claire Westmacott & Mike Bulthuis, 2015) redeveloped by author.

NEW DELHI AND CASE STUDIES

New Delhi is said to be the greenest metropolitan city of India with about 22 % green cover, yet one of the most polluted cities of the world (Kumari et al., 2019). Air pollution is spreading its roots because of various sources contributing together to formulate poison that people are breathing these days. A study recommended by IPCC

studies in Chicago (USA) urban trees, which occupy 11% of city area, removed about 234 tons of PM₁₀(, Nowak, & Rowntree, 2019). In 2007 a study carried out in U.K. explored that 2 to 10% of PM₁₀ can be reduced just by planting trees in one-quarter of the city. (McDonald et al., 2007)

ANALYSIS

New Delhi is congested in terms of space, but it is only because open spaces are not managed properly. In terms of green, it is said to be greenest metropolitan yet not completely managed in terms of vegetation and other means to meet clean air standards. From the case studies, the major finding is that the right type of vegetation removes dangerous air pollutants and improve air quality index. In the case of Delhi, tons of particulate matter (PM and PM_{2.5}) and other gaseous pollutants like (SO_x, NO, H₂S, etc.) can be removed if present green spaces in New Delhi are converted to breathable open green spaces by implementing Vegetation Cover (urban forest). Delhi is in dire need of open green spaces like urban forests to mitigate air pollution.

Some studies suggested that planting trees can emit volatile organic compounds that react with atmospheric gases (e.g. Nitrogen) and forms ground-level ozone. (Yin et al., 2011) and that can be taken as one of the limitation of this research.

CONCLUSION

Air pollution is eating New Delhi like an epidemic except it can be treated. Some studies highlighted that Open green spaces can mitigate air pollution and improves air quality. Few studies investigated the decline of open green spaces in New Delhi. Hence, the researchers propose that increasing open green spaces in New Delhi is a need of the hour for the city's inhabitants (Kumari et al., 2019). It appears clearly that the preservation of open green spaces is one of the right ways to achieve sustainable development and highly important to accomplish a better quality of life. (Rakhshandehroo, Johari, Yusof, et al., 2017) Plants and trees are important for decreasing the level of toxic pollutants in New Delhi. However, having open spaces is not enough until they are not being populated with enough vegetation and New Delhi needs such green open spaces to mitigate air pollution. Mitigating air pollution will not be a winning situation until and unless it is not being stopped from source.

SUGGESTIONS

Present open spaces are in poor condition except in Lutyens Delhi, as it is well planned; whereas, no strict regulations were made to keep a good landscape quality in various other parts of Delhi. Industries, automobiles and anthropogenic activities are only generating air pollution with the passing days. Therefore, new amendments should be

added in the law to take air pollution down from its very beginning i.e. source. In this era of technological advancements, technology that absorbs pollutants and cleans air should be incorporated like air filters, electrostatic dampers attached to chimneys, etc. more importantly people should be aware of air pollution and health effects associated with it. Awareness should be spread among people in such a way that they get to participate in it (like green practice in day to day life) which will not only mitigate pollution but also lead them to sustainability.

Many things can be done in open spaces to reduce air pollution:

- The addition of green vegetation like small plants, terrace garden, gardening in balcony, etc. at building level should be incorporated in local bye-laws.
- Abandoned lands like brownfields, vacant plots, unused property, should be converted into small open green spaces so that microclimate get improved.
- Unnecessary roads, unused vehicular bridges, etc. can be turned into green interactive spaces which can improve air quality and endorse economic growth as it does in Seoul, South Korea.
- The government should implement innovative strategies on an immediate basis to mitigate air pollution as it happened in China. (Wang & Hao, 2012)

ACKNOWLEDGEMENT

I sincerely extend my gratitude to Ar. Soumyashree Pattnaik, who has been kind enough to be my mentor, evaluated and has given her valuable insights at every stage of the project, thus allowing me to complete it on schedule.

REFERENCES

- i. *White paper on pollution in Delhi with an action plan. Gov INDIA Minist Environ For. 2016:1-26. <http://www.urbanemissions.info/wp-content/uploads/docs/1997-CPCB-White-Paper-on-Delhi-Air-Pollution.pdf>.*
- ii. *WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide.; 2005.*
- iii. *(CPCB). Air Quality of Delhi. [http://cpcbenviis.nic.in/enviis_newsletter/Air pollution in Delhi.pdf](http://cpcbenviis.nic.in/enviis_newsletter/Air%20pollution%20in%20Delhi.pdf).*
- iv. *À DJN, Crane DE, Stevens JC. Air Pollution Removal by Urban Trees and Shrubs in the United States Air pollution removal by urban trees and shrubs in the United States. 2006;(September 2018). doi: 10.1016/j.ufug.2006.01.007*
- v. *Banerjee T. The Future of Public Space. 2007;(August 2013):37-41. doi:10.1080/01944360108976352*
- vi. *Baró F, Chaparro L, Gómez-Baggethun E, Langemeyer J, Nowak DJ, Terradas J. Contribution of ecosystem services to air quality and climate change mitigation policies: The case of urban forests in Barcelona, Spain. Ambio. 2014;43(4):466-479. doi:10.1007/s13280-014-0507-x*

- vii. Brauer M, Amann M, Burnett RT, et al. Exposure Assessment for Estimation of the Global Burden of Disease Attributable to Outdoor Air Pollution. 2012.
- viii. Cabaraban MTI, Kröll CN, Hirabayashi S, Nowak DJ. Modeling of air pollutant removal by dry deposition to urban trees using a WRF/CMAQ/i-Tree Eco coupled system. *Environ Pollut.* 2013; 176:123-133. doi: 10.1016/j.envpol.2013.01.006
- ix. Cavanagh JAE, Zawar-Reza P, Wilson JG. Spatial attenuation of ambient particulate matter air pollution within an urbanised native forest patch. *Urban for Urban Green.* 2009;8(1):21-30. doi: 10.1016/j.ufug.2008.10.002
- x. Chen R, Hu B, Liu Y, et al. Beyond PM_{2.5}: The role of ultrafine particles on adverse health effects of air pollution. *Biochim Biophys Acta - Gen Subj.* 2016;1860(12):2844-2855. doi: 10.1016/j.bbagen.2016.03.019
- xi. Davies ZG, Edmondson JL, Heinemeyer A, Leake JR, Gaston KJ. Mapping an urban ecosystem service: Quantifying above-ground carbon storage at a city-wide scale. *J Appl Ecol.* 2011;48(5):1125-1134. doi:10.1111/j.1365-2664.2011.02021.x
- xii. Dockery DW. AN ASSOCIATION BETWEEN AIR POLLUTION AND MORTALITY IN SIX U.S. CITIES. *N Engl J Med.* 1993;329.
- xiii. Dzierzanowski K, Popek R, Gawrońska H, Saebø A, Gawroński SW. Deposition of particulate matter of different size fractions on leaf surfaces and in waxes of urban forest species. *Int J Phytoremediation.* 2011;13(10):1037-1046. doi:10.1080/15226514.2011.552929
- xiv. Floor LG, Colony D. A Study on Delhi's Perception & Accountability on Air Pollution Table of Content: 2019.
- xv. Freer-smith P, Taylor G. Effective tree species for local air quality management. *J Arboric* 26 13-19. 2000;(January 2000):11-19.
- xvi. Greenness S. Surrounding Greenness and Exposure to Air Pollution During Pregnancy: An Analysis of Personal Monitoring Data. 2013;(9):1286-1291.
- xvii. Jo HK. Impacts of urban greenspace on offsetting carbon emissions for middle Korea. *J Environ Manage.* 2002;64(2):115-126. doi:10.1006/jema.2001.0491
- xviii. Kampa M, Castanas E. Human health effects of air pollution. 2008; 151:362-367. doi: 10.1016/j.envpol.2007.06.012
- xix. Kordowski K, Kuttler W. Carbon dioxide fluxes over an urban park area. *Atmos Environ.* 2010;44(23):2722-2730. doi: 10.1016/j.atmosenv.2010.04.039
- xx. Kumari B, Tayyab M, Hang HT, Khan MF, Rahman A. Assessment of public open spaces (POS) and landscape quality based on per capita POS index in Delhi, India. *SN Appl Sci.* 2019;(April). doi:10.1007/s42452-019-0372-0
- xxi. Makhelouf A. The Effects of Green Space on Urban Climate. 2009;6(1):35-40.
- xxii. Malhotra G. India's contribution in carbon emissions - a case study on Delhi region. *Interdiscip Environ Rev.* 2013;14(3/4):230. doi:10.1504/ier.2013.058925
- xxiii. McDonald AG, Bealey WJ, Fowler D, et al. Quantifying the effect of urban tree planting on concentrations and depositions of PM₁₀ in two UK conurbations. 2007; 41:8455-8467. doi: 10.1016/j.atmosenv.2007.07.025
- xxiv. Mcpherson EG, Simpson JR, Xiao Q, Wu C. Landscape and Urban Planning Million trees Los Angeles canopy cover and benefit assessment. *Landsc Urban Plan.* 2011;99(1):40-50. doi: 10.1016/j.landurbplan.2010.08.011
- xxv. Olsson H. Integrated Green Spaces in Urban Areas - A case study of inner Brisbane Integrated Green Spaces in Urban Areas - A case study of inner Brisbane. 2012.
- xxvi. Paoletta E, Bardelli T, Giovannini G, Pecchioli L. Air quality impact of an urban park over time. *Procedia Environ Sci.* 2011; 4:10-16. doi: 10.1016/j.proenv.2011.03.002
- xxvii. Rakhshandehroo M, Johari M, Yusof M. Terminology of Urban Open and Green Spaces. 2017;(November).
- xxviii. Rakhshandehroo M, Johari M, Yusof M, Arabi R, Parva M, Nochian A. The Environmental Benefits of Urban Open Green Spaces. *Alam Cipta.* 2017;10(1):10-16.
- xxix. Rizwan SA, Nongkynrih B, Gupta SK. Air pollution in Delhi: Its Magnitude and Effects on Health. *Indian J Community Med.* 2013;38(1):4-8. doi:10.4103/0970-0218.106617
- xxx. Science E, Mackenzie AR, Whyatt D, Hewitt CN. The effectiveness of green infrastructure to improve urban air quality. 2012;(March 2018). doi:10.1021/es300826w
- xxxi. Selmi W, Weber C, Rivière E, Blond N, Mehdi L, Nowak D. Urban Forestry & Urban Greening Air pollution removal by trees in public green spaces in Strasbourg. *Urban for Urban Green.* 2016;17(2):192-201. doi: 10.1016/j.ufug.2016.04.010
- xxxii. Service F, Nowak DJ, Rowntree RA. Air Pollution Removal by Chicago's Urban Forest Agriculture Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project.; 2019.
- xxxiii. Shah PS, Balkhair T, Group S. Air pollution and birth outcomes: A systematic review. *Environ Int.* 2011;37(2):498-516. doi: 10.1016/j.envint.2010.10.009
- xxxiv. Tallis M, Taylor G, Sinnett D, Freer-Smith P. Estimating the removal of atmospheric particulate pollution by the urban tree canopy of London, under current and future environments. *Landsc Urban Plan.* 2011;103(2):129-138. doi: 10.1016/j.landurbplan.2011.07.003
- xxxv. Tara Zupancic, MPH, Director HR, Claire Westmacott RC, Mike Bulthuis SRA. The Impact of Green Space on Heat and Air Pollution in Urban Communities: A Meta-Narrative Systematic Review.; 2015.
- xxxvi. Tiwary A, Sinnett D, Peachey C, et al. An integrated tool to assess the role of new planting in PM₁₀ capture and the human health benefits: A case study in London. *Environ Pollut.* 2009;157(10):2645-2653. doi: 10.1016/j.envpol.2009.05.005
- xxxvii. Wang S, Hao J. Air quality management in China: Issues, challenges, and options. *J Environ Sci.* 2012;24(1):2-13. doi:10.1016/S1001-0742(11)60724-9
- xxxviii. Yang J, McBride J, Zhou J, Sun Z. The urban forest in Beijing and its role in air pollution reduction. 2005; 3:65-78. doi: 10.1016/j.ufug.2004.09.001
- xxxix. Yin S, Shen Z, Zhou P, Zou X, Che S, Wang W. Quantifying air pollution attenuation within urban parks: An experimental approach in Shanghai, China. *Environ Pollut.* 2011;159(8-9):2155-2163. doi: 10.1016/j.envpol.2011.03.009

Design Concern For Seating Area In Stadium Structures

Devyani Kumavat

Bharati Vidyapeeth College of Architecture, Pune, India.

Email: devkmt@gmail.com

Ar. Mukta Latkar-Talwalkar

Bharati Vidyapeeth College of Architecture, Pune, India.

Email: mlt@bvcoa.in

Abstract: Stadiums hold a variety of areas, where they require concern regarding the planning of seating area, roofing system, orientation, etc. Depending on the type of sports the concern for planning differs, whether the sports is an outdoor or indoor sports. Due to the growing popularity and participation, many provisions for the spectators are provided inside the stadium such as exhibitions, galleries, etc. The paper aims to study and understand the orientation of the playfield for an outdoor stadium and seating area for an outdoor and indoor stadium.

Keywords: Stadium seating area, Orientation, Viewpoints, Playfield, Sightlines, Stands.

INTRODUCTION

The Stadium is an arena, where primarily it is used for outdoor sports and allows numerous spectators to experience the live sport simultaneously. Stadiums first were designed in ancient Greece and Rome for community gathering and display of strength and talent. The Greek stadiums were constructed in 2 ways – cut out of a hillside or on flat ground. Building into the hillside provided natural seating along the banks with good sightlines. Examples of this type of construction are Olympia, Thebes, and Epidauros. The modern stadium, which can still be seen today, had seating and held **50,000** spectators in **46** rows. Like the stadiums, Hippodromes were U-shaped stadiums as shown in figure no.1, and were commonly built on the hillside for naturally rising tiers for the seating area. Similar in dimension to stadium 200m long and 37m wide.



Figure no.1

Stadiums at times also provide an arena for different events, concerts, festivals, etc., and serve adequate services required for the huge amount of spectators. Stadiums include different areas, specifically a field, safety margins, and a bowl which is a tiered structure surrounding the field for the spectators to stand or sit and view the sport. Over the past years, stadiums have evolved

in various aspects such as planning a sports arena indoors or outdoors, additional facilities for the spectators inside the stadium, structural systems, roofing systems, etc. Planning a stadium in respect to indoors or outdoors has different specifications and concerns, where the type of sports and the playfield is different, the orientation of field is considered, spectators seating area, environment for the spectators, roofing system, sightlines are considered and differ accordingly. With the growing popularity and participation, different provisions are planned inside the stadium for entertainment and revenue purposes. Planning a stadium with galleries, exhibitions, offices, shops, cafes, banquet halls for VIPs, etc. provides an increased number of visitors inside the stadium even when there is no event held, however, this directly does not affect the seating area but accommodating the huge space below the seating area with these spaces help frequent use rather than dead space. The orientation of the playfield in an outdoor stadium is one of the major concern where it is necessary to consider the comfort of the players while playing the sports and protect them from the weather conditions. A major part of a stadium is the bowl (Stands) which is the seating area. Due to the huge scale and shape of the seating area, the viewpoints of the spectators differ technically and individually. The stands generally are placed at the longer side of the playfield but, when planning a stadium with a huge number of spectators the stands are planned around the playfield giving different viewpoints. This research paper gives an idea of how the seating area is planned based on the capacity, sightlines, and factors affecting the orientation of the area.

MATERIAL AND METHODOLOGY

The research paper is studied and analyzed by the reference of 'FIFA football stadium Technical recommendations and requirements 'guide, 'the Neufert Architects' Data Fourth Edition' and the reviews of the spectators regarding the stadiums. The specifications provided by the associations 'Federation International de Association' helps in the understanding of the technical aspects of the stadium, whereas the reviews regarding the stadium help understand the user experience. The study helps understand the required

orientation of the playfield for an outdoor stadium, which provides an idea for the spectator seating area, where the segregation for the VIPs, spectators, and the media is zoned. The audience preferences define the viewpoints and the most preferred seating areas. To understand and analyze the effectiveness of the various concerns seating area, no. of case studies were analyzed. Reviewing the stadiums through case studies according to the sports arena, help understand the need for an indoor or outdoor provision of a stadium. Depending on the capacity, the increased number in the tiered structure specifics the distance of the last spectator from the playfield which leads to the increase of the height of the seating area. The conclusion for the research paper is analyzed through the guidelines and reviews. The following table below explains the case studies in a comparative form based on visual analysis of the - type of field, capacity, the orientation of field and spectators, etc.

Location - Marousi, Athens, Greece.

Name of the Complex – Athens Olympic Sports Complex. All the stadiums are Olympic stadiums and are located inside the complex.

Name of the Stadium			
	Olympic Aquatic center	Olympic Stadium	Olympic Indoor sports center
Type of Field	Swimming pool	Football	Basketball
Type of Stadium	Outdoor	Outdoor (partly covered)	Indoor
Seating capacity	11,500 Spectators	69,618 Spectators	18,500 Spectators
Orientation of Playfield	20° west of north-south southeast	20° west of north-south southeast	northwest-south southeast
Orientation of Spectators	2 Tier structure – northeast - southwest	2 Tier structure around the field – northeast-southwest	3 Tier structure with 2 tier around the field and 1 tier at the longer side – northwest-southeast
First-row distance from the Playfield	Side rows – approx. 10m End row – approx. 15m	Side rows – approx. 20m End row – approx. 28m	Side rows – approx. 5-6m End row – approx. 2-3m
End row distance from the Playfield	Side rows – approx. 100m End row – approx. 70m	Side rows – approx. 150m End row – approx. 100m	Side rows – approx. 55m End row – approx. 40m
Height of the first row from Playfield	Above the Playfield – 5m	At the Playfield level	At the Playfield level

Results and Tables

● **The orientation of the playfield** – The aim is to provide the participants a beneficial environment, where the sun’s direction needs to be considered, and the natural factors such as wind direction, etc. Generally recommended in the North-South direction to minimize the effect of setting sun on the players. The following orientation is applicable for an outdoor stadium-

- I. Athletics, Basketball, Croquet, Handball, Lacrosse, Tennis, Netball – Between 20° west of north and 35° east of north.
- II. Football, Soccer, Ruby league, Ruby union – Between 20° west of north and 45° east of north.
- III. Hockey, Polo, Polocrosse - Between 45° west of north and 45° east of north.
- IV. Baseball, Cricket, Softball - Between 45° west of north and 35° east of north.

● **Roof Covering for an outdoor stadium** – When planning an outdoor stadium the roof plays an important role to protect the spectators from the natural weather conditions so that the spectators do not get distracted from the game.

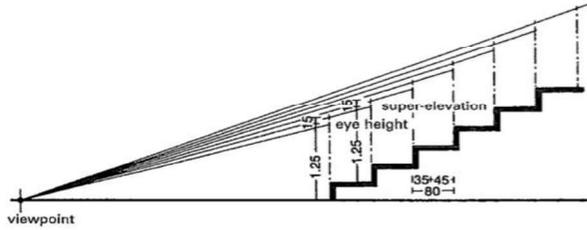
● **Distance of the spectators** (Indoor and Outdoor stadium) - When planning an indoor or outdoor stadium the distance of the spectator from the playfield is also important. Where an indoor stadium is an enclosed arena with a controlled environment and due to the roof span consideration there are no extra activities involved around the playfield which eventually leads to a closer seating area around the playfield. When planning an outdoor stadium, extra activity provision around the playfield such as Athletics, Pole vault, etc. are provided which increases the distance of the spectators, as well as height from the playfield. The optimal distance from the center of the playfield to the first row of the bowl is 90m and the maximal distance from one corner of the playfield to the end corner of the bowl is 190m.

● **Concern regarding the Seating area** (Indoor and Outdoor)– Side stands (the ones along the playfield) offer a good view of the pitch (distance is less), specifically near to the center and relatively high. The end corners of the seating area of the playfield give a difficult view to the spectators and disconnect with the event. Whereas the end stands give the struggle to get the depth perception on the pitch. They provide an atmosphere for the vociferous supporters.

● When events are held in the evening at an outdoor stadium, the west side stands provide a glare-free view.

● The height for an ideal view is the middle section at the center, neither too high nor too low. Where too low down seats won’t give a good sense of the event. And too high seats might give a bird’s eye view of the pitch.

• **Sightline** - A fixed gradient where the seating area has less number of rows has a sightline of 1:2, but when the number of spectators increases the gradient takes a parabolic curve with reference of spectator's sightline construction with superelevation of 12cm for standing places and 15cm for the



seating area. Refer the figure no. 2

Figure no. 2

CONCLUSION

An indoor or outdoor stadium gives the spectators a different environment, where an indoor stadium provides the spectator a sense of involvement in the event in comparison to an outdoor stadium where the amount and distance are more and chances of getting lost is more.

ACKNOWLEDGMENT

I strongly acknowledge Ar. Mukta Latkar-Talwalkar Ma'am for guiding and inspiring me at every stage of my Architectural journey. I am grateful for this opportunity of getting guided by Ma'am, which helped me for an appropriate approach, and how to frame the research paper was the major guidance from Ma'am.

REFERENCES

- i. https://www.ksi.is/media/mannvirki/FIFA_Football_Stadium_ms.pdf - 'FIFA football stadium Technical recommendations and requirements .'
- ii. https://www.academia.edu/27095297/Neufert_Architects_Data_Fourth_Edition_By_Wiley_Blackwell - 'the Neufert Architects' Data Fourth Edition' pdf download.
- iii. <https://showupandplaysports.com/indoor-outdoor-Interview-question-answer> - Interview question answer.

Shared Open Spaces: In The Neighbourhood of PCMC

Divyani Surendra Deokar
Student, 5th Year B. Arch.
divyanideokar@yahoo.in

Abstract: In relation to the intersection between production and productive environment, the current trend is the sharing kind. This research is to study various open spaces and how these spaces are used by various age groups to work as well as play. The study will also help to know what attributes of open space help to contribute to user experience. To study the various aspects a neighbourhood of Pimple Saudagar is selected with varied open spaces. These spaces are connected to each other in some or the other way, a detailed activity mapping of these spaces which include activities of various kinds. This study is also to focus on use, abuse and utilization of these spaces. The idea of space conjures a variety of images in the mind, some very clear and specific, others ethereal. This study aims to serve as a guide to know about the active and passive use of spaces and how tangible and intangible things help in the contribution of a space. A critical literature review was carried out for this study to know various comprehensive approaches. It will also show the interpretation of the spaces, their intended use and the use by the user. The research will open up discussions of the social networking which is getting created with different types of people in the public spaces and how these spaces help in collaborative approaches with emergence of new ideas which also help in knowledge sharing and gaining. The outcomes of the study will provide a systematic classification use for planner and policy makers in preparing open space strategies and in setting development plan policies.

Keywords: Public Open Spaces 1, Social behaviour 2, Social networking 3, Urban Environment 4, Neighbourhood 5, Sharing 6

INTRODUCTION

The 21st century is a time interval when humankind has been exposed to many changes that have changed our day-to-day life. One of the major areas to see this transformation in multiple dimensions is the new kind of open spaces. These spaces are self-directed, collaborative, flexible, and voluntary work. About the intersection between production and productive environment, the current trend is the sharing kind.

The role of design has traditionally been conceived as top-down, and occasionally bottom-up. There is a need to expand the space between these two typical modes to explore an alternative conceptual approach. The how in a conventional top-down process involves pre-planning all aspects of a project with select few actors (e.g. architect, contractor, client), whereby the end-users are seen as the “recipients” who may or

may not be consulted during the design process (a gap that space making seeks to fill). A bottom-up process is conceptually different in that it begins with individuals and community groups at a grassroots level, which incrementally solidify themselves into a larger movement that seeks to affect those planning processes at the top of the hierarchy. This interplay between top-down and bottom-up processes creates a cyclical frame and a dialectical relationship between design professionals and the social. In this sense, there is always ‘participation’ between architects and society, but when it happens is a variable that changes the impact and responsiveness of a project to its respective people and place.

The scope of the study is based on the urban environment like Pimple Saudagar, PCMC where three public gardens in the same neighbourhood are studied to lay guidelines for open spaces which are derived through various approaches and their use at various timings of the day. The study aims to have an idea about the contribution of elements in space making which leads to behavioral changes of people in that surrounding; the elements also define a pattern in their usage. These spaces nowadays are governed by activities that are not likely to happen because of the space design but the human interaction. If these spaces would have studied the evolving activities of human interaction wouldn't the spaces be designed in that way? The idea of open is not just to plant trees and create beautiful surroundings but also to look at the captive usage of the space. Space making, while having existed for several decades, has become the term du jour, for the expression of new urbanist strategies. However, it is simply the newest iteration in a line of new urbanist “processes” which harness the production of abstract space. Space making is a contradictory process that despite claiming to “make” place and have transformative properties serves to dominate and homogenize spaces through generalized rules independent of context. These generalised rules and the common perspective amongst designs and planners that behaviour and activity can be controlled through the physical environment can be linked to behaviourist ideas of space and a deeper environmental determinism.

To create such an image the designers play an important role, for them to understand the changing needs of the users and to enable the users’ participation in more numbers in these spaces.

Just as human cultures interact to constantly reproduce and co-produce hybrid cultures, the professional designer and those users and experiencers of design (at whatever scale) must interact to co-produce open spaces and places of activity. Through a critique of the practice of place-making, we highlight the need to differentiate between participation in these spaces and co-production of the same. Understanding participation as one element of the design process and the role of design at larger scales of co-productive processes can help people have a better understanding of how spaces are produced, and the role of designers in the creation of spaces of potentiality for human satisfaction.

LITERATURE REVIEW

Research paper, Comprehensive Public Open Space Categorization using Classification system for Sustainable Development of Public Open Spaces is about the Public Open Spaces (POS) in Malaysia, this paper seeks to classify public open space rather than private land. The term Open Space was used by a committee in public trial in London in 1833. To reach the maximum level of efficiency of Public Open Space, the planners and the designers need to know what kind of open space they exactly deal with. Therefore a comprehensive classification is a useful tools to assist professional, managers and all policy makers who are engaged in this regard to achieve sustainable development. Open spaces are categorized into two methods i.e. typology and classification. The classification method in classifying open spaces generally covers three approaches: i) the catchment hierarchy (who will use the open space), ii) function (the role of the open space) and iii) landscape/environmental character (what the open space looks like). The investigation in all three levels revealed that the open space classifications are mainly bases on 'catchment hierarchy' approach. In other words, there is a lack of comprehensive open space classification in Malaysia. Therefore a comprehensive classification as a framework would be a useful tool for sustainable development and management of public open spaces.

The research paper is based on an open space near the river, the verdant and well maintained Huangpu Park stands as silent witness to the various forces that have shaped Shanghai's landscape. The park was established as part of Shanghai's treaty port status from The Treaty of Nanking in 1842, yet the urban fabric surrounding it has changed from Victorian era architecture to the high rises and skyscrapers of late capitalism. Originally referred to as The Public Gardens of Shanghai, its renaming to Huangpu Park marked not only a shift in ownership and use, but a repositioning of actors and forces in China's imperial past; a rewriting of history that marks China's assertion of agency in constructing its identity as a modern nation, shrugging away a legacy of imperialism and semi-

colonialism. The British-Shanghai lander identity was defined through the exclusion of "the other", and simultaneously a place charged with the building of Chinese nationalism. Rather a country's citizen allow for an open ended future; a place that is simultaneously contemporary yet old, an idealized, nearly "democratic" space under the guise of constructing a nation of imagined, modern futures.

Urban streets and green areas are old love and affairs of cities, the story of modern cities being one of eradicating and controlling the wild life of streets and setting aside vegetated areas as parks. Historians are trying to reconstruct the complex origins of guidelines, unravelling the fascinating social and conflictual construction of the plainest technical rules. So if access to public and open space is important, the question remains: how much open space? The response, historically, has been to establish minimum standards of POS per person, in a similar way to the space standards imposed on residential buildings in order to insure reasonable living standards. However, these standards vary widely from place to place. This space allocation has to be added up to the allocation for public services (such as schools, kindergartens etc.) and the necessary streets to allow for access to buildings. The need for open space has often been claimed for different reasons. In the modernist approach of the city as a 'living machine', built and unbuilt parts are disconnected: in the unbuilt side, streets were demoted to traffic corridors, in order to support increasing mobility. Car mobility in particular has led to dematerializing streets into the notion of networks, and confined them to the realm of engineering rather than place-making. Parks have however resisted the reduction to functional machines. Most of the research has concentrated on the profound social and pedagogical implications of green areas. Only recently, parks have been reinvigorated by the international concern with public health, the environment and urban sustainability, and recently urban metabolism.

RESEARCH METHODS

The study investigates the idea of Public Open Spaces in one of the neighbourhood of PCMC in terms of its spatial organisation, materiality and use. The sites were selected in the same neighbourhood to understand the response of people visiting these sites. The sites, all three being a garden has its own characteristics and functions. One, being a linear garden space where activities are performed in a linear stretch. Second, being a garden with time restrictions where people come in on a particular timings. This garden also is on the edges of the neighbourhood where it acts as a connection between two neighbourhoods where people from various neighbourhoods interact. Third, being enclosed by the residential structures and school around it, the space acts as a part of the structures. All three sites are different in their characteristics but are part of

the same area, making them unique in their own way from varied terrains to physical built to varied activities. They all have inflow of users at various time. Their physical characteristics define each space making them different from the other. The intention behind the selection of these sites is to work out the guidelines for open spaces at neighbourhood level.

The data was collected in two formats. The first, the physical and activity aspects of public open spaces, collected through field survey. The data gives information about the quality of open space, and how intensive people used it. The second, the people's perception of public open space, collected through an interview based on a questionnaire. There were 165 respondents, which were distributed proportionally in three public open spaces. The respondents were people which were doing their activities in these spaces. The samples were selected at random from age group of 6 years and above. Their responses were recorded and analysis in the form of diagrams were made. The relationship between the open space and the public engagement is looked and commented upon. These three case studies were conducted on three different timings on the same day i.e., 7am, 2:30pm and 7pm respectively. The sites were visited once a week for one month continuously. These timings were selected on the basis of activities performed by various users of different age groups which led to contributing to the quality of these spaces. The responses were recorded during the day to know the answers at different timings for a wider overview of these spaces.

Various parameters were reviewed keeping in mind the varied age groups of the people interviewed through different parameters of these spaces like:

- **Accessibility-** The entrance and exit points in the premises
- **Movement Pattern-** To record the patterns of various age groups and to find out the concentration of various activities at different times.
- **Proximity-** The distance from the user's residence to these gardens.
- **Walkability-** The radius from where the users are intended to come
- **Safety in terms of crowding in the space/ having the eyes on the street approach-** safety of the space plays an important role in the inflow of all age groups.
- **Physical Infrastructure-** The space is made up from physical things like textures, furniture, etc. which help in building up the quality of space.
- **Level of services-** To enhance the user experience different services are required like hygiene, maintenance, sanitation, etc.

- **Elements contributing to the space-** various tangible and intangible elements contribute in space making, these elements help a user to form experiences which contribute directly or indirectly in interactive sessions between space and people.
- **Social construct (of neighbourhood)-** This parameter is dependent on the observation of these spaces, which means to get to know about the various perspectives of the user and of the bonding that is created through these interactions between the users.
- **Light and Shadows-** This parameter goes hand in hand with the safety of the place, which means users only come to these spaces because it has got some sense of territoriality to it. During the day, people find spaces under the tree or under shaded spaces in the gardens.
- **Anthropometry-** Ratio of man to the scale of the garden to the objects (tangible) kept in these spaces for space making. Anthropometry of these spaces should be such that the users do not get dominated by the space and the spaces act like a part of them, not make them feel inferior.

These parameters were studied in detail through questionnaires and interviews. Two types of interviews were recorded one with experts and other with the respondents. The interviews were semi-structured which allowed room for new information and insights to be incorporated as the interview was in run. This will allow a wide range of experiences and ideas to be shared. These types of interviews help in creating new types of questions which add on to the already structured or planned questions. The questions hinted upon the various design briefs given to the designers and the psychology of the users and how they tend to behave in various settings and how these open spaces leave an impact on the minds of the users. Also while understanding the briefs, the bylaws and the zoning of these open spaces were studied.

These three sites being in the same neighbourhood, have varied context. These responses are documented through questionnaires, photographs and interviews. Also, the data which is quantifiable is presented with the help of info graphics. Both qualitative and quantitative methods were used to review these public open spaces. Qualitative research is a strategy that usually emphasises on words, it provides insights into the problem or helps to develop ideas or hypothesis for potential quantitative research whereas, in case of Quantitative research is a strategy that seeks to understand behaviour by using mathematical and statistical modelling, measurement and research. Quantitative method is much more structured than qualitative method where research is interpretative. These findings are viewed through a critical lens with respect to its

impact on the people as well as the open space and its tangible and intangible objects.

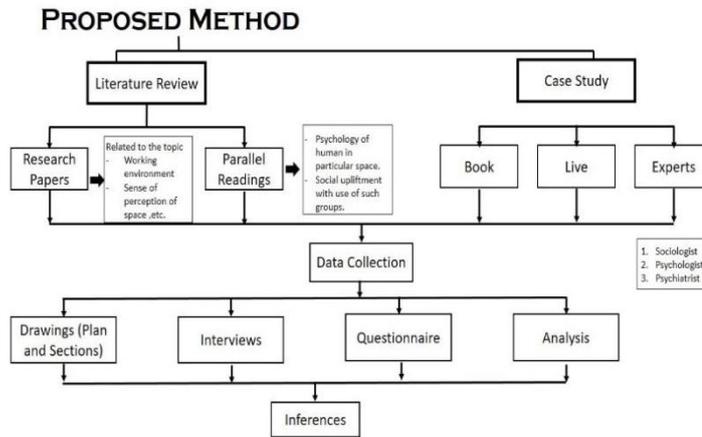


Figure 1: Diagram of methodology

ANALYSIS & RESULTS

The analysis was based on the qualitative and quantitative research methodologies. The three case studies were reviewed critically by various means and the responses were calculated and analysed. The first example looked upon here is the Linear garden, PCMC. As the name suggests this garden is setup linearly along the road. This space has various types of users during the time of the day from hawkers coming to take some rest in the shade to children coming to play after their school gets over to the senior citizens who come in the morning to walk. The second example is the Savitribai Phule Garden, PCMC has time restrictions during the day but has visitors coming in. This garden is mostly visited by the users on weekends with their children, it has a varied terrain from the other two gardens. It has been elevated from the level of the road. The last example is of the Shree Sambhaji Maharaj Garden, PCMC which is surrounded by residential buildings on four sides. This garden is usually used by the residents nearby where users come together to reside lessons from Bhagvad Gita or to walk/jog or to play with their children or to complete their assignments after the school. This garden also has school in the surrounding because of this the garden has maximum number of users in the afternoon.



Figure 2: Plan of the neighbourhood: A) Linear Garden B) Savitribai Phule Garden C) Shree Sambhaji Maharaj Garden



Figure 3: Pictures of Gardens: Shree Sambhaji Maharaj Garden, Dhyanjyoti Savtribai Phule garden and Linear Garden respectively.



Figure 4: Plans Showing Age Group-wise footprints

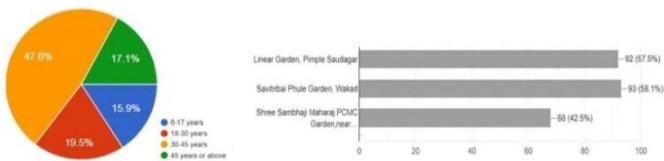


Figure 5: Pie-Charts for Age group and Bar graph showing percentage of people visiting these gardens

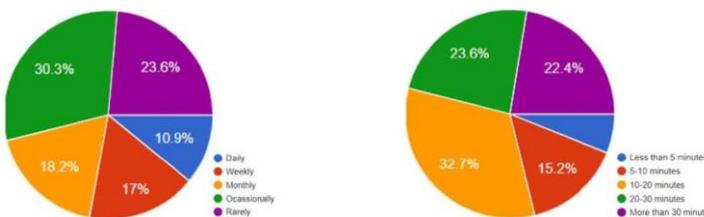


Figure 6: Pie-Charts for Use and the Distance required to travel

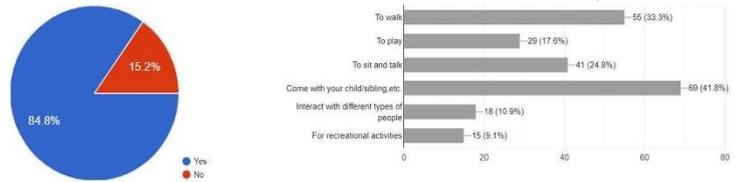


Figure 7: Pie-Charts for liking of Periodic Installations and Bar graph for the Purpose to visit the gardens

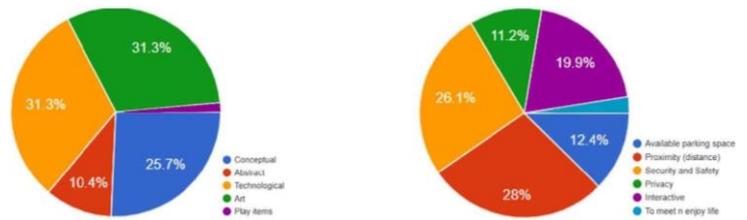


Figure 8: Pie-Charts for Types of Periodic Installation liked and Reasons to visit these spaces

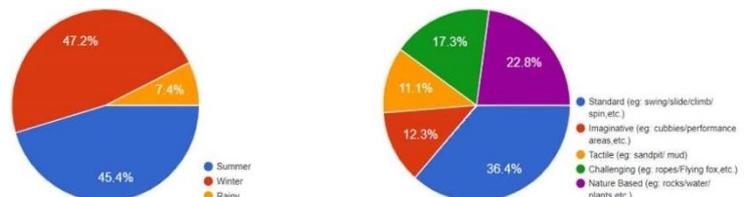


Figure 9: Pie-Charts for Preference of Seasons and Type of play experience

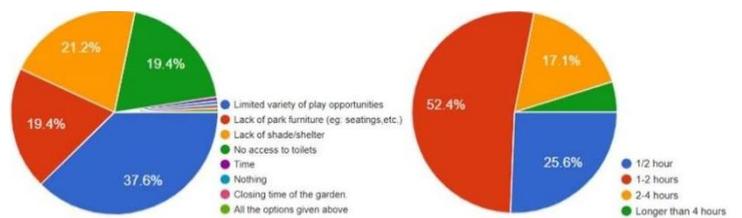


Figure 10: Pie-Charts for Factors limiting the stay at the garden and the Time spent in these gardens

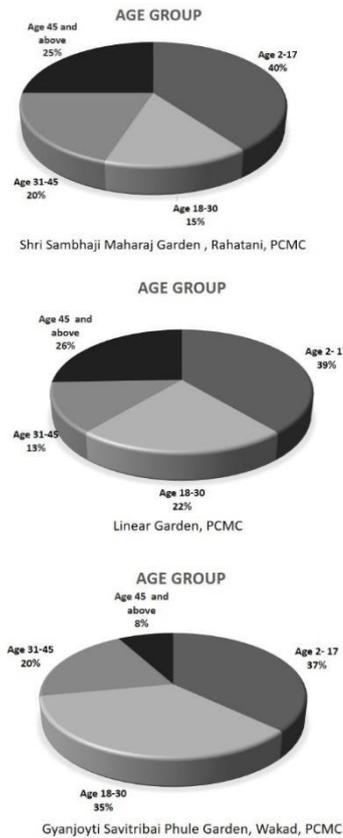


Figure 11: Pie-Charts for the percentage showing the age group

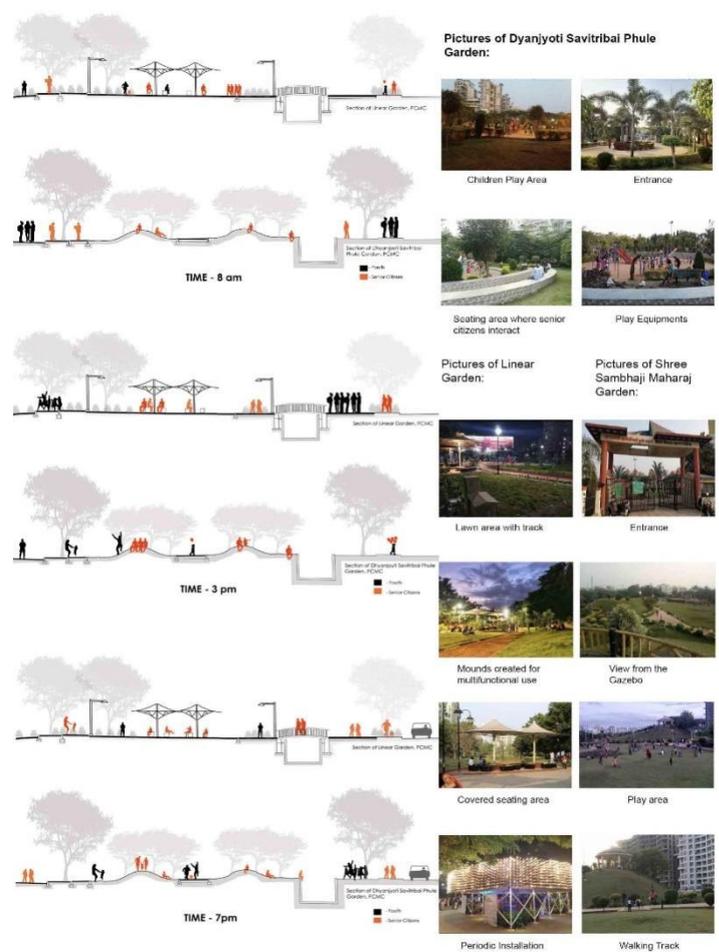


Figure 12: Showing sections at different timings along with the pictures of the gardens

The Public Open Spaces are important for health and well-being, as well as the environmental functioning of the city, but it seems that when they are mandated, they are actually over-supplied, little used, and become a burden on the community's resources. The reason for the conundrum, is that we have become oblivious to the major resource of open spaces in the city. Even in modern planned cities, streets constitute the largest extent of public space. They are necessary, because they provide access to private property. We know that they are the place where most encounters occur in public space. But in order for encounters to happen, there has to be co-presence and awareness of each other in public space. . These spaces when added on with the gardens tend to form pause points in the neighbourhood which help in recreational activities and interaction between the users. These pause points act as a medium to forming a community where people come to celebrate, interact, complain and rejuvenate.

CONCLUSION

As society is becoming gradually urbanized, environmental quality is degrading. Hence the development of open space in

our rapid growing cities is one of ultimate solution to maintain or increase the quality of life. The examples taken of public gardens in one of the neighbourhood of PCMC throws light on the designing of various types of open spaces. After conducting the research it was found out that the people behave differently in linear and enclosed spaces.

Linear gardens should have multiple entry and exit points to allow access to the people along the stretch whereas in the enclosed gardens single entry and exit points is sufficient. According to the study of behaviour patterns in both the spaces it has been seen that people in liner garden tend to have the movement patterns along the stretch whereas in case of enclosed spaces the patterns can be random according to one's activity. While deciding the place or position of public gardens it is important to decide upon the users that are going to participate. The most important aspect to cater to is the proximity of the garden from their houses. If the garden is created for the neighbourhood, people from the radius of 2km or less tend to use the space more so their needs should be given priority.

Linear gardens are placed mostly adjacent to the road stretch where chain link fencings are to use to facilitate visual connection but also to provide safety for the children playing inside, whereas in case of enclosed gardens compound walls are constructed which block the view of the outsider. To improve the social construct in the neighbourhood more of the interactive garden furniture should be introduced which will help facilitate discussions and interactions at the neighbourhood level as through study it has been observed that users tend to interact more while taking their children to play. Through the study, it has also been observed that the lack of hygiene and sanitation restricts people from staying at these spaces. So, the introduction of toilets, drinking water, wash basins, etc. should be introduced for the increased stay of the user. The scale of the furniture or the equipment used should always be with reference to the scale of the human, for them to be usable and also not dominate the space. These guidelines can be adopted for future as well as the introduction of the new types of play experiences can further strengthen the idea of Public Gardens.

ACKNOWLEDGEMENT

I would like to take this opportunity to express my deepest gratitude towards Ar. Narendra Denge for giving me valuable inputs in the R.I.A jury conducted in V.I.T.'s Padmabhushan Dr. Vasantdada Patil College of Architecture, Pune. I would also like to thank Chandrakant Nakhate, the Corporator for helping me with all the permissions required and for providing me with the drawings. I would also like to thank the Director Ar. Prof. Prasanna Desai and Mr. Jitendra Pitaliya

for making us available purchased online library sources. Last but not the least I would like to thank the librarian of in V.I.T.'s Padmabhushan Dr. Vasantdada Patil College of Architecture, Pune.

REFERENCES

- i. A, M. (1993). *Transactions of the Institute of British Geographers*. 4(18), 516-531.
- ii. Agamben. (2007). *The coming community*. Minneapolis.
- iii. Ali, M. T. (n.d.). *Multi-dimensional Assessment Method of Open Spaces in New Communities/ Low- Middle Income Housing*. *Proceedings of Science and Technology*.
- iv. Ashkan Nochain, O. M. (2015, December). *A Comprehensive Public Open Space Categorization using classification system for Sustainable Development of Public Open Spaces*. *Alam Cipta*, 8(1), 29-40.
- v. B., A. D. (2002). *The Globalizing Learning Economy*. Oxford: Oxford University Press.
- vi. Curaoğlu, F. a. (2016). *As a future working place: coworking places*. Nottingham Trent University, 66-74. Retrieved from http://www.cumulusnottingham2016.org/wcontent/uploads/2015/08/OS919_Cumulus_publication_Final_260117.pdf
- vii. D., H. (2012). *Rebel cities: From the right to the city to the urban revolution*. London: London: Verso.
- viii. Demirbaş, F. C. (2017). *From Co-Working Places to New Education Places*. *The Design Journal*, S4765-S4767.
- ix. H, H. (2013). *Space as receptor, instrument or stage: Notes on the interaction between spatial and social constellations*. *International Planning Studies*, 3 and 4(18), 342-357.
- x. H, L. (1991). *The production of space*. Oxford, UK: Blackwell.

Traditional And Modern Architecture: Replacement or Co-Existence!

Drishti Nahar

Prof. Vaishali Anagal

drishtinahar.bnca@gmail.com

Abstract: *Should modern architecture replace the traditional counterpart OR can the two co-exist?*

Traditional means encompasses use of material and resources that are available locally which has an economical advantage. It further involves commitment to local people, culture and tradition. The structures are constructed to withstand weather conditions.

With the influence of the western culture modern architecture gained popularity in the late 19th century. The structure were so built that were internationally acceptable which led to the reduction in the traditional means. Modernization led to demand of an increase in the level of comfort. This research paper attempts to compare modern architecture with traditional architecture in terms of efficiency of time, energy, cost, space saving, functionally and minimalism.

This study would involve considering a structure built in both traditional and modern ways. A case study method is adopted for analysis purpose.

Keywords: Efficiency, Aesthetics, Counterpart, Replace, Co-exist

I. INTRODUCTION

What is traditional? What is modern? What is traditional architecture? What is modern architecture?

Definition of traditional is something that is keeping with long-standing tradition style or custom. Traditional architecture is that way of building which makes serious use of the familiar symbolic forms of a particular culture of particular people.

Modern means contemporary or relating to the present time. Modern architecture, an architectural style based upon new and innovative technologies of construction. Method of case study is undertaken to debate on the replacement or co-existence of traditional and modern architecture. Comparative analysis of existing Dhepewada and Vishrambaug Wada, the residential form of Maratha Architecture.

Comparative analysis of existing old Goan bungalows with hypothetical modern counterparts was also done.

Traditional architecture is important because it maintains our link to the past. It is this link to the past that keeps us latched to the traditional buildings and styles that can be incorporated into other building designs. By rejecting ornament and embracing minimalism, Modernism became the single most important new style or philosophy of architecture and design of the 20th century. The style became characterised by

an emphasis on volume, asymmetrical compositions, and minimal ornamentation.

Wadas are a rich and cherished architectural heritage in Maharashtra, reflecting the pride, religion, culture, traditions and the turbulent history of Marathas. The traditional residence 'WADA' included houses of several families or only one family who stayed there. It is generally used to denote courtyard house mansion. This house form belonged to ruling classes as well as commoners. This typology is very significant in terms of historical, cultural and economic aspects.

On the other hand, Goan traditional architecture had a language of its own, intricate, beautiful and very artistic characteristic. The chief building materials involved in a typical Goan house were all very local and indigenous. Laterite and stone were widely used along with wood, metal and tiles of different patterns and varied styles.

II. METHODOLOGY

A literature study was done, to understand the traditional and modern architecture. It covered the traditional and modern techniques and scope for the upcoming materials and technologies. The case study carried out in the research would help analyse the traditional and modern structures in various aspects i.e, efficiency of time, efficiency of labour, energy, cost, space saving, functionality and minimalism.

CASE STUDY OF THE WADAS

Dhepewada was built in 2015, designed by architect Awinash Sowani. After his own study and inspiration, the Architect had designed an approximate built-up of 8000 sq.ft. On a plot of about 2 acres. Dhepewada is designed around a single courtyard. Around it was planned a pooja room, kitchen and six bedrooms on the ground floor. The first floor has two halls and 6 rooms. Chowk planning, orientation, spatial configuration and spatial grid is designed similar to traditional wadas. Instead of wooden columns RCC columns are used. Though RCC columns can be placed at a greater distance but to reflect the traditional one they are placed same as the wooden columns. The newly designed wada has toilets attached to the room unlike the traditional one. Getting minimalistic with the contemporary the façade design is kept simple. Decorative columns on the plinth structure are avoided. Full height windows are used to maximize light and ventilation in the new

design. Like the traditional one, the staircases are placed between the walls but are updated with light and contemporary design.

CASE STUDY OF THE GOAN BUNGALOWS

The traditional Goan houses were designed and built during the 16th and 17th century by the Portuguese Era. The traditional houses open into the courtyard and it can be updated with lawn and mature plants. Ornamental columns with a higher plinth could be replaced by RCC columns with cladding and smaller plinth heights. Modern material like frameless glass railing, metal pipe railing fine wood work could be used instead of railing with intricate embellishments. Symmetrical planning kept similar to achieve the efficient planning. Updating with the current material lime wash or concrete plastering can be done which is suitable for painting and cladding unlike the burnt earth plaster. Concrete walls and brick walls are anytime recommended over the mud walls because of its durability and other advantages. Bright and subtle colours enhance the interiors more than paler colours.

III.RESULTS AND TABLES

After studying both the case studies, there are few similar elements that highlight the importance of the traditional period. The traditional architectural feature of the threshold signifies the transition of space from public to private, outside to inside, external to internal and open to enclose. The external space acts as an transitional spaces that encourages communication for the residents and the passers-by. The most significant feature of both the case studies ‘The courtyard’ is the most prominent feature of the traditional architecture connects inside and outside , ground floor and first floor and all the rooms facing the courtyard thus offering light and ventilation .

GOAN BUNGALOW

TRADITIONAL	MODERN	REASONING
Houses opening into courtyard	Courtyard in external and internal with lawn and mature plants	Enhances and creates a pleasant atmosphere
Ornamental columns	RCC columns with cladding	Better efficiency in terms of cost , material and construction
Higher plinth height	Smaller plinth height	Material as much as required
Large ornamental windows	Clear glass window with precise framing	Less labour work , less installation

		time ,easy maintenance ,
Railings with intricate embellishments	Frameless glass railing , metal pipe railings , fine wood work etc	Easy installation , better appearance , cheaper , no skilled labour required
Symmetrical planning	Symmetrical planning	Allows better planning
Burnt earth plaster over cow dung and hay or patterns made with tiles	Lime wash or concrete plaster both suitable for paint and cladding	Materials easily available and can be maintained easily
Country tile as corbel	Wooden , brick corbelling	Better options
Mud walls	Concrete , brick wall	Efficiency in construction , maintenance and labour
Wooden false ceiling	Mirror tiles , wall overhang , pop ceiling ,	Availability of materials , better appearance
Paler colours with solid highlight	Bright and subtle colours	Enhances the interior mood

WADAS

TRADITIONAL	MODERN	REASONING
Wooden columns	RCC columns	Better efficiency in terms of cost , material and construction
Toilets in the rear side of the house	Attached toilet to each room	Better functionality
Ornamental façade with classic wooden balcony projecting	Simple façade design	Minimalistic , less skilled labour required
Entrance in seven bays	Entrance in two bays	Keeping it minimal
Window narrow and tall	Full height window	Ensuring maximum light and ventilation
Staircase usually dark and sandwiched between walls	Staircase placed between walls but updated with light and contemporary design	Enhancing the staircase and improving the functionality

IV.CONCLUSION

But the real solution to all the confusion is choosing the middle path. Yes, both traditional architecture and modern architecture can blended together to give a unique expression to your structure. Modern architecture could co-exist with the traditional style when the proportion is thoughtfully worked out to get the best of both design worlds. This makes it change with time.

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my guide Prof. Vaishali Anagal for their able guidance and support in completing my paper.

I would also like to extend my gratitude to the principal Dr. Anurag kashyp Sir for this opportunity.

REFERENCES

- i.*Diploma Project : Houses of Goa by Latika Nehra (Graphic design , 2014 , NID)*
- ii.*Traditional Approach towards Contemporary design : A case study (International Journal of engineering Research and Applications)*
- iii.*Architecture of Goan Catholics*

Re-Tailoring The Podium And Tower Form For High-Density Mixed- Use Development In Mumbai

Farida Fidvi, Dr. Mukund Athavale

Sir JJ College of Architecture

Email: faridafidvi9@gmail.com

Abstract: By 2030 it is estimated that over 55% of the Asian population will be urban (World Urbanization Prospects, 2018). With more than half of the world's population living in cities, the land has become a rare commodity, resulting in a shift from horizontal to vertical neighbourhoods. In "The Image of the City", Kevin Lynch differentiates between observing the city and being an active participant. Today buildings and their skylines collectively allow us to view the city as an object but not as an active inhabitant. This research focuses on how the building meets the ground – podium, how can it be re-tailored to make the design physically rooted in the surroundings making us an active participant rather than faced by rudimentary blocks.

Keywords: population rise, high rise, spatial typology, podium plus tower, social sustainability, urban fabric

INTRODUCTION

In 1950, only 17% of the population in Asia lived in urban areas but by 2030 it is estimated that over 55% of the Asian population will be urban. With more than half of the world's population now living in cities, the land has become a scarce commodity clubbed with the population rise, building tall is the only way to build at all.

Historically the first skyscrapers were not banks or corporate headquarters; rather, they were cathedrals, temples, or public monuments which brought the community together. Today high-rises often establish themselves as monoliths that do not interact with the neighbourhood –they build-up to the plot lines, incorporate podiums, and generally interrupt the flow of the streetscape - closing it in on itself. The rapid densification of cities seems in many cases to be progressing without regard to already established urban theories regarding the design of successful cities. In "The Death and Life of Great American Cities" (1963) Jane Jacobs addressed the design of the pedestrian precinct in the city and Hans Blumenfeld also wrote on the need for the modern city to connect to the historic fabric in "The Modern Metropolis" (1971). Significantly, these urban theories were emerging during the

post-World War II period as cities were rapidly expanding and densifying through the construction of towers. All authors suggested design guidelines for less dense city zones but when designing the base of a high rise these theories can be extended to establish the importance of the design of city streets and the role of architecture in facilitating a highly energized and active street life. These authors recognized that the most important zone of interaction with buildings in the city lay in the 6m/18ft high base immediately adjacent to the sidewalk which ultimately determines the character of the urban ground environment. Hence for the survival of lively cities and their unique grounded identities, architects, policy designers and developers must adopt a strategic design plan to make our high rises more connected to the urban fabric.

Therefore, the research focuses on the study of the spatial typology of how the building meets the ground and to explore the strategies to retailor the three-dimensional form to achieve the integration of the high rise in the urban fabric.

BACKGROUND STUDY

Podium + Tower - the prevalent spatial typology for mixed-used high-rise development in Mumbai

Background research was conducted by collecting data from the MHARERA website – all registered projects since 2013. A total of 737 projects were registered till November 2020, in Mumbai City. When segregated it was observed that there are 148 mixed-used and 589 single-use buildings projects. Out of which a total of 118 are high rise and the other 29 are low rise building projects*. Given below is the graphical representation of the inference of the spatial typology of these 118 buildings evaluated for the number of podiums and stilts (Source: The in "The Modern Metropolis" (1971). Significantly, these urban theories were emerging during the post-World War II period as cities were rapidly expanding and densifying through the construction of towers. All authors suggested design guidelines for less dense city zones but when designing the base of a high rise these theories can be extended to establish the importance of the design of city

streets and the role of architecture in facilitating a highly energized and active street life. These authors recognized that the most important zone of interaction with buildings in the city lay in the 6m/18ft high base immediately adjacent to the sidewalk which ultimately determines the character of the urban ground environment. Hence for the survival of lively cities and their unique grounded identities, architects, policy designers and developers must adopt a strategic design plan to make our high rises more connected to the urban fabric.

Therefore, the research focuses on the study of the spatial typology of how the building meets the ground and to explore the strategies to retailor the three-dimensional form to achieve the integration of the high rise in the urban fabric.

BACKGROUND STUDY

Podium + Tower - the prevalent spatial typology for mixed-used high-rise development in Mumbai

Background research was conducted by collecting data from the MHARERA website – all registered projects since 2013. A total of 737 projects were registered till November 2020, in Mumbai City. When segregated it was observed that there are 148 mixed-used and 589 single-use buildings projects. Out of which a total of 118 are high rise and the other 29 are low rise building projects*. Given below is the graphical representation of the inference of the spatial typology of these 118 buildings evaluated for the number of podiums and stilts (Source: The application form submitted by developers to MHARERA)

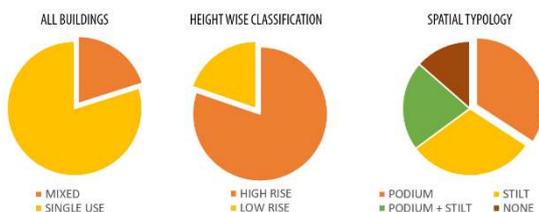


Figure 1: Pie chart showing mixed-use high rise spatial typology distribution since 2013 (Source: Author)

Public and private development proposals for large sites across Mumbai continue to arrive at architects' doorsteps with three essential components: high-density, high rise, and lots of parking. As seen above the most common response – giant podiums with shapely towers, habitually ignore existing context and have mostly failed to offer compelling new paradigms of urbanism. Conceived with a conviction that the central issues of this sort of large-scale development include [relative] scale, connectivity, typology, and the relationship between open space and building fabric [on its own or with

pre-existing fabric], the objective aims to find out the problems of this typology.

Origin of the podium form and the vision behind its development

A part of the strategy to accommodate better liveability standards the government has mandated a 20% recreational ground (RG) open space for high-density development in Mumbai to pay more attention to public spaces and amenities. This is to provide a new concept of relaxing spaces, community-sharing facilities, convenient amenities and cultural functions. Accommodating this area and parking is predominantly done by providing a block podium. It is to provide additional space to accommodate some activities that would otherwise have to be accommodated on the ground level [economically most valuable].

What they have become today

As seen in Figure 2 the application and design of the podium structure seem to be conducted solely based on its rudimentary form with the assumption that the form itself provides the function. One of the basic assumptions is that separating the circulation pattern between the pedestrian and the automobile by a podium, the pedestrian automatically uses the podium to access the building while the automobile circulation confined to the space below the podium. Furthermore, since there is no systematic design guideline, the physical entity of a podium structure can play a negative role



in creating an island without a proper connection with the adjacent urban fabric harming the social sustainability parameters of design. This approach boosts the disintegration and segregation of the community.

Figure 2: Types of podium and tower spatial typology (Source: Author)

Importance of a well-designed podium

The discussion ahead presents a statistical base; an economic one for an appropriate podium design in the context of the urban fabric. A development consultant in the Asian market recently quoted an impressive statistic that underscores the importance of retail in numbers: a successful retail podium can generate eight times more value per square foot for the developer when compared with the office tower associated with the same development (Yager & President,

2015)[vii]. Certainly commercial office space is a valuable revenue generator in its own right; but retail, when successful, leverages the combination of quality, vibrancy, and return on investment that enables the entire development to become iconic—not just the tower.

Formulation of research

The above background study of podium and tower typology for a mixed-used development led to the formulation of this research of first evaluating the problems in this typology either faced by the end-user or the urban fabric and retailoring the three-dimensional form, for mixed-used high-density development in Mumbai.

METHODOLOGY AND MATERIALS

Aim

To critically appraise the podium and tower spatial typology for mixed-used development in Mumbai and to resolve the issues by proposing a re-tailored form for such high-rise high-density development.

Research questions

The broad umbrella question is how can the podium plus tower be re-tailored for mixed-used high rise development in Mumbai, this question which the research aims to address has the following sub-questions-

1. Critically analysing the spatial typology based on how the building meets the ground.
2. How can the above-inferred problems be solved through design leading to re-tailoring of the form?

Research methodology

The research involves coming to an answer to each research questions by fulfilling the objectives with each of them having individual research methods and taking the inference of the first objective as the starting point of the second objective. This has been illustrated in the diagram below.

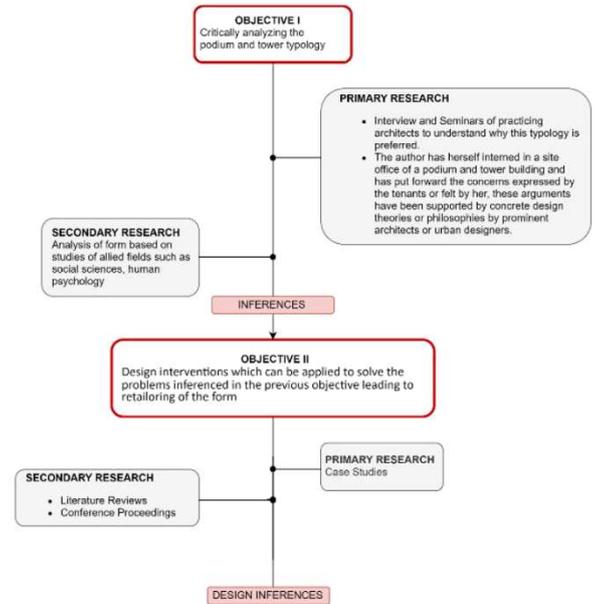


Figure 3: Research Methodology (Source: Author)

OBJECTIVE I: The critical analysis of the podium and typology

The advantage of the podium form

The podium is a widely accepted and implemented form, questions posed during a seminar by Architect Vilas Avachat (*architect of Colorise, the tallest building in Dadar, Mumbai which is also a podium plus tower building*) the main reason for adopting this typology is due to the compulsion made by the government according to DCPR 2034 of providing 20% recreation ground, which the developers don't find it economical to give on the ground floor because of the high land price on the ground, so a podium is provided to house this area at an upper level as such a provision is allowed according to the regulations, which also helps the developers to market their building as a building with a better living standard.

The drawbacks of this solid block form for urban redevelopment

1. Focus on superficial iconography of the building

Tall buildings are fully accepted today, their construction in place of lower-density development has become the status quo. One reason for this is that tall buildings are resoundingly appreciated and celebrated for their ability to address issues of identity and iconography in cities. Yet the original critique about tall buildings was never aimed at their iconic potential; rather it was squarely focused on their perceived inability to contribute to the social well-being of the city (Gang, 2016)[iv]. There is a misconception that an exciting skyline equates to a

vibrant city. While skylines might be important indicators of the character and identity of a city, they do take the focus away from the more important detailing of the engagement of dense buildings with the streetscape - the design of the base condition which makes a city lively(Boake, 2015)(Boake, 2015)[ii].

2. Creation of dead facades

The podium level parking or stilted parking creates dead spaces which negatively impact the urban fabric of the area. This also leads to an increase in crimes which is generally more associated with high rise than in low rise residential apartments.

3. Podiums are not human scale

Podiums are so tall that they make no visual sense to a pedestrian at eye-level. One can't even see the whole building unless one is in another high-rise.

4. Lack of porosity

Mumbai Island city doesn't have tabula rasa development, the lively streets which are present before the redevelopment get replaced with a rectangular box that is focused either only inwards or only outwards. This results in the lack of porosity of the urban fabric.

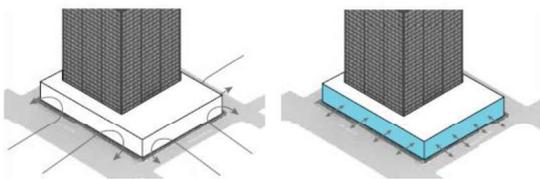


Figure 4: Podiums are designed either introverted(left) or extroverted(right) Source: (Katz, 2019)[v]

5. Lack of physical and visual connection to the upper floors

The second and third retail floors are cut off from the ground - plane with internal mall-type circulation which decreases the number of on-foot customers to a large extent as well as loses the ground floor pedestrian inflow. The landscaping at the podiums isn't a public open space, because of the height of the podiums these spaces aren't even visible to a person at the street level.

6. Lack of public realm

The podium is generally aligned to property boundaries, the glazing line on the street, all the activities of the public realm crammed into the 9-12 meters between the buildings. This zone is jam-packed with services, transport vehicles,

pedestrians, awnings, and signage, limiting options for generous planting and water-sensitive urban design.

7. A decrease in porous ground surfaces

The rainfall compared to tropical climates is spread relatively evenly throughout the year, making water-sensitive urban design a highly practical strategy for making green spaces. Lining podiums up along the street edge limits the space for dealing with urban water meaning water sensitive urban design opportunities are also limited.

8. Lack of airflow at the street level

Towers without protruding podiums can introduce more airflow from above down to the pedestrian area, and recessed entrances and portico façades can be ventilation friendly features for pedestrians.

OBJECTIVE II: Re-tailoring of the form to solve the issues reasoned in the last objective

PRIMARY RESEARCH

CASE STUDIES

In **Sky Park, Hong Kong** designed by Palmer & Turner the retailing of the podium is done by echoing the human scale of the culturally rich neighbourhood shopping streets. The concept of the mall was to subvert the centralization of retail space to create an internal street, thereby increasing frontage for ground floor shops as well as pockets of space for plantings. For the urban fabric to continue interior streets with a central plaza has been created, bridging the gap between indoor and outdoor, providing a human-scale environment. The street-level is brought to the upper floors with a grand staircase in front of the plaza providing a strong visual and direct connection.

In the **Island of Borneo, China** which has a similar climate to Mumbai one of the design criteria made as a regulation added to the building code proposed by Tom Ford(Ford et al., 2015)[iii] is of an arcade. The proposed strategy addresses the rain and direct sun which negatively impact an unprotected public realm to a greater degree as well as providing a human scale development at the base. The Master Plan put in place by Tom Ford made building arcades mandatory for all new construction in the CBD. This design feature illustrates the steps that according to the urban designer Broadway Malyan, Singapore makes an effective public realm as stated in the conference proceedings of CTBUH(Baker et al., 2016) [i] which are respecting the context – new vs old, programmed public realm – create reasons to enjoy, easy pedestrian access, creating a safe environment, designing to the local climate,

keeping in mind the human scale, with a visual appeal in public spaces and quality design focused on placemaking and legibility – ensuring that the place created is unique and relevant.

In **Mission Rock, San Francisco** designed by Studio Gang with the intent was to reinterpret the typical tower podium, the building's base is carved with steps leading up to a plateau with sunny planted terraces and raked seating. The terraces offer views of the activity in the main public square below. At ground level, shops and cafés contribute to the neighbourhood's liveliness. The stepped facade brings a human scale to the tower, accommodating a variety of public and private terraces.

In **HFZ, New York** designed by BIG Architects the podium has been broken down by creating plazas and through and through block links with upper-level street connections for offices in the podium, the building form has been designed using solar carving, bringing the light to the base and the neighbourhood context has been used while designing the overall form and elevation to contextualize the building to its surrounding.

SECONDARY RESEARCH

LITERATURE REVIEWS

In **“Beyond the Podium: Urban Spaces for Tall Buildings in a Subtropical City”** (Stalker, 2015)[vi] the Author Caroline Stalker, Director, Architectus who works in Brisbane strongly recommends that though Brisbane City Council's City Centre Master Plan 2014 seeks to embed the idea of a subtropical experience in the tall buildings; with the tagline” Buildings that breathe” which is essentially a tower and podium form is not the correct solution for such a climate. The author has evolved prototypes to solve these problems by learning from the climate-adaptive vernacular “Queenslander”. The four adapted typologies are as follows, a stepped podium that acts as a grand staircase to the upper floors to avoid lower stories of development dominated by parking dead facades commercially and design-wise. An urban undercroft that is stilted offering deep shade, breezes to flow through, activated with retail pods. A subtropical loggia creating an arrival space to the building and levels for retail and recreation activity. An urban mesh -which is the use of plazas and lanes which are mutually shaded by the building mass. In conclusion, using the principles of urban safety, activation, and street unity by integrating landscape and urban design rather than less flexible glazing lining the street approach.

In **“It's Not About the Skyline, It's About the Base Condition”** (Boake, 2015)[ii] the author Terri Boake, suggests the following strategies to keep in mind while designing the base i) Porosity and a fine-grained commercial fabric, ii) Static sculptures combined with seating iii) Increasing the distance between the elevator core and sidewalk to create an incentive for occupants to return to the street for shopping and dining iv) Provision and connectivity of public space at small, medium and large scale.

In **“Tall Buildings as Urban Habitats”**(Zhou et al., 2019)[ix], the authors give a quantitative understanding of the type of preferred pattern of lower public spaces in Singapore, a similar high-density scenario like Mumbai, by using stated preference and analytical hierarchy process enabling a systematic and objective evaluation of the social impact of lower public spaces by 12 experts specialized in urban design and public building fields. The following is the hierarchal distribution from the most to the least important qualities of lower public spaces and then within them the most preferred options. 1) **Spatial typology** being the most important with the preferred type being in the order of Streets covered, Plaza covered and sunken plaza. Followed by 2) **Street element** with the preferred type of evergreen trees, bushes and chair and sculptures 3) **GL function** should be retail shops followed by 4) **Spatial Connection** with preferred types as passing through, then escalator, ramps and visual connection and stairs with the most non preferred being elevators followed by 4) **Building elements at the street level being** shops then walls high transparency 5) **Building elements at upper levels** have the lowest influence on the character of the lower public space.

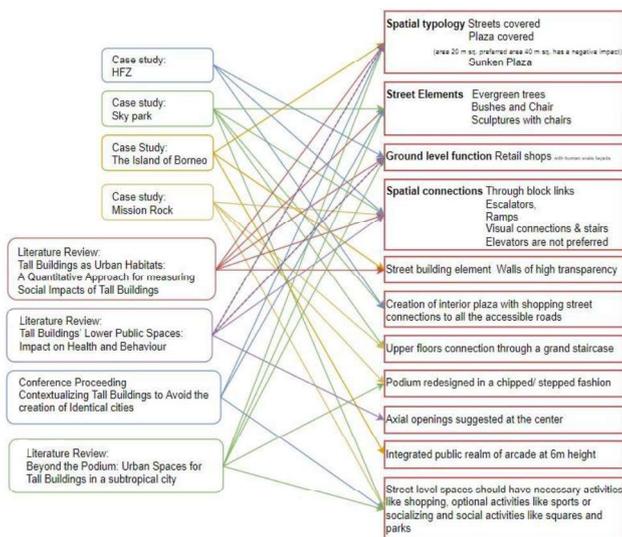
In **“Tall Buildings' Lower Public Spaces: Impact on Health and Behaviour”**(Yu Ye, PhD, Assistant Professor et al., 2020)[viii], the same authors elaborate on the previous research using virtual reality to understand how can a podium be better designed according to human perspective and urban designer perspective and marks were given. The hierarchal preference when viewpoints were on the street: trees along the streets, through block links, arcades at 6m height, sculptures with chairs, plazas of 20 m sq. same as ground floor function of shops, plazas of 3.6 m as street buffers. Parking and plazas of 40 meters square had negative utilities in the model. The hierarchal preference when viewpoints are on the podium were: greenery for the spatial environment, chairs on rooftops, ramps connecting to higher public spaces, public spaces that have a horizontal connection lower than a podium rooftop were rated higher (height of 10m from the street). The connections that provide places to stay (stairs, ramps,

escalators) were preferred to direct transportation (elevators). The opening suggested in the spatial typology is in the middle.

In the conference Proceeding of “Contextualizing Tall Buildings to Avoid the Creation of Identical Cities”(Baker et al., 2016)[i], the authors infer from the book “Life between Buildings” by John Gehl how to bring identity and uniqueness be the ground level. They recommend three types of activities that public spaces need to cater for: necessary Activities, which are things that everyone has to do all year round, for e.g., attending work or shopping; optional activities, which only take place under favourable conditions and in quality spaces, for e.g., sports or socializing and social activities, which depend on gatherings in communal spaces, for e.g., squares and parks.

CUMULATIVE DESIGN INFERENCES FOR RETAILORING OF SPATIAL TYPOLOGY

The following diagram illustrates all the cumulative design



inferences from the research for retailoring the podium.

Figure 5: Cumulative inferences for re-tailoring of this spatial typology, Source:(Author)

CONCLUSION

Reaching for the sky is one of the simplest and purest of human instincts. Tall buildings answer that desire in so many ways—symbolically, socially, and economically. However, beyond what a city gains from the tall building, there must remain an ability for it to function as an urban habitat. The above cumulative inferences podium redesigning is a step forward in that direction as tallness is superficial unless it is literally and physically rooted in the dynamics of context and culture.

ACKNOWLEDGEMENT

To my research guide Professor Dr Mukund Athavale, I would like to extend my sincere thanks for aiding my vision and providing a framework for the formulation of this research. I conjointly would like to sincerely thank Professor Arun Joglekar, Professor Rekha Nair and Professor Rajesh Rokade for their guidance in the past years. I would also like to express gratitude to my family for their strong support. I am extending my deep gratitude to Sir J.J College of Architecture for giving me an opportunity for growth in various paradigms during the past five years of my architectural education.

REFERENCES

- i. Baker, E., Malyan, B., & Suksmaningsih, M. (2016). *Contextualizing Tall Buildings to Avoid the Creation of Identical Cities*. <http://global.ctbuh.org/resources/papers/download/2881-contextualizing-tall-buildings-to-avoid-the-creation-of-identical-cities.pdf>
- ii. Boake, T. M. (2015). It ' s Not About the Skyline , It ' s About the Base Condition. *CTBUH 2015 New York Conference*, 494–501. <https://global.ctbuh.org/resources/papers/download/2503-its-not-about-the-skyline-its-about-the-base-condition.pdf>
- iii. Ford, T., Design, U., Gilchrist, R., Tall, F., Practice, B., Leader, A., Issues, S., Design, U., Compliance, C., Space, P., Design, U., & Gilchrist, R. (2015). *Base Instincts*. <https://global.ctbuh.org/resources/papers/download/2465-base-instincts.pdf>
- iv. Gang, J. (2016). Three Points of the Residential High-Rise: Designing for Social Connectivity. *International Journal of High-Rise Buildings*, 5(2), 117–125. <https://doi.org/10.21022/ijhrb.2016.5.2.117>
- v. Katz, S. (2019). Bringing an Icon into the Future: Willis Tower. *50 Forward 50 Back: The Recent History and Essential Future of Sustainable Cities - Proceedings of the CTBUH 10th World Congress*, 72–78. <https://global.ctbuh.org/resources/papers/download/4258-bringing-an-icon-into-the-future-willis-tower.pdf>
- vi. Stalker, C. (2015). *Beyond the Podium: Urban Spaces for Tall Buildings in a Subtropical City*. <https://global.ctbuh.org/resources/papers/download/2433-beyond-the-podium-urban-spaces-for-tall-buildings-in-a-subtropical-city.pdf>
- vii. Yager, G., & President, S. V. (2015). *High-Density , Mixed-Use Developments and the Guiyang Riverside Theatre Project*. <https://global.ctbuh.org/resources/papers/download/2418-high-density-mixed-use-developments-and-the-guiyang-riverside-theatre-project.pdf>
- viii. Yu Ye, PhD, Assistant Professor, T. U., Zhendong Wang, PhD, Professor, T. U., Nannan Dong, PhD, A. D. & A. P. D. D., Built Environment Technology Center, T. U., & Xihui Zhou, Research Assistant, T. U. (2020). Tall Buildings ' Lower Public Spaces : Impact on Health and Behavior. *CTBUH Journal 2020 Issue I*. <https://www.ctbuh.org/resources/papers/download/4247-tall-buildings-lower-public-spaces-impact-on-health-and-behavior.pdf>
- ix. Zhou, X., Ye, Y., & Wang, Z. (2019). Tall buildings as urban habitats: A quantitative approach for measuring positive social impacts of tall buildings' lower public space. *International Journal of High-Rise Buildings*, 8(1), 57–69. <https://doi.org/10.21022/IJHRB.2019.8.1.57>

Redevelopment Guidelines For Shimpi Ali, Kasba Peth, Pune

Gargi Gokhale

VIT's PVP College of Architecture

Email: gargigokhale@gmail.com

Abstract: The wadas in the Pune had a significant value as they symbolized grandeur and power. Currently, these wadas are facing issues of neglect in terms of their repair. The redevelopment of these dilapidated wadas is necessary as their collapse may pose a threat to the life. Kasba Peth being one of the oldest peths in Pune, most cases of wada collapse are reported in this area. The paper aims at studying the Kasba Peth area and then focusing on Shimpi Ali for giving the guidelines for redevelopment and conservation. The guidelines are prepared such that they serve the modern-day function and yet help retain the character of the place.

Key words – character of the place, conservation, Kasba Peth, redevelopment guidelines, Shimpi Ali, , wadas,

INTRODUCTION

Many cases of wada collapse in the core city have been reported in the recent years. The old and dilapidated wadas are to be redeveloped. The government has sent notices to vacate these wadas. Now, the main question of how should one redevelop these wadas remains. For preparing the guidelines for redevelopment, one must take into account the people and the space which the wadas offered, the context and the need of the people.

Guidelines should be developed such that there is a study regarding the current trends and the olden residential typology of the wadas. With the collapse of the wadas, it has become a major concern to redevelop or restore these wadas. The space requirements of the redeveloped spaces should take into consideration the contemporary needs. Thus, a sector must be studied with equal amount of current housing typology and the traditional typology.

The scope of the research is to look at a particular street in Kasba Peth and to give guidelines for conservation and redevelopment for the same. While developing guidelines, the area of Kasba as a whole must be looked at for understanding the building materials, land use, building typology.

What is redevelopment?

Redevelopment is a process to rebuild or restore an area or a structure in a state of decline, dispossession, or neglect. Redevelopment is not just reconstructing the buildings; it includes the factors like improving the living quality and the environment. Redevelopment is usually looked upon as a factor associated with land use and positioning of

the structure. It ignores the idea of design, value of the historic assets, public spaces, environment in a community development. Redevelopment can be a public or a private initiative.

An important parameter which contributes in this process of redevelopment is the human capital. Any community is not only about bricks and mortar but about the people in that community.

The redevelopment in Shimpi Ali is essential because the structures are old and their maintenance is neglected. There is redevelopment which is currently taking place in this area. The guidelines which are proposed in this paper are regarding the nature of this redevelopment.

What is conservation?

Architectural conservation describes the process which focuses on the history, material and the design built in the past and strengthening it to last longer. Architectural conservation is about increasing the life of the structure with an emotional connect with it. The key factor in conservation is restoring and not development.

What is adaptive reuse?

Adaptive reuse is about using a structure for a different use than its previous use, allocating a new function to the old space. Adaptive reuse is about preserving and enhancing the elements of the structure and reusing the spaces for a different function. It is not about retrofitting but about retaining the essence of the spaces. Adaptive reuse becomes an easier option to establish a function to the structure which goes with the time. It contributes to the economy.

LITERATURE REVIEW

Architectural and Development Control Guidelines for Mahatar Pakhadi Precinct-

The report gives guidelines after studying the area of Mahatar Pakhadi Precinct. The study is conducted by Pankaj Joshi for MMR Heritage Conservation Society. Pankaj Joshi is the Executive Director of Urban Design Research Institute. The report states about the history and growth of that region. It takes help of already conducted research and upgrades it for preparing guidelines. The guidelines would be implemented based on recommendations of the residents.

The aspects which are studied in the report are –

1. **The present built form** – the present built form was studied through mapping in which the open and built ratio is studied. The built form was studied as single units with the help of plans for understanding space organization and the spaces which exist in those dwellings.
2. **Open space and built form pattern** – this was studied through maps, the relationship between the built and open and the patterns which emerged were noted down.
3. **Traffic pattern, condition of buildings** – the traffic pattern was studied through marking of different traffic movements and pedestrian movements. The conditions of buildings were studied according to their state of decay and collapse.
4. **Ownership of buildings** – the structures were classified according to the ownership ex. Private, government.
5. **Physical transformation in buildings** – any additions or retrofitting done to the existing structure were recorded.
6. **Demographic data** – this consisted of the census records
7. **House form and climate** – The cluster of dwellings was studied to analyze its climate response. This was done in terms of its plans. The planning of the dwellings responsive to the climate is analyzed.
8. **Religion and social life** – the places of worship are identified and the social life is studied by noting down the festivals and gatherings which take place in the study area.

The guidelines are given on the criteria of -

1. TDR
2. Hoardings and signages – the building elevation is studied to give the dimensions and the fixing position of the signages and hoardings.
3. Redevelopment and reconstruction of buildings
4. Road widths – the height of the structures and the width of the structure is studied to give the road widths.
5. Open spaces – the purposes of open spaces are defined.
6. Amalgamation and subdivision of plots
7. FSI
8. Crosses – the road junctions are suggested as guidelines which act as the nodes.
9. Height of buildings
10. Roofscape – guidelines regarding a flat roof or a sloping roof and the pitch of the roof are given.
11. Materials – the construction material guidelines are given for compound walls, building materials, plinth and its height.
12. Doors and windows – the material and the sill and lintel levels are given as guidelines.

Kasba Peth- report

The report focuses on the issues related to land, housing, water, sanitation and livelihoods. The report is based on the study conducted by Urban Ecological Planning NTNU. NTNU is a Norwegian University of Science and Technology.

The report defines and locates the area of study. It broadly explains the history of Kasba Peth and Pune. It looks at Pune as a developing smart city and describes what Kasba Peth is today. It defines Kasba Peth as ‘almost frozen in time’.

The stakeholders of Kasba Peth include Pune Municipal Corporation (PMC), Nagar Sewak, INTACH and religious organizations. The Pune Municipal Corporation was established in 1950 under Bombay Provisional Municipal Corporation Act (BMCA). The corporation consists of Corporators directly elected by the people which is headed by a mayor. A Nagar Sewak is the person elected by local people for solving and representing their issues in Municipal Corporation. INTACH was founded in 1984 in New Delhi with the vision to create a membership organization to simulate and spread awareness about heritage conservation in India.

The study is carried out in two parts viz Kasba Peth West and Kasba Peth East. The area considered is along the Murtha river and Veer Santaji Ghorpade Road from the North, Dagadi Pool Road from west and its southern side borders with Gate road. In this area, only two plots, the butcher market and the PMC-office are governmental while rest is private. Maximum area is residential. Wadas and row houses are dominant typologies in this area. These traditional structures were built with local materials like bricks, limestone and timber. The wadas, many of which are over 80 years old, have been neglected and are in bad condition. Some residents have demolished their old structures and constructed modern ones which have new architectural designs. These modern buildings are concentrated in Bhoi community where most residents own their houses.

In the Kumbhar community, people work with clay or a clay-gypsum mixture. This community makes clay items like earthen pots, idols, hanging bells, lamps etc. In the Bhoi community, fishing industry was there.

The report states that the area has a strong sense of community and the fish market in the area is one of the most socializing spaces in the area. It also mentions about the social activities on the streets and benches as interaction spaces. The statement is supported by mapping of the fish market and photograph of interactive spaces.

The report is from an etic perspective and lacks an understanding from the point of view of the subject. The method of mapping is efficiently used, but even from an etic perspective, it lacks statistical data to support its statements.

The report lacks an in-depth study for which guidelines can be given as a whole. It independently gives proposals for different aspects like green spaces, market spaces.

MATERIAL AND METHODOLOGY

The criteria for selecting the site- Kasba Peth is the oldest residential part of Pune. Many cases of neglect of maintenance are seen in this area which pose a threat to life. Thus, considering this area for redevelopment such that it helps maintain the character of Kasba Peth.

Sampling strategy- An area of Kasba Peth which has redeveloped structures as well as the colonial structures is chosen. Shimpi Ali in Kasba Peth is one such area. Being a residential and commercial area, this area had the houses of tailors (Shimpi).

Method employed for gathering data from the site -

- 1) Typology of the structure- Institutional, commercial, residential, mixed use.
 - 2) Condition of building- Dilapidated (collapse in structural system, collapse in non-structural elements like baluster, plaster, roofing tiles) and structures which require no repair.
 - 3) Physical transformation in the structures: Any interventions like hoardings, introduction of built in the open spaces which disturbs the character of the structure.
 - 4) Visual survey of materials of structures
 - 5) Mapping of the height of the buildings
 - 6) Mapping of the timeline of the structures
 - 7) Photographs of the street elevations of the structures
- After studying and collecting the above-mentioned data, it has been analyzed to derive the parameters which would help in maintaining the built character of Shimpi Ali while carrying out the process of redevelopment.

Data analysis

- The analysis of the data is by pie charts for the aspects of-
 - 1) Building height
 - 2) Land use
 - 3) Timeline of the structures
- The architectural features of the façade are analyzed through the photographs of the elevation.
- The materials and hoardings and signages are analyzed through a visual survey.

The guidelines will be given on the basis of the parameters derived from the case studies which are –

1. **Hoardings and signages** – Hoardings and signages play an important role in defining the façade of the structure. They can hide the architectural features. Thus, giving the dimensions for hoardings and signages. Stating the position on

the building façade. Thus, studying the elevation of the structures which belong to the colonial era and determining the position and dimension of the hoardings and signages such that the architectural façade elements are enhanced.

2. Materials – The building material should contribute to the experience of the space inside the structure and outside the structure. The materials of various elements should be studied. Generally, the construction materials of the same era are same. Determining the materials of – structural system, slabs, railings, doors, windows, ventilators.

3. Elevation of the street façade – Documenting the elevation of the structures through photographs. Identifying the factors which contribute to that typical façade of the colonial era. By documenting the street elevations through photographs, one can see the shift in the elevational character in the colonial and post-colonial era.

4. Building heights – Mapping of the building heights. Finding the building heights to determine the correct ratio of building heights to the road widths.

5. Land use – Mapping of the buildings. Finding out the land use of Shimpi Ali to develop the guidelines.

6. Timeline of the structures – Determining the timeline of the structure through mapping. Classification of the structures – colonial and post-colonial.

RESULTS AND TABLES

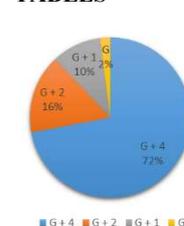


Figure 1 – Building heights in Shimpi Ali

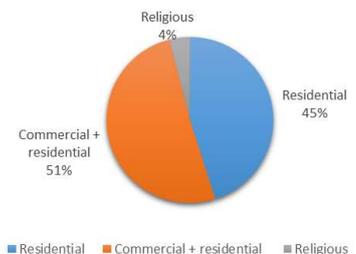


Figure 2- Land use of the structures in Shimpi Ali



Figure 3 – Timeline of the structures in Shimpi Ali

only seen stated that have a height which is pr



Figure 4 – The elevational character



Figure 5 – The elevational character

proportionate with the road such that light reaches the road for major part of the day. A viewer cannot comfortably see the structure while on the central street.

24% structures are colonial and this colonial character is reducing as 76% people have opted for redevelopment according to the current building trends. These colonial structures still help transfer one's mind to the timeline when the tailors used to make the dresses for the kings and queens.

Majorly the structures are pure residential or residential + commercial having private ownership. Thus, a sensitive redevelopment can be implemented by each owner. The interiors and the spaces which were once there in a residential structure may not be the same. These structures being residential and commercial have been constantly in use. Having temples and daily need shops the community has become sustainable for the daily needs. There is no major traffic movement seen in the central street. The commercial activities include electrical shop, hardware stores, grocery stores, tuition classes, tailor shops, garage.

Table 1 – Redevelopment guidelines for Kasba Peth

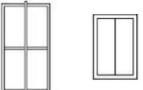
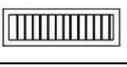
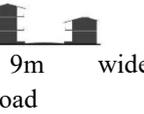
No.	Features	Diagrams	Proportions
1	Door		Length = 2100mm Breadth= 900mm
2	Window		Sill level= 900mm or 300mm from finished floor Lintel level= 2100 or till beam bottom
4	Ventilators/ jali		
5	Plinth and verandha		Width = 1.5m – 2m Height = 0.75m
6	Structural framing		
7	Slab band		
9	Hoardings and signages		
10	Height and massing	 9m wide road	Height = 9m to 12m

Table 2 – Redevelopment guidelines for Kasba Peth

No.	Features	Material	Description
1	Door	Timber	The door should be a double swing door with the pattern as shown.
2	Window	Timber framing	The windows should be casement windows.
3	Balcony	Timber and steel	The balcony railing should be of timber and steel. The balusters should be sperate i.e. there should be no parapet wall.
4	Ventilators/ jali	Timber framing and steel	The jalis should be placed above the doors and/or windows and should have the vertical bars as shown.
5	Plinth and verandha	Stone	
6	Structural framing	Timber	The framing should be exposed and visible from the outside.
7	Slab band	Timber	The slab band should be visible from the outside and it should be projected out to act as weather protection for the windows and doors on the floor below.
8	Walls	Bricks	The walls should be painted from the outside.
9	Hoardings and signages		The position of the hoardings and signages should be as shown in the figure.
10	Height and massing		The height should be restricted to G + 2.
11	Roof	Manglore tiles	The roof should be a sloping roof.

ACKNOWLEDGEMENT

I would like to acknowledge everyone who helped me with my research. Firstly, my faculty who kept me motivated to go further with my research and gave valuable inputs. This research was supported by my guide Ar. Prerna Shetty. I would like to thank Ar. Prof. Prasanna Desai and VIT's PVP College of Architecture. Through this research I have learned a lot about formation of guidelines in old city and the factors to be considered for the same.

REFERENCES

- i. 22 rescued after staircase and wall of wada collapse. (2019, July 30). *Times of India*.
- ii. Bhujel Nitu, K. N. (2017). *Kasba Peth. Pune: Norwegian University of Science and Technology.*- www.ntnu.edu
- iii. correspondent, S. (2019, December 15). *Old building in Raviwar Peth area collapses; no casualties reported. Sakal Times.*
- iv. Joshi, P. (n.d.). *Conservation Guidelines for Mahatar Pakhadi Precinct, Mumbai. Mumbai: MMR - Heritage Conservation Society.* - mmrhcs.org.in
- v. Paul, A. (1999). *Documentation and Provision of Guidelines for Dadar Parsi Colony, Matunga Central, Hindu Colony and Khodadad Circle Precinct. Mumbai: Kamla Raheja Vidyanidhi Institute for Architecture and Environmental Studies.*- mmrhcs.org.in
- vi. *PMC sends cluster development policy to Pune government for approval. (2018, July 25). Times of India.*
- vii. *These Pune wadas are one downpour away from destruction. (2019, June 28). Hindustan Times.*
- viii. *Wada collapse: It takes Pune Police 1 year to file a case. (2014, May 5). DNA.*
- ix. *Wada wall collapses, lone resident homeless. (2019, August 4). Times of India*
- x. *Heritage Cell. (n.d.). Retrieved from Pune Municipal Corporation: <http://pmc.gov.in>*
- xi. *Joshi, P. (n.d.). Conservation Guidelines for Mahatar Pakhadi Precinct, Mumbai. Mumbai: MMR - Heritage Conservation Society.*- mmrhcs.org.in
- xii. *Mehta, K. M. (2014). Transformation of Architecture in Core city: A case-study of Kasba Peth. Pune.*
- xiii. *Narayan, K. R. (2016). Analyzing Streetscape of Pune City Case studies: Kasba Peth, Karve Road, ITI Road. Pune.*

Study of Adaptive Facades For a Sustainable Environment

Haritha Meyyappan

D.Y. Patil School of architecture, Lohegaon, Pune

Email- harithameyyappan10@gmail.com

Abstract: *There is an unsaid lack of coherence between commercial design and environmental thought, where green ideas are sometimes used as part of a method to turn the building façade into a generator, based on renewable energy. The BIPV façade is meant to supply energy alongside conventional design objectives like aesthetics. Its relevance to a good range of applications, horizontal and vertical means a wider area is in use to get solar power than simply conventional roof tops. An adaptive BIPV facade may be a facade mounted photovoltaic system that adapts to the solar conditions of a specific environment. It merely combines the advantages of shading with facade integrated solar panels so as to get electricity, improve utilization of daylight, and improve energy performance of the facade by obtaining reductions in heating/cooling loads. Further, by generating electricity at point of use means energy losses are reduced. BIPV facades also can deliver added energy saving benefits in reduced heat loss and warmth gain and as a non-system it requires little or no maintenance over its lifetime.*

This research paper seeks to review the potential of BIPV facades in commercial buildings and on how they will enhance the standard of architecture by proving how passive design thinking and therefore the urban business building can proceed hand in hand. The various parameters and techniques are also explored to see the benefits of this concept in reality.

Key words : BIPV, Photovoltaic cells, Façade design, Energy conservation, Commercial buildings.

INTRODUCTION

In the growing sphere of sustainable architecture, a need to develop effective new strategies and solutions has become necessary to combat the rapid oscillation of climate change and deterioration of energy. Façade designs play a major role to help a building in becoming more efficient and productive. Several innovative building envelope technologies and ideas have been proposed as solutions to improving indoor comfort conditions and reducing the environmental impact during the life cycle of buildings. Particularly, the integration of passive and active design technologies in the building envelope are gaining attention from the research and development community. Thus, incorporating dynamic or adaptive facades in a commercial building increases its effect on achieving the major performance requirements in terms of occupant's satisfaction, energy saving, and environmental impact equalization.

Adaptive facades are building envelopes that are able to adapt to changing conditions in the form of weather fluctuations, diurnal cycles, or seasonal patterns. The facade acts as a mediator between the interior and the exterior environment and fulfils various functions. BIPV facades in particular cater to the structure as a solution to increase the share of renewable energy in the final energy supply. It is one of the most promising technologies for attaining nearly zero energy buildings in the near future.

STRATEGIC BENEFITS OF BIPV

BIPV is a multifunctional technology and therefore is usually designed to serve more than one function. Along with the fundamental function of producing electricity, it can fulfil several other tasks such as being a façade element, solar protection or glare protection. The major benefits of BIPV are observed in the following ways [1,2,3]:

- **Design Benefits:** relating to architectural integration and function of BIPV as a building component.
- **Economic Benefits:** relating advantages accrued as a result of BIPV application.
- **Environmental Benefits:** relating to micro or macro environment improvements due to BIPV application.

The list below contains a categorization of the multiple functions that BIPV modules can perform based on their unique characteristics.

1. Design-related benefits

- View and daylighting—semi-transparent options allow for light transmission and contact with exterior.
- Aesthetic quality—integration in buildings as a design element
- Sun protection/shadowing/shading modulation.
- Replacement of conventional materials such as brickwork, concrete etc.
- Public demonstration of owner's green ecological and future-oriented image
- Safety—application of safety glass.
- Noise protection—reaching up to 75 dB sound dumping.
- Building envelope—Mirror finish on skin of the building.

2. Economic Benefits

- Removal of the need for the transmittance of electricity over long distances from power generation stations.
- Reduction in capital expenditure for infrastructure and maintenance.
- Reduction in land use for the generation of electricity.

- Material and labour savings as well as electrical cost reductions
- Reduction in additional assembly and mounting costs, leading to on-site electricity and lowering of total building material costs and significant savings. In addition, ongoing costs of a building are reduced via operational cost savings and reduced embodied energy

3. Environmental Benefits

- Reduction of carbon emissions.
- The pollution-free benefit of solar energy.

BIPV FAÇADE APPLICATIONS: BARRIERS AND STRATEGIES

The adoption of BIPV globally has its own barriers that are faced. It has been proved that the sustainability goals of the future can be only achieved by adopting new technologies that can help in improving the current state of climate change and its consequences. These include challenges in the various stages of application such as the design stage and installation stage, and in some regional cases, expertise limitation, lack of promotion, and financial issues. [5]

There are also key barriers that are general to BIPV adaption, and in some cases, affect the building integration of other renewable energy technologies. Some of these general issues from a more holistic point of view are sociotechnical, management, economic, and policy-related as well as knowledge and information-related.[6] Others include insufficient presentation of BIPV product and project databases, lack of adequate business models, and insufficient dissemination of BIPV information. [4]

In almost all of these studies, strategies for overcoming these barriers have been proposed. These strategies are drivers in various forms with the potential to advance or facilitate the BIPV implementation in the built environment. In some cases, they are proposed solutions to counter one or more barriers when fully applied.

TYPES OF BIPV APPLICATION

Application techniques may vary depending on the architecture of the building, so BIPV is usually developed with multiple designers working together. These are the following ways that are commonly practiced [7] :

- 1) **Cladding based application:** These PV spandrels are fitted into a façade that is designed based on the specifications and have the panels mounted onto them. Trenches will have to be developed to maintain consistent wiring for ease of remote monitoring and electrical maintenance. Based on the amount of natural light required the panel can be placed.
- 2) **Curtain wall application:** This is a BIPV system which can replace all of the glass in the façade but uses a different kind of panel that allows maximum penetration of wall. It is extremely aesthetic and can

find applications in many kinds of structures such as office spaces, museums, malls, public offices and many more developmental buildings.

- 3) **Window based application:** Solar panels can also replace window glass, called transparent skylight or PV canopy types of installations allow more light to pass through and are a very good replacement for vision glass in buildings. Generally used in urban buildings and homes window based BIPV have a huge potential to disrupt the way we view modern construction.
- 4) **PV rooftop application:** The more popular technology known as rooftop solar plants can be integrated into a building through its structure. There are methods to replace the roofing material with a concrete PV panel acting as both the roof as well as the solar power plant.

CASE STUDY

Asia's Largest Rated-4 CtrlS Datacentre's Ltd has deployed building integrated vertical solar photovoltaic (PV) system from Waaree, a leading PV module maker, at its Mumbai facility.[7]

The first ever such system was constructed for a data centre done by CtrlS Datacentres Ltd. As the building is cemented on all four sides, a glass façade was considered essential to add to its aesthetic appeal. But instead of applying regular façade covering glass, the client chose to install 2,466 high-efficiency monocrystalline-Building Integrated Photovoltaic (BIPV) series WSM 350 Wp Waaree frameless solar panels and module level optimisations was carried out with the help of MPPT optimizers. [7] The misconception about low generation for BIPV can be proven wrong, with results achieved by introducing smart technology such as Solar Edge inverters, as used in our installation at the datacentre can substantially increase energy generation and allow for module level monitoring. Custom designed aluminium rails were used as the module mounting structure. The result is a 863.1 kwp capacity solar power generating façade. The solar power plant has a Performance Ratio of 75%, which is well higher than the simulated PV System report when it was planned. With an average generation of 40,000 – 55,000 kWh per month, the solar power plant is able to offset enough carbon to sequester 7000 trees per year. More buildings can choose to integrate this technology on their structures, with a generation of 6,00,000 units per MWp it is possible to offset the lighting loads with clean energy. Green building certification codes also include solar power as a metric, which is beneficial in case a company uses BIPV technology. [7]

CtrlS Datacentres Ltd, Mumbai – with the installation of 2,466 high-efficiency mono-crystalline-Building Integrated Photovoltaic (BIPV) series WSM 350 Wp Waaree frameless solar panels



Fig 6. CtrlS Datacentres Ltd, Mumbai

COMMERCIAL VIABILITY

The BIPV method consists of fitting modules to existing surfaces via superimposition once construction has been completed, such as during an energy renovation project. This is currently the trend in Europe and North America, wherein the older buildings are being renovated and retro-fitted with PV panels. Thin film and coloured glass photovoltaic panels allow architects the ability to design aesthetically pleasing buildings. The debate around commercial viability is based on the one-time cost of the installation and does not account into the benefit provided by energy generation, energy efficiency and sustainability value. For a commercial building/ urban structure build to last over 50 years, it is better to have a solar power plant that adds value to the structure for half its lifetime. A BIPV installation typically has a payback of approximately 5 years and it will generate free electricity for the remainder of its lifetime for approximately 20 years. As better panels are introduced in the market, we can estimate that the lifetime of a solar power plant will also increase. Moreover, a good operations and maintenance contract will allow for better performance of the system over time.

RESEARCH METHODOLOGY

Data Collection: The data obtained for this study is mainly through secondary research which involves a study of various research papers, articles, facts and videos from reliable sources focusing on the various aspects of Bipv facade. In order to carry out this research, detailed information has been collected focused majorly on why and how is bipv and important example for obtaining zero energy building in the near future.

FUTURE PROPOSAL

Having studied the various aspects of Bipv, it can be observed that its benefits can help the urban design for the better, especially using them in place of conventional glass facades in commercial buildings can revamp the anatomy of the building as the building becomes a working module that provides for itself. Adaptation of this advanced façade will not only provide 75% of energy for the commercial building but also will reduce the carbon emissions and be a saviour for our trees.

CONCLUSION

Bipv facades are becoming the latest source for attaining nearly zero energy buildings throughout the world. These facades simply present an approach to optimize both solar energy production and solar gain control through a smart, dynamic, PV integrated shading device mounted on the facade. Looking at the case study presented above we can justify the need to incorporate Bipv facades in commercial buildings to make them sustainable and efficient.

ACKNOWLEDGEMENT

I would like to thank my research guide Prof .Rasika Medhekar ma'am for her assistance in writing this paper and for her valuable comments that greatly improved the manuscript.

REFERENCES

- I. Jelle, B.P. *Building integrated photovoltaics: A concise description of the current state of the art and possible research pathways. Energies* **2016**, 9, 21. <https://www.mdpi.com/1996-1073/9/1/21>
- II. Montoro, D.F.; Vanbuggenhout, P.; Ciesielska, J. *Building Integrated Photovoltaics: An overview of the existing products and their fields of application. In Report Prepared in the Framework of the European Funded Project; SUNRISE: Saskatoon, Canada, 2011.* https://www.cagbctoronto.org/files/BIPV_Overview_existing_products.pdf
- III. Farkas, K.; Frontini, F.; Maturi, L.; Munari Probst, M.C.; Roecker, C.; Scognamiglio, A. *Designing Photovoltaic Systems for Architectural Integration; Farkas, K., Ed.; International Energy Agency: Paris, France, 2013* https://www.academia.edu/20991304/Designing_Photovoltaic_Systems_for_Architectural_Integration
- IV. Ritzen, M.; Reijenga, T.; El Gammal, A.; Warneryd, M.; Sprenger, W.; Rose-Wilson, H.; Payet, J.; Morreau, V.; Boddaert, S. *IEA-PVPS Task 15: Enabling Framework for BIPV Acceleration. (IEA-PVPS). In Proceedings of the 48th IEA PVPS Executive Committee Meeting, Vienna, Austria, 16 November 2016.*
- V. (Goh, K.C.; Goh, H.H.; Yap, A.B.K.; Masrom, M.A.N.; Mohamed, S. *Barriers and drivers of Malaysian BIPV application: Perspective of developers. Procedia Eng.* **2017**, 180, 1585–1595)
- VI. (Karakaya, E.; Sriwannawit, P. *Barriers to the adoption of photovoltaic systems: The state of the art. Renew.Sustain. Energy Rev.* **2015**, 49, 60–66.)
- VII. https://issuu.com/wfm-india/docs/36th_edition_sep-oct2017/s/11104822

To Study Origami Structures And Formulate How They Can Be Used As A Quarantine Facility Unit In Mumbai, By Comparing Various Forms of Origami Structure Concerning Its Materials.

Harshada Manoj Hikare, Prof. Manjusha Gokhale, Prof. Bijal Vakharia

Sinhgad College of Architecture, Pune

Email: hikareharshada@gmail.com

Abstract: A morphogenetic solution to the most stressful need worldwide pandemic due to coronavirus has certainly brought the need for hospital beds for quarantine and testing facility of patients. Origami structure involves a folding mechanism, its transformative properties make it multifunctional. The concept of designing an origami shelter is an innovative approach it is lightweight, compactable, durable, and made of a single sheet, by the art of paper foldings with easily available material and can easily be erected by unskilled people. A flat square sheet is turned into a finished sculpture through the technique of folding for serving the required purpose.

Keywords: Origami shelter, Deployability, Lightweight, Prototype, Folding system, transformable.

I. INTRODUCTION

There are different types of deployable structures such as tent structures, pneumatic structures, tensegrity structures, origami structures, and prefabricated modules. Certainly from all of the above origami structures are the simplest to erect made of a single material by the Japanese traditional act of paper folding, these are lightweight, transformable, and adaptive to the user. These can be constructed on-site or can be transported by compacting into 2D folded sheets and erected at the location into its original 3D form.

Maharashtra state was worst hit by the pandemic as per the reports by National Health Mission (NHM), Mumbai has a huge significance in Maharashtra certainly is worst hit by the covid pandemic. Adapting to the situation this is an innovative solution to all the haphazard, the study involves a comparative evaluation of few forms of deployable origami shelters that are feasible for quarantine facilities based on several factors. By several iterations, there are several outcomes possible so there are some specific intents to be fulfilled-

- It should be able to accommodate at least 3 people quarantine facility at once.
- It should withstand the local climate of a considered location that is Mumbai for a minimum of 14 days.
- It requires a minimum quantity of material that could have more folds as it strengthens the structure.
- The shape should be aerodynamic to respond to heavy winds as the structure is light in weight.
- The height should be between 2m to 2.6m such that it contains medical equipment i.e. ventilator and intravenous fluid stands.

Background

In this pandemic situation entire world is under lockdown due to increasing cases of corona patients, all hospitals are full also other buildings such as colleges, schools, hostel buildings are being used to treat patients and still some requirements are not reached. Because of the financial crisis, the lockdown is partially removed several precautionary measures were taken on an individual level and several other buildings are made functional. The increasing demand for structures is getting difficult to fulfill it means that there is an urgent need for temporary structures. There is a dilemma of creating a permanent structure, several buildings are also built for the treatment of Covid patients in India, but there is an alternative solution of creating immediate fast, and steadily erecting deployable structures.

Scope

Deployable Structures play a vital role in turbulent situations, these are previously being used at country borders as a rescue shelter to soldiers, for refugee migrants, and for disaster relief. There are several cases where deployable structures are used to respond to emergencies such as Christian Weber designed the Shiftpod which can facilitate the family of four for 30 days is used as a refugee in Greece and for the homeless in Hawaii, Weaving a Home by Abeer Seikaly, Students Lucas Boyd, and Chad Greenlee designed a proposal of pop-up churches, synagogues, and mosques for those fleeing conflict in refugee camps, and Carlo Ratti converted shipping containers into

Intensive-Care Pods for the COVID-19 Pandemic. This design is modular and could be in huge demand at emergencies or for temporary use, further this structure could be reused by carrying the structure at a required place with the help of transportation and as it is compactible and lightweight.

Aim

To propose a deployable origami structure for medical treatment and quarantine facility of Covid patients in Mumbai.

II. LITERATURE REVIEW

There are several types of research carried out in the field of deployable structures and made applicable wherever required such as information indicates.

A paper by **N. De Temmerman, K. Roovers, L. Alegria Mira, A. Vergauwen, A. Koumar, S. Brancart, L. De Laet & M. Mollaert- Belgium, June 2014 Lightweight transformable structures: materializing the synergy between architectural and structural engineering** is about the study of 6 different case studies

- The geometry of the bridge is derived from folding a flat piece of paper along two parabolically curved fold lines
- A scissor unit is formed by interconnecting two bars by a revolute joint at the intermediate hinge point
- Setting up automated design loops that rationalize designs by taking into account structural data.
- The building envelope acts as the interface between inside and outside.
- Due to its multi-faceted character, housing has the potential to support and facilitate personal, social, and economic recovery, the shelters cannot be static.
- Tensairity is a synergetic combination of struts, cables, and an inflated membrane (by low pressurized air).

N.Torres – Spain, June 2013 Deployable stage Proposal of an application with mobile structures is about a folding and portable stage, configured from scissors-type elements, folding systems, and membranes, which create the ability to open and close, making easier his transportation without the need to disassemble structural elements separately.

Graziano Salvalai - Milano, Italy 2017 Architecture for refugees, resilience shelter project: A case study using recycled skis is used in Northern Italy are undisputable which are used for constructing a sky shelter a habitable living space. They are very effective as they are multi-layered and act as insulation. The material which is chosen has a limited size therefore it limits its structural size.

Miranda Gilcrease – Texas, 2020 Emergency response shelter prototype, The unit is capable of packing and can be transported these are single-family and multi-family units each unit has independent solar panels, composting toilets, and a rainwater harvesting system. The special construction system has been. Adapted footing details, roof panel connection details, wall to wall connection detail, corner wall connection detail, and roof to wall connection detail.

III. CASE STUDIES

Case Study 1: Deployable emergency module offers protection after natural disasters -

- The project aimed to create a housing structure that could be responsive to the characteristics and peculiarities of a specific climate, transportable, modular, easy to fold and unfold, strong, and resistant.
- Radial distribution achieves a self-supporting structure each module is composed of a PVC circular base where an aluminum framework is attached and unfolded to turn into a dome-like unit.
- A second skin is added made of a thermal insulation foil, protecting the whole structure of extreme weather, a controllable aperture can be found to allow air to come in while an opening was placed on top for warm air to go out.
- Location and Date: Peruvian coast, July 2015, State: built prototype, capacity: 8 persons, ensemble time: 4 hrs, persons needed to assembly: 4

Case Study 2: Shiftpod by Christian Weber

- Inspired by the hexayurts at Burning Man, Christian Weber designed the Shiftpod, a reflective, insulated, wind-resistant tent that can also come with care kits, first aid, and water filters. His company, Advanced Shelter Systems Inc. (ASSI) in December 2015, has donated Shiftpods to refugees in Greece and the homeless in Hawaii, among others.
- “Our goal is to set up kits for individuals to take with them that have a shelter, water filtration, and everything you need for a family of four to survive for 30 days,” Weber says. “And to build systems for up to 1,600 people [that can be stored] in one container.”

- Weighing in at 64 pounds the Shiftpod compacts to 77"x13"x13" and can be assembled in minutes.

Case Study 3: Covid-19 rapid deployment test center

- In Australia, a consortium is working to develop two designs, one for hospital intensive care units and one for COVID-19 testing centers, that can be used across the country and overseas.
- By using recycled shipping containers as the core structure, the price of the buildings will be less than a third of the cost of conventional designs.
- In both building types, the container doubles as structure and packaging. This means the designs are self-contained and easy to distribute anywhere in the world. All the building parts, technical equipment, cabinets, and other fit-out materials pack into the container.

Case Study 4: Abeer Seikaly's structural fabric shelters weave refugees' lives back together

- The collapsible structural fabric shelter can adapt to various climates, while also providing the comforts of contemporary life such as heat, running water, and electricity.
- Composed of high-strength plastic tubing molded into sine-wave curves and woven into a stretchable fabric membrane, the system creates "a technical, structural fabric that expands to enclose and contracts for mobility."
- Due to the cellular nature of the structure, individual segments of the system can be left open to create doorways or to promote air circulation in warm weather, or all of the segments can be kept closed to retain heat in the winter. The hollow plastic tubing creates conduits for the provision of services such as electricity and water.



Figure 1: Reference images of the above-mentioned case studies

IV. Methodology

The paper shows didactic strategies of working based on the secondary data and formulation by comparative analysis, the study demonstrates a brief procedure of material study, Architectural ideas and innovations, geometric evaluation, and design finalization. Firstly basic design requirements such as 4.4m x 4.4m minimum floor area as shown in figure 2, and minimum internal clear height must be 2.4m such that all the equipment and people inside should have proper flexibility inside.

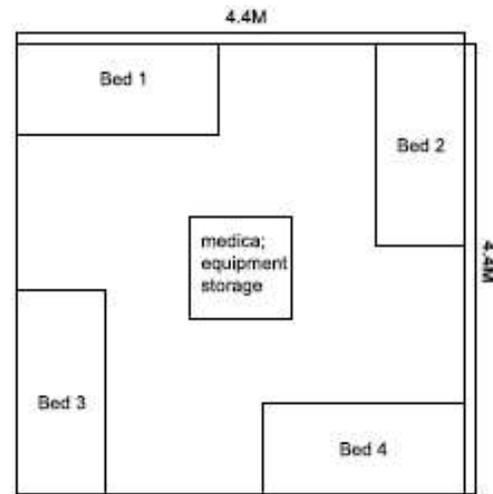


Figure 2: Minimum dimensions of a structure required to accommodate a quarantine facility (Not to scale)

After getting the minimum requirement as per architectural aspects concern origami structure is selected, while there has to be geometric design consideration but before that material is the most important factor that is finalized.

Table 1: Properties of Material

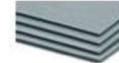
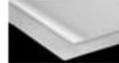
Material	Dim. Of Material (M)	Ease of Foldability	Thickness of material (mm)	Tensile Strength (MPa)	Density (kg/m ³)	Elongation (%)	Water absorption (%)	
Fluted Polypropylene sheets	1.8 x 1.2	85%	4	35	910	8	0.1	
PVC Flexible sheets	3.2 x 50 long	75%	3	50	1450	30	0.4	
Mill board	1 x 1	30%	5	9.65	1250	13.8	2	
Laminated bakelit sheet	1.2 x 2.4	40%	2.5	100	1450	31	1.5	
PET Sheets	2 x 1	70%	1	60	1380	20	0.6	
Corrugated Cardboard Sheet	1 x 0.6	55%	2.5	56.3	300	1.42	9.5	
Ribbed Acrylic sheets	3 x 1.6	90%	3	41	540	4.5	0.2	

Figure 3: Materials

Now, after material analysis, geometric design is finalized with by comparative method based on the basic minimum requirements some of the shortlisted origami structure will be compared with factors such as floor area, internal clear height, sheets dimension, no. of folds, weight, compact form size, faces, edges, vertices, advantages, and disadvantages.

The above table represents that PVC Flexible sheets would be the most suitable material for Origami structures as it has a higher dimension and ease of foldability and has good tensile strength and elongation, also is water-resistant. PVC flexible sheet is a recyclable material.

Analysis of Materials

Table 2: Design of Model

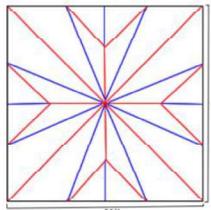
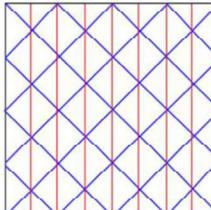
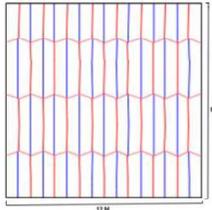
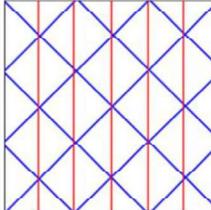
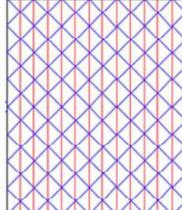
Factors	Design 1	Design 2	Design 3	Design 4	Design 5
Folding Lines					

Figure 4: Specification of Geometry of various origami design structures					
Model					
Compact Size					
Clear Height	2.8 M	3.2 M	3.5 M	3 M	2.8 M
Sheet Size	5.6 M x 5.6 M	8 M x 10 M	12 M x 8 M	6 M x 6 M	3.2 M x 10 M
Faces	24	72	96	42	70
Advantages	Less no. of folds. High internal height good for ventilation	Higher clear height inside. Good for cross ventilation.	Gives more clear height. Cross ventilation circulation.	Less no. of folds and comparatively easy to make Not more than 4 anchors are required.	Easy to transport. More usable space is achieved. Hot air can escape from the top. Aerodynamic shape and hence very stable.
Disadvantages	Sloping design restricts full area utilization inside.	Space inside could not be fully utilized. Too many folds. Acquires more space in compact form compared to others.	Heaviest comparatively to other designs	Smaller in size. Sufficient space is not reached.	Too many folds. Too many anchors point to fix with the ground.

Analysis of Model

Comparing the various designs of deployable origami shelter with several factors it can be seen that Design 5 is sunflower dome-shaped has sufficient floor space that is more usable area and also sufficient height with the least material.

The shape of that structure is aerodynamic and has too many anchor points therefore it can be tightly fixed with ground. It follows a principle that cool air enters from below and escapes from the top.

That design requires the least material and all the requirements are met and can easily accommodate 4 patients facility, more no of folds makes the structure more stable. It is easy to construct and donot require any special skills.

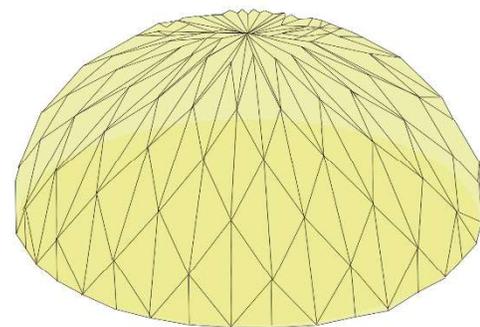


Figure 5: Sunflower Dome deployable folded origami structure

Limitations

- The design could be modular but the material in varying climate seems to be the limiting factor for this proposal.

- The structure has limited durability as it is a temporary shelter.

V. CONCLUSION

The study shows a preliminary idea of construction strategies for deployable origami structure, which is lightweight, transformable, and easily transportable. This modular unit is designed by the folding pattern made of PVC material which will function as a quarantine and treatment unit in Mumbai for Covid patients in the pandemic.

VI. ACKNOWLEDGMENT

I am grateful to acknowledge my guide Prof. Manjusha Gokhale and Prof. Bijal Vakharia. I am also thankful to the faculty of Sinhgad College of Architecture, Pune, and my colleagues.

VII. REFERENCES

- I. Covid -19 Rapid Development Test Centre - <https://www.design4disaster.org/2020/06/09/covid-19-rapid-deployment-test-centre/>
- II. Yale Students Propose a Series of Pop-Up Religious Buildings to Sustain Culture in Refugee Camps - <https://www.archdaily.com/789047/yale-students-propose-a-series-of-pop-up-religious-buildings-to-sustain-culture-in-refugee-camps>
- III. Prefab Pop-Up Shelter Designed for Burning Man and Perfected for Disaster Relief - <https://www.archdaily.com/883389/prefab-pop-up-shelter-designed-for-burning-man-and-perfected-for-disaster-relief>
- IV. Deployable emergency module offers protection after natural disasters - <https://www.designboom.com/architecture/deployable-emergency-module-peruvian-coast-11-10-2015/>
- V. Recover shelter by Matthew Malone - <https://www.coroflot.com/mmalone/recover-shelter>
- VI. Abeer Seikaly's Structural Fabric Shelters Weave Refugees' Lives Back Together - <https://www.archdaily.com/778743/abeer-seikalys-structural-fabric-shelters-weave-refugees-lives-back-together>
- VII. Graziano Salvalaia, Marco Imperadoria, Federico Luminaa, Elisa Muttia, Ilaria Polese - Architecture for refugees, resilience shelter project: A case study using recycled skis –
VIII. Natalia Torres - Deployable stage. Proposal of an application with mobile structures – Research Gate (2013) - https://www.researchgate.net/publication/299944390_Deployable_stage_Proposal_of_an_application_with_mobile_structures
- IX. Fenci, GE and Currie, NGR - Deployable structures classification : a review - International Journal of Space Structures (2017) - <https://journals.sagepub.com/doi/10.1177/0266351117711290>
- X. Testing machines, inc. - <https://www.testingmachines.com/application/corrugated-testing>

Psychological impact of colours on interiors spaces in retail stores

Author 1: Himanshi Pankaj Furia

4th Yr. B. Arch, SSMS CoA

Email: himanshifuria@gmail.com

Author 2: Ar. Shubhashree Upasani

Assistant Professor, SSMS CoA

Email: sdupasani10@gmail.com

Abstract: Colour plays an important role in evoking emotions in people and is considered an effective tool in advertising and branding. This research shows the understanding and perseverance of the space for colours and relationship between human psychology, emotions and behaviour related to colours in a retail space. The data collected was based on primary and secondary data collection that includes personal experiences as a consumer and studying various research papers of scholars from specialised fields. It was analysed that different groups of colours give a different perception of the space and alters the mood of a consumer.

Keywords: Colour psychology, Colour theory, Perception of colours and interior space, consumer, Retail store

I – INTRODUCTION

Colour theory is the collection of rules and guidelines which designers use to communicate with users through appealing colour schemes through visual communication. To pick the best colours, designers use a colour wheel and refer to collected. While studying it, Sir Isaac Newton developed the colour wheel to understand the colours as human perception of the wavelength of light. Colour plays an important role in evoking emotions in people and is considered an effective tool in advertising and branding. This research paper shows that a consumer perceives colours in the interiors of a retail store, evoking certain emotions in human brains. Colour can either enhance or weaken the perception of a consumer for the departmental store. Combination of any colour and the store is visible if either the store is visited frequently or the colour used is easily caught by the eye of the consumer. There are various aspects to a commercial space, like offices, retail shops, conference rooms, theatres, multi-purpose halls, malls, etc. Many researchers say that colour affects the nature and habits of consumers. Na Ree Lee (2002) states that colour as a sign offers possibilities of many interpretations rather than only one way of looking at any issue. Humans experience message in colour as it triggers their sensations and thus influence can be seen on buying decision.

II - METHODOLOGY AND MATERIALS

Colour Perception In Interiors –

Colour can change the look of the space without changing the placements.

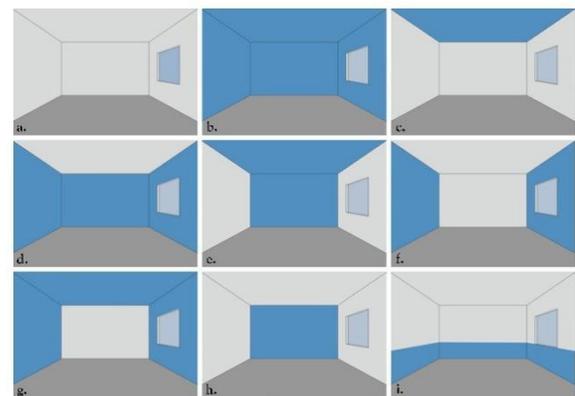


Figure 1

The following material is based on Figure 1

- Enlarge the Space –**
Natural lighting entering the light-coloured room reflects on plain surface, appearing larger to eyes.
- Compact the Space –**
Darker/warm colours on the room, appears compacted and cosier, absorbing the natural light.
- Lower the Ceiling –**
To make the ceiling appear low, it is painted darker than the walls.
- Stretch the Space –**
To make the ceiling appear high, the walls are painted darker.
- Widening the Space –**
The same dark coloured ceiling, back wall and lighter sidewalls make space appear wider/spacious.
- Narrow the Space –**

Darker side walls and lighter ceiling and back wall make the space narrower, improving the imbalanced proportions of room

g. Highlight A Wall –

Darkening the walls other than the highlighted wall can draw the attention it needs

h. Shorten the Space –

Darker back wall and contrasting colours in other walls shorten the space intimidating the larger space.

i. Shorten the Walls –

Painting upper or lower side of wall darker than the other part makes the walls appear shorter.

c. Sony Play-Station –

- Blue colour is associated with trust, reliability, coolness, calmness.
- Being associated with calmness, this colour gives the feeling where one wants to sit back and think about the product before buying them.

d. Wellness

24+

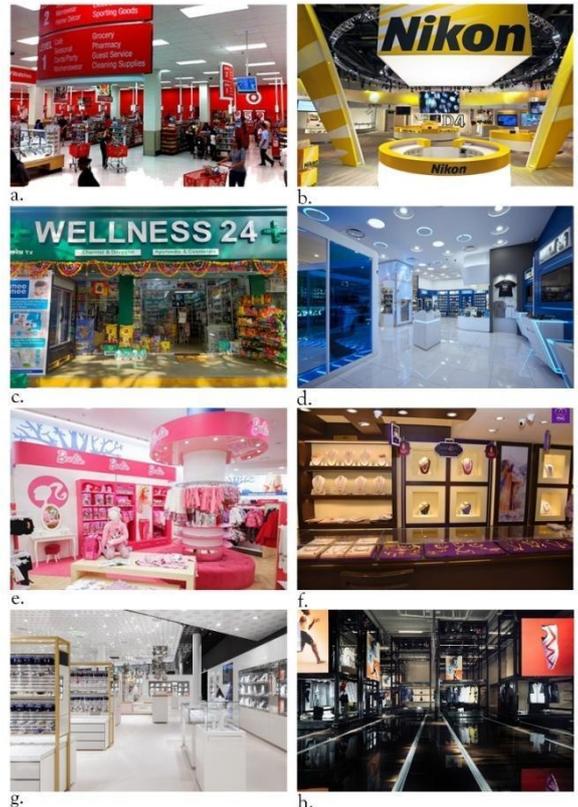


Figure 2

Colours are associated with objects on different dimensions. The sequence of colours follows the hue dimension on an activity scale of preferences.

Figure 3

a. Target – American Retail Corporation –

- The colour red is prominently used in the interiors of the shop i.e., on the display board, walls, trolley as it expresses excitement, energy and easily catches one's attention and stimulates them.

b. Nikon Showroom –

- The company Nikon uses yellow colour in its logo which symbolize expansion and passion, and the black portrays reliability and quality. Wellness 24 is a pharmaceutical shop where green colour is used in its logo as well as interiors.
- Green colour is considered calm, natural, healthy.
- Used in pharmaceutical shops where one buys products for their health.

e. Barbie Store –

- Pink is a feminine colour giving an emotion of softness, sweetness, nurturing and security and often used in girly products to attract more female crowd.

f. P. N. Gadgil –

- PNG is a jewellery showroom in Pune with interiors of wood and purple velvet material which adds a sophisticated and royal touch to the jewellery showroom.

g. Swarovski Kristallwelten –

- Swarovski is a crystal shop where white is dominantly used.
- It is associated with feelings of pureness, cleanliness, perfection and high reflection.

h. Spyder Flagship Store –

- This store is located in South Korea.

- The architects have poured black resin over the aged wood flooring giving a whole luxurious and mysterious look to the store.

III – RESULT

The analysis done for the following is done with reference to Figure 3

a. Target – American Retail Corporation –

- Some studies says that people are more comfortable shopping in Target than other stores as it is more welcoming.
- Also red attracts attention easily, hence making it easy to catch attention on their sales and deals.

b. Nikon Showroom –

- The company Nikon uses colour yellow that symbolizes expansion and passion, which the consumers show through their passion of photography.

c. Wellness 24+

- Wellness 24 is a pharmaceutical shop where the colour green is used in its logo as well as interiors.
- Green colour is often associated with nature, freshness and health. In pharmaceuticals, people need to trust the shop and the owner as they are buying products related to their health.

d. Sony Play-Station –

- Blue is associated with trust, reliability, belonging, coolness.
- Play-station being an old gaming brand have used blue from beginning and have gained trust of many people since past.
- Play-station has gained their recognition due to the use of the colour blue in their brand.
- These lead them to be in best gaming brand that exists.

e. Barbie Store –

- Pink often associated with feminine colour gives an emotion of softness, sweetness, nurturing and security.
- Barbie is one of the brands that is used by almost every small girl as pink appeals them.
- Due to pinks, the Barbie company has profited a lot.

f. P. N. Gadgil –

- PNG is a jewellery showroom in Pune with interiors of wood and purple velvet, which adds a sophisticated and luxurious touch to the showroom.
- While authors visit, they noticed the royal treatment which the customers received, not only from the sales personnel, but also from the look and feel of the shop

g. Swarovski Kristallweltem

- White gives an openness in a space that Swarovski has achieved through designing its interiors in such way.
- Being a crystal shop, the white background also shows the clarity of the crystals and other artifacts.
- This induces the consumers in getting a clear picture of the brand and its purity.

h. Spyder Flagship Store –

- While shopping here, the consumer gets a luxurious and mysterious feel, attracting a crowd that would enjoy that atmosphere

ANALYSIS -

- Colour can either enhance or weaken the perception of a consumer for departmental store. Combination of any colour in the store is visible if either the store is visited frequently or the colour used is easily captured by the consumer.
- Warm colours are visible and tend to make objects look closer and larger. They easily catch focus and create excitement.
- Cool colours are less visible and tend to make objects look far away and smaller. They don't easily catch focus. They have an increasing concentration and calming effect.
- Compared to cool colours, warm colour is easy to recall as they grab immediate attention.

IV – CONCLUSION

- Colour plays a key role in evoking emotions in people as it does impact consumer behaviour in a retail showroom.
- It is considered an effective tool in advertising and branding
- Although, due to the lack of knowledge, architects and designers misinterpret the colours.

ACKNOWLEDGEMENT

I would like to express my gratitude to my guides Prof. Shubhashree Upasni and Prof. Anuradha Joshi for their thorough guidance. Their knowledge has helped me complete the research paper.

REFERENCES

- i. Abdel, Hana. 2020. "Spyder Flagship Store Gangnam / Jo Nagasaka + Schemata Architects." *ArchDaily*. September 4. Accessed March 6, 2021. <<https://www.archdaily.com/946942/spyder-flagship-store-gangnam-jo-nagasaka-plus-schemata-architects>> ISSN 0719-8884.
- ii. AGX. 2019. "COLOUR PSYCHOLOGY IN RETAIL DESIGN." *AGX Look no Further*. June 4. Accessed March 6, 2021. <https://www.agx.in/colour-psychology-in-retail-design/>.
- iii. Bahareh Motamed, Richard Tucker and Margaret Grose. 2015. "Colourful Language: Researching Architects' Knowledge and Use of Colour." *Living and Learning: Research for a Better Built Environment: 49th International Conference of the Architectural Science Association 2015*. Melbourne: Architectural Science Association, 2015.
- iv. 2021. "Color Theory." *Wikipedia*. February 14. Accessed March 6, 2021. https://en.wikipedia.org/wiki/Color_theory.
- v. Daivata Patil, Department of Communication & Journalism, University of Mumbai, India. 2012. "Coloring consumer's psychology using different shades the role of perception of colors by consumers in consumer decision making process: a micro study of select departmental stores in Mumbai city, India." *Journal of Business and Retail Management Research (JBRMR)* Vol. 7 (Issue 1): 60-73.
- vi. 2020. "Paint Academy's Colour Psychology." *ACEDGE*. Accessed March 6, 2021. <https://www.acedge.in/courses/take/IR-CP/texts/7637647-welcome>.
- vii. Patel, Neil. n.d. "The Psychology of Color: How to Use Colors to Increase Conversion Rate." *The All-In-One SEO Tool*. Accessed March 6, 2021. <https://neilpatel.com/blog/the-psychology-of-color-how-to-use-colors-to-increase-conversion-rate/>.
- viii. Souza, Eduardo. 2020. "How Colors Change the Perception of Interior Spaces." *ArchDaily*. March 9. Accessed March 6, 2021. <<https://www.archdaily.com/935067/how-colors-change-the-perception-of-interior-spaces>> ISSN 0719-8884.
- ix. Velasquez, Ingrid. n.d. "The Psychology of Retail Store Interior Design, Part 1: Color." *FOHLIO*.
- x. 2015. *Why We Like Target Better than Walmart: It's a Visual Thing*. December 14. Accessed March 6, 2021. <https://thevisualcommunicationguy.com/2015/10/03/why-we-like-target-better-than-walmart-its-a-visual-thing/>.

Reviewing Fractal Geometry as a Design Aid in Architecture and Township Layouts

IshitaSingh , Dr. Sujata Karve

Dr. B. N. College of Architecture, Pune

Email- a17007.ishitas@bnca.ac.in, sujata.karve@bnca.ac.in

Abstract: The paper aims at using fractal explanations for calculating the approximate visual complexity of township layouts in architecture. This idea is applied to measurable features like the size and distribution of green spaces, the pedestrian & transportation web, and hierarchy of connections necessary to sustain urban life. That is achieved by discussing existing architectural precedents in India-Specifically Asiad Games Village, by using quantifiable approaches like deploying a grid to provide a measure of the relative complexity of the built space. The research investigates the potential of the emergent patterns of fractals as an organizational principle in designing housing layouts, while limiting it based on site constraints, size and the transforming rules.

Keywords: Fractal geometry, scaling, grid disposition, hierarchy of spaces, housing layout, network systems, iteration of a unit

I. INTRODUCTION

The relation between mathematics and architecture is prevalent in our built environment. Fractals are patterns that possess structure on a hierarchy of scales. Importantly, fractal patterns typically provide multiple combinations of benefits that work in synergy. Analysis methods like the measured dimension using a scaling coefficient help determine the order of manmade shapes to identify such patterns. In his book “The Nature of Order”, Christopher Alexander had distilled a working toolkit called “fifteen fundamental properties”, which are essential features of both natural and man-made coherent systems. “One property is scaling hierarchy; another is the need for contrast; yet another is the presence of abundant local symmetries but the relative insignificance of an overall symmetry.” This paper aims to explore how fractal concepts are utilized in the creation of townships to attain mechanisms where urban society connects on the neighborhood and street level. A modernist school of thought that embodies disconnectedness and segregation has confused the importance of human interaction and importance of network of webs on an urban level.

In order to further explain the concept, we will refer to past and present 'urban network thinkers' like Dupuy, Barabási and Salingaros. Dupuy states ‘A city’s life comes from

itsconnectivity’ in his network urbanism model 1991. Similarly, we gauge that in a neighborhood, geometry plays a keys role in supporting the connective web so that human interactions can occur. Salingaros talks about the connective properties between two nodes to carry out information exchanges in his paper ‘Information Architecture of cities’ in 1998 . Such theories repeatedly talk about how the larger/stronger connections should not overpower the existing fundamental physiological and psychological reasons for why pedestrians require small scale connections on the ground level.

The paper also tries to clarify the mechanism whereby urban society connects on the neighborhood and street level. Diffusion through capillary channels directs the flow of vehicular and pedestrian traffic, An obsession with the largest scales in the car network leads to the disconnected urban geometry seen nowadays. A healthy network requires all levels from ones that slow down and those that fast up- which is controlled by streamlined fractals which add geometrical constraints.

Talking about the idea of connectivity, green spaces sometimes fail their urban function by becoming disconnected inaccessible spaces. The presence of green spaces of different sizes, even in an inverse-power distribution, has to connect first on the human range of scales before becoming a network.

In “Connecting the Fractal City” Salingaros talks about two ways to construct a fractal as one goes down to the smaller scales. The first is to ADD substructure, while the second is to SUBTRACT substructure. The other method of constructing a fractal is to create gaps at successively decreasing scales, like punching holes out of a material. The size of the holes gets smaller and smaller, forming a sieve or perforated membrane. In the same way, perforated urban interfaces allow pedestrian flow across an urban boundary, while preventing the flow of cars across the same boundary. Examples include colonnades, porticoes, arcades, small shop entrances, bollards along a sidewalk, etc.

II. MATERIAL & METHODOLOGY

Working on a selected scaled layout of Raj Rewal's Asiad Games Village, Delhi; we take it as an example of contemporary Indian housing designs and deploy a grid on it to understand the mathematical comparison of the hierarchy of spaces. We look at a top-down approach by looking broadly at repetitive or rhythmic compositions to understand how the layout serves to tie the different scales together; analyze how small elements are inserted in a continuous and coherent whole.

The study will also use urban level design theories to verify geometric solutions to connect nodes in a network. Grid disposition to draw mathematical scaling comparisons is looked at. We can then build characteristics of housing layouts to understand- what are their fractal properties, methods of connecting and repairing urban space, and effective ways of arrangement of nodes and interconnections.

Data is received from measurement of one unit located on the layout which is then compared with the grid disposed between built spaces and open spaces. The expected outcome is to perceive a certain ratio or distribution algorithm visually in plan, to confirm the presence of fractal patterns. To go ahead with this, I would like to define some technical terms at the outset of the study-

"Fractal" -The key notion of a fractal is that it possesses structure on a hierarchy of scales. A structure defined at an overall size x implies something similar at a size rx , where r is a scaling factor like $1/3$. For a structure to be fractal, there exist substructure at decreasing sizes r^2x , r^3x , r^4x , etc. A true mathematical fractal has self-similar structures going all the way down to the infinitesimal scales. For a physical fractal, the smallest scales become too small to see, so this implies a range of scales from very large to the very small.

The number r is called the "scaling factor" and can in theory be any fraction. In most common fractals it is usually some fixed number between $1/2$ and $1/10$. Naturally occurring fractals (such as cauliflowers, fern leaves, and the human lung) exhibit a nested structure with r not very different from $1/3$ (Source: Salingaros, 1995; Salingaros & West, 1999)

Fractals are also coherent and self-similar. This means that the scaled shapes are related by some sort of scaling symmetry. In the simplest of geometrical cases, a design is repeated to tie different scales together into a whole. This is also believed to be what unifies the distinct scales into a whole coherently.

III. RESULTS

Redressing network systems

Highlighting transportation and pedestrian networks and green spaces to understand the use of scaling and hierarchy in such spaces



GREEN SPACES



VEHICULAR CIRCULATION



PEDESTRIAN CIRCULATION

Base layout source-rajrewal.in

The network of urban space coincides with and supports the network of pedestrian paths (Krier,1998; Salingaros, 1999).This breakdown of space is not accidental- it is a straightforward application of transportation geometry that is

compatible with urban space. Crossover of networks require a capillary structure to slow down paths in dense areas and allow small scale connections on the ground level for pedestrians.

1. Fractals and size distribution

Considering how many pieces of the layout are there that measure a size x or a multiple of the size x . These could be iterations of the parent elements in a function. As shown in the diagram below. This iteration is further distributed within boxes proportional to each other on the given site. The result being an orderly arrangement of spaces with a variation. Fractals here are unit-based and, can thus allow exploration in architectural design with the 'unit' as a fundamental issue or necessity.



Lattices composed of self-similar line segments in two dimensions.

Base layout source-rajewal.in

An alternate grid of x and $3x$ with x being the width of one typical dwelling unit, seems to cut through the built up and open space.

Deploying clear cut visual rectangular boundaries on the layout, the site, though asymmetrical, houses a layout which visually is in scaled up dimensions of the single dwelling unit.- multiples of 12.5.

IV. CONCLUSION

A major part of the Asiad Games Village's form exploration process- knowingly or unknowingly- must have included having used mathematics as a guiding factor to evolve a formal methodology. Specific mathematical underpinnings

lead to compositional principles such as symmetry, rhythm, and proportion. Asiad Games Villages stands as an example of the designer having used such principles to overlap and interface the complex diversity required in a township layout- to provide the final composition.

ACKNOWLEDGEMENT

I express my sincere gratitude to the Research In Architecture faculty at BNCA without whose advice, expertise and encouragement this research would not have happened. I also thank my classmates for the stimulating discussions and BNCA, Pune for providing me the opportunity to embark on this project.

REFERENCE

- i) Alexander, C. (1965) "A City is Not a Tree", Architectural Forum 122. Reprinted in: Design After Modernism, Edited by J. Thackara, Thames and Hudson, London (1988) pp. 67-84. Published electronically at <https://www.patternlanguage.com/archive/cityisnotatree.html>
- ii) 'Connecting the Fractal City' by Nikos A. Salingaros, Department of Mathematics, University of Texas at San Antonio, San Antonio, Texas <https://applied.math.utsa.edu/~yxk833/connecting.html>
'The fractal analysis of architecture: calibrating the box-counting method using scaling coefficient and grid disposition variables' by Michael J Ostwald, School of Architecture and Built Environment, University of Newcastle, Australia <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.884.7292&rep=rep1&type=pdf>
- iii) 'Application of Fractal Growth Patterns in Housing Layout Design' by SUBHADHA BATTINA, K.S. School of Architecture, Bengaluru <https://cs.chitkara.edu.in/index.php/cs/article/view/134/118>
- iv) SALINGAROS, N. (1998) A Scientific Basis for Creating Architectural Forms. Journal of Architectural and Planning. [Online]15(4). p. 283-293. http://www.jstor.org/stable/43030470?seq=1#page_scan_tab_contents
- v) Neighborhood spaces in residential environments: Lessons for contemporary Indian context- Ritu Gulati, Frontiers of Architectural Research, Volume 9, Issue 1, 2020. <https://www.sciencedirect.com/science/article/pii/S2095263519300780>
- vi) CHING, F.D.K. (1996) Architecture: Form, Space and Order.
- vii) Kauffman, S. (1995) At Home in the Universe, Oxford University Press, New York.
- viii) Krier, L. (1998) Architecture: Choice or Fate, Andreas Papadakis, Windsor, Berkshire, England. French translation: Architecture: Choix ou Fatalité, Norma, Paris, 1996. Italian translation: Architettura: Scelta o Fatalità, Editori Laterza, Roma-Bari, 1995



<https://artsandculture.google.com/asset/diagrams-of-the-masterplan-key-concepts-leon-krier/WQEbL7Zx8jA8Dw?hl=en>

- ix) Gabriel Dupuy-L'Urbanisme des réseaux : théories et méthodes-translated to Urban planning of networks, theories and methods
https://www.persee.fr/doc/flux_1154-2721_1992_num_8_9_1648
- x) Raj Rewal Associates. For images and scaled plan layouts<http://rajrewal.in/>
- xi) The Nature of Order, Book One (Alexander, 2002) (fifteen fundamental properties)
- xii) Houses Generated by Patterns. / Angel, Shlomo; Alexander, Christopher; Hirshen, Sanford ; Ishikawa, Sara ; Koffin, Christie. Berkeley CA : Center for Environmental Structure, 1969.
Research output: Book/Report › Book

Paper In Architecture

Janhavi Hinge; Er. Himanshu Manjrekar

D.Y.Patil School Of Architecture, Lohegaon

janhavijh@gmail.com , himanshu@dypatilarch.com

Abstract: With the increasing population a shortage of space is observed. Increasing population escalates the need of construction, which then causes adverse effects on the ecosystem. To make the building sustainable, fast to construct and cost-effective paper can be used in various forms and as various structural members. Paper buildings can be easily constructed, demolished and even recycled making it an ideal material. This research paper suggests that paper is a versatile, flexible, sustainable material which can be used for the construction of various elements. Replacing paper from conventional building materials can help reduce excessive construction waste, is dismantlable and can be recycled which provide sustainability and diversity.

Key words: sustainable, paper forms, building material, recycle, ease of construction

INTRODUCTION

Paper is a material which is used extensively in our day to day lights. Right from newspaper to packaging boxes, paper is used in many forms and varieties. Paper was first in China to the emperor of the Han dynasty by Cai Lung. It has been primarily used as an information carrier and packaging material. However, the architectural applications of people have been known since the eighth century A.D. Growing awareness of the scarcity of fossil fuels and natural resources, the need to curb CO₂ emission and the necessity of reducing the ecological burden caused by the use of materials such as polythene and its derivatives, concrete, steel is encouraging people to find more environmentally friendly solutions, including economical factors. Paper and its derivatives can overcome the ecological burden. But due the growing digital age paper is replaced by electronic devices. Since the use of paper has no limits it can be used to only for communication or packaging purposes but its use in architecture can be experimented.

LITERATURE REVIEW:

To understand the paper and its forms for architectural use, it was necessary to study researches already conducted and the architects working with paper. Research paper by Lawrence C. Bank, Terry D. Gerhardt talks in detail about the paper board

tubes. The Research paper by Jerzy F. Latka explains elaborately the various paper products, its derivatives, properties and its application in architecture.

METHODOLOGY

The objective of the paper was to understand how paper can be used in architecture and to what extent it can be used. To conduct this study, literature study and case studies were the primary material of the study. The literature study helped in deriving the use of paper products and its varieties in buildings whereas the case study helped explain the applications of paper in architecture.

MAKING OF PAPER

The most common raw material for paper production is pulp of the wood. It can also be produced from other cellulose containing materials like straw, bamboo and cotton. Paper production is divided into two steps. Step one is preparation of paper pulp. Step two is processing the pulp and paper mills to form paper sheets. Following is the flowchart of making of paper in brief:

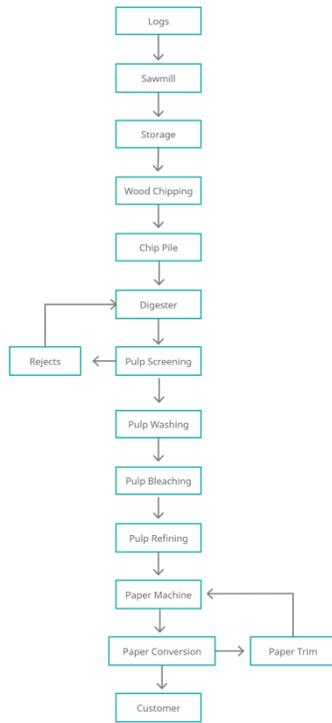
PROPERTIES OF PAPER

The basic properties of paper are defined by weight and density, moisture content, physical characteristics, strength properties, optical properties and different criteria.

Paper is classified as paper and cardboard. Paperboards are distinguished per the fibers employed in the assembly, the assembly and pulping ways and also the weight of the paper. There are many grades of paper, whose categorization depends on properties like weight, usage, conversion, staple or pulping ways.

The following weight based grades of paper are recognised:

Tissue: low weight < 40 g/m²; Paper: medium weight 40–120 g/m²; Paper board: medium high weight, one 120–200 g/m²; Board: high weight >200 g/m²



The thickness of paper board will vary from 0.25 mm and so to 4 mm. It's grammage ranges from 224 g/m² to 1650 g/m². Solid board is defined by high strength and stiffness. The structural behavior of paper board is plagued by its variety of layers, the direction of the fibers and also the style of adhesive used.



Paper tubes:

Paper tube is the most common form of paper used for architectural purposes. It gained its popularity in the field of architecture mostly because of Ar. Shigeru Ban's work. There are two ways to produce paper tubes: parallel winding and spiral winding. Parallel winding incorporates winding a sheet of paper with a hard and fast breadth and around a core. Consequent layers of paper are pasted along. The length of the tube is set by the breadth of the sheet of paper. Spiral winding consists in winding a sheet of paper around a core at an angle. This production technique is named endless and also the length of the tubes is set by wherever the tubes are cut throughout the assembly method. Tubes that are created by the parallel winding technique are additional sturdy and that they are axis concurs with one among the most orthotropic directions of paper that conjointly makes it easier to explain their mechanical properties.

PAPER PRODUCTS USED IN ARCHITECTURE

There are primarily 5 product that a mast created by the paper business which might be used as structural parts in architecture:

1. Paper board
2. Paper tubes
3. Corrugated cardboard
4. Honeycomb panels
5. L and U shapes

Paper board:

Paper boards are defined by comparatively high rigidity. The primary paper board was created in European nation within the early nineteenth century; folding boxes were made-up, as were mechanical die cutting and creasing of blanks. Paper board has high-density. The board will either have a unvaried structure or it is created from many piles. Composition board is finished with a liner manufactured from special paper example waterproof paper.



Z direction, that's perpendicular to the surface which can be as high as 100 KN/m².



Corrugated boards:

Corrugated board could be a sandwich composition of two flat layers of paper with a layer of furrowed medium called groove in between. The thickness of the groove will vary from zero.8 MM – 4.8 MM, and its grammage are going to be between 80- 180 g/ meter; whereas the liners have a grammage of 115–350 g/m². There are differing kinds of corrugated board example single-wall board (With one corrugated medium and one or 2 liners), double-wall board (two corrugated mediums and 3 liners boards), triple-wall board (three corrugated mediums and are alternated with four liner boards). The foremost normally created style of corrugated board is single-wall board.

U and L shapes:

Cardboard U and L profiles incorporates many layers of paper ironed into form, laminated and coated with a finishing layer, which might be colored, high glass or written. Layers of paper are as heavy as 450 g/m² and 0.7 mm thick, or laminated with water-based liquid adhesive. The flanges are between 35mm to 100 mm and might have a thickness 2mm to 100mm. Profiles are primarily used for transportation functions, as a method to guard edges of products being transported, Example books or article of furniture.



Honeycomb panels:

Honeycomb panels are denseness, cellular sandwich panels. They're created from three layers, two facings and one core layer that has honeycomb like structure. The panel is made up of paper or different materials like fiberboard, plywood, aluminum, reasons or different metals and polymers. Honeycomb panels are usually employed in article of furniture, primarily as a filler work surface and shelves. They're commonly used as door fillers. Honeycomb panels are defined by high compression strength in

Paper has been used for architectural application for the past five hundred years in Europe within the style of wallpaper that was most likely made-up in Persian. Paper has been used as a structural material for the past 150 years.

Five useful classes are distinguished with relation to the extent of quality, size, material composition, budget and period of the project:

- Furniture, interior design, industrial design, arts and crafts and products for everyday use.
- Structures are built for temporary use of up to one year. Eg. Exhibition pavilions
- Building projects with a lifespan of five years. Eg. houses.
- Structures built to last for twenty years or more. Eg. Schools, institutional buildings..
- Buildings with a less lifespan or temporary structures. Eg emergency and relief architecture.

The sizes of S, M, L, XL were established by means that of conducted analysis on the basis of art, industrial style, interior style and design, accomplished within the twentieth and ordinal centuries. The aim of size categorization is to systemize data of style and design created out of paper and cardboard. The dimensions classes not solely replicate the physical size of the project (measured in sq. meters) however conjointly the quality of the structures, the budget needed, the expenses associated and also the method of style, analysis and implementation. Refer table 1.

SIZE OF THE PROJECT	AREA (sq.m.)	COMPLEXITY	PAPER FORM USED	EXAMPLES	IMAGES
Small (S)	< 5 sq.m.	Low	Honeycomb board, Corrugate board	Door panels, space dividers, furniture, book shelves	
Medium (M)	5 – 50 sq.m.	Moderate	Cardboard	Housing structures, Major art installations, exhibition pavilions, etc.	
Large (L)	50 – 450 sq.m.	High	Cardboard, Paper tubes	Institutional Buildings	
Extra Large (XL)	>450 sq.m.	Highest	Cardboard, Paper tubes	Institutional Buildings	

Table 1

CONCLUSION:

Paper being organic in nature, it can be recycled, reused and even decomposed. The conventional building materials like glass, steel, cement, concrete cannot be replaced completely but it can be complimented by paper till a certain extent, resulting into more sustainable buildings.

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my guide Er. Himanshu Manjrekar for his constant suggestions, inputs and time throughout the research process. Your interest and the involvement in the research helped me explore more about this topic.



REFERENCES

- i) [Paper honeycomb sandwich panels as lightweight structural components \(nist.gov\)](#)
- ii) [PAPER SOFA – Procédés Chénel \(procedeschenel.nl\)](#)
- iii) [Paper Pavilion :: Future Architecture \(futurearchitectureplatform.org\)](#)
- iv) [Paper Log House Kobe | Architect Magazine](#)
- v) [\(PDF\) PAPERBOARD TUBES IN ARCHITECTURE AND STRUCTURAL ENGINEERING: A REVIEW \(researchgate.net\)](#)
- vi) [Paper in architecture: Research by design, engineering and prototyping | A+BE | Architecture and the Built Environment \(tudelft.nl\)](#)
- vii) [Buildings made from cardboard tubes: Shigeru Ban architecture | TED Blog](#)
- viii) [Works | Shigeru Ban Architects](#)
- ix) [The Humanitarian Works of Shigeru Ban | ArchDaily](#)

Structural System And Design Strategies of Earthquake Resistant structures with the study of koti banal architecture uttarakhand

Author 1: Kaiwalya Manohar Apte

4th Yr. B. Arch, SSMS CoA

Email: kaiwalyaapte@gmail.com

Author 2: Ar. Shubhashree Upasani

Assistant Professor, SSMS CoA

Email: sdupasani10@gmail.com

Abstract: In the Rajgarhi area of Uttarakhand a large number of intact buildings of the distinct construction type known as KOTI BANAL is found. It is the name of a village which represents the earthquake resistant design. It evolved this earthquake-safe construction style 1,000 years back. In the Koti Banal architecture, locally available materials such as wooden logs, stones and slates were used. The height of these structures varies between 7 and 12 m above the base platform. These structures are four to five stories. The buildings withstood and performed well during many past damaging earthquakes in the region.

Keywords: Earthquake Resistant, Structures, Koti Banal, Structural System, Design Strategies.

I – INTRODUCTION

Buildings of this construction type can be found in the northern part of the state Uttarakhand and the southern part of the state Himachal Pradesh. The most magnificent examples of the Koti Banal architecture are observed in the valley of the river Yamuna in Rajgarhi area where many villages have a fair number of these houses. Though this kind of construction is presently observed only in rural areas evidentially, lack of maintenance has led to the deterioration and the complete destruction of many of these structures.

The Koti Banal structures located in a high seismic risk area, exhibits an elaborate tradition of constructing multistoried houses. The State of Uttarakhand falls in seismically highly sensitive zone. Though the region has been spared by high magnitude earthquakes, the region has witnessed devastating earthquakes in 1720 and 1803. In the recent past the region has witnessed earthquakes in Uttarkashi (1991) and Chamoli (1999) and the seismic activities in the region suggest that earthquakes would have been a common feature in the past as well.

This area was therefore selected for detailed investigations. Koti Banal architecture did not depend on any building codes and recommendations. At the time of its origin, concepts of science and earthquake resistance were beyond the thought process of people. Despite all these designs of the multistoried houses seem to follow the present day building codes of earthquake safety. Noticeable amongst the earthquake safety characteristics of these houses are—form and proportion; small

and single entrance; and, joinery details. Such examples highlight traditional knowledge systems, indigenous building materials, community involvement and craft skills.

The houses in the villages Koti Banal Architecture of Uttarakhand reflect an agrarian lifestyle belief systems and way of life and the resources provided by the surrounding forests. Many houses still follow the Koti Banal style, but others have transitioned into an international style, which utilizes concrete, brick and other new materials (easier to build). Koti Banal style of construction is indeed vernacular in nature and holds values that need to be celebrated and preserved. The paper represents the vernacular construction in Uttarakhand. any construction may be called as vernacular if its style relates to specific region or surrounding culture.

II - METHODOLOGY AND MATERIALS

Information and understanding on the Koti Banal style of architecture was gathered through Historiography. A conceptual framework was formulated that emphasized on the inter-relationship between Koti Banal, traditional knowledge systems, indigenous building materials and community involvement. Detailed investigations were undertaken in the area to establish the antiquity of the traditional structures, also earthquake safety provisions incorporated traditionally. This architectural style exhibits the existence of elaborate procedures for site selection, preparing the platform for raising the multi-storeyed structure, also for the detail of the entire structure that was constructed on principles somewhat akin to that of framed structures of modern times. This research involved a comprehensive understanding of the Koti Banal construction, Analysis and inferences drawn.

LITERATURE STUDY

Communities residing in hilly areas are often affected by earthquakes. They were quick to understand the fundamental premise of earthquake safety that the key to avoiding loss of human lives lies in ensuring safe construction. This fundamental understanding led to the evolution of koti banal architecture, which ensured safety from structural collapse. The house was generally composed of the alternate bands of dressed timber and stone rocks that were tied at corners through interesting joinery. The structure was further reinforced with

the help of wooden beams fixed alternately, that run from the middle of the walls on one side to the other intersecting at the centre. This arrangement divided the building into four parts and provided for joists supporting the floorboards in each floor of the building. Different floors were connected with timber ladders. The roof was composed of the patthal (local stones), which were supported over wooden framework. These structures used wood in huge amount both for construction and ornamentation. Like the RCC frame of present day multi-storied construction, the Koti Banal architecture used wooden frame for the entire structure. The voids were filled with rocks (local stones). These walls took the vertical load; while the interconnected wooden joists running in both directions took the horizontal load. To enhance the seismic performance, two beams running across from opposite directions were placed from outside. The structure was raised on a platform two to four meters above ground. The stone-filled solid platform kept the centre of gravity and centre of mass of the building closer to each other and near the ground. This effect protect it during earthquakes. Tying of walls at corners and by providing horizontal bands at certain levels such as the lintel level to ensure that individual walls do not suffer out of pane failure due to seismic forces during earthquake. The bands can be provided in timber or reinforced concrete and structural connections between basic elements of a building—foundation, walls, columns and floor slab/roof should be such so as to allow safe transfer of the inertia forces generated by the earthquake. While the floor slabs and beams receive due attention, it's mostly the vertical elements such as walls and columns which fail under the stress and cause damage to the building.

III – RESULTS

The multistoried houses with abundant use of wooden beams are characteristic of Rajgari area. Similarity in the architectural principles and structural details suggest their possible evolution under one single architectural school. Locally available building material; long thick wooden logs, stones and slates are judiciously used for the construction of these structures. The height of these structures is observed to vary between 7 and 12 meters above the platform. These structures are observed to be four (Caukhat) and five (Panchapura) storied.

a. Raised Platform-

The multi-storied traditional structures are observed to be constructed on raised and elaborate stone filled solid platform (Fig.1) that is the continuation of the filled in foundation trench above the ground. In case of in situ rock being exposed the platform is observed to be raised directly over it. The height of the platform is observed to vary between 6 and 12 feet above the ground. Dry stone masonry is used for the construction of the platform. Massive solid platform at the base of the structure helps in keeping the centre of gravity and centre of mass in close proximity and near to the ground.



Fig1: Raised platform erected over in situ rocks to support the multi-storied structure.

b. Simplicity –

The structures are observed to be constructed on a simple rectangular plan (Fig.2) with the length and width varying between 4 and 8 meters. The ratio of the two sides of the structures is observed to vary between 1.1 and 1.4. The height of the structures above the platform is restricted to double the length of the shorter side (length or width). All the houses have a single small entry and relatively small openings. Strong wooden empanelment is provided around all the openings to compensate for the loss of strength.



Fig.2: Simple layout of the multi-storied structures.

c. Walls-

The walls of the traditional multistoried structure are raised by placing double wooden logs horizontally on the edge of the two parallel sides of the platform. The thickness of the walls is determined by the width of the logs (70 centimeters). The other two walls are raised with well-dressed flat stones to the surface level of the logs placed on the other two sides. The walls are further raised to 30 cms by placing heavy, flat, dressed stones upon the wooden logs on the two sides and by placing another pair of wooden logs upon the stones on the other two opposite sides. The four walls of the structure are thus raised using the

wooden logs and dressed up flat stones alternately (Fig.3). The structure is further reinforced with the help of wooden beams fixed alternately that run from the middle of the walls of one side to the other, intersecting at the center. This arrangement divides the structure into four parts and provides for joists supporting the floorboards in each floor of the building.

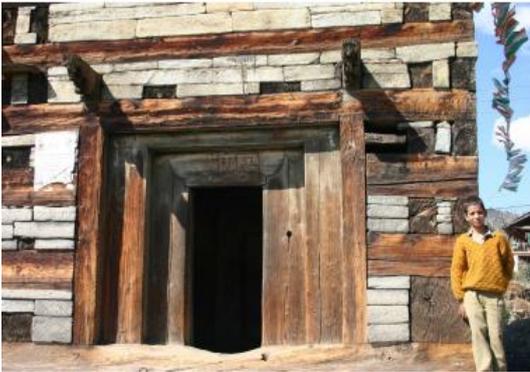


Fig.3: Wood – stone architecture of the walls of the traditional multi-storied structures.

ANALYSIS -

- The use of thick wooden logs running through the entire length of each of the walls alternately with heavy stones.
- At the corners the edges of the pair of logs on the adjacent walls are joined together by hammering thick wooden nails through them. This has the effect of turning the structure into a single piece construction.
- All the windows, doorways, ventilators and floor-joists are joined to these well-secured pairs of logs and these further strengthened the structure.



Fig.4: The vertical wooden beam on the side walls is considered to be a seismic safety related provision.

IV – CONCLUSION

Tradition of erecting structures over a solid and raised platform reduced overturning effect in these high structures. Construction style observed to be quite distinct and large number of the structures were observed to be built on similar fashion that is indicative of evolution of this particular Architecture in the region.

ACKNOWLEDGEMENT

I would like to express my gratitude to my guides Prof. Shubhashree Upasani and Prof. Anuradha Joshi for their thorough guidance. Their knowledge has helped me complete the research paper.

REFERENCES

- i. <https://www.thebetterindia.com/37649/earthquake-resistant-houses-koti-banal-uttarakhand/> Earthquake resistant houses by Shreeya Pareek 6Nov 2015
- ii. https://link.springer.com/chapter/10.1007/978-981-10-3521-0_14 Indigenous Realities and Community Involvement
- iii. <https://www.himalayan-gypsy.in/koti-banal/> Koti Banal Architecture a 900 year old historic marvel.
- iv. <https://www.jstor.org/stable/24102602?seq=1> Earthquake-safe Koti Banal architecture of Uttarakhand, India
- v. <https://www.emerald.com/insight/content/doi/10.1108/09653560910965655/full/html> elements in traditional Koti Banal architecture of Uttarakhand, India

Traditional Architecture of Sikkim

Author ¹. Kasturi Atmaram Kulkarni

Email:-kasturi.atm.kulkarni@gmail.com

Author ². Prof. Kamakshi Vaidya.

Email: - kamakshivaidya@gmail.com

Bharati Vidyapeeth college of Architecture Navi Mumbai 2015-2020

Abstract: The cultural background of Sikkim is expressed beautifully by a homogeneous mixture of religious practices and innovative traditions of the people. Sikkim's tradition, culture, ecology and its territory are an important and interconnected asset of the state. Since, Sikkim's boundary is attached to three more countries, the Indian Army has fought and defended our borders. There is a need to acknowledge the patriotism and bravery of the Indian Army.

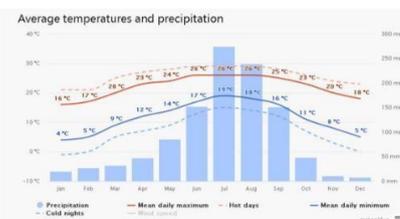
This research reflects a brief knowledge about Sikkim's lifestyle, dwellings, their traditional and sustainable construction practices. Structures constructed of wood/ bamboo in traditional methods performed quite well during earthquake, is Sikkim falls under earthquake prone regions in India.

This research studies construction techniques of the traditional Sikkim housing typologies

Key words – Traditional construction material, Earthquake resistant structure, Sustainable, Housing styles

INTRODUCTION

Climatic condition of Sikkim



Summers temperature- Maximum Average of 22° in summer from March to June

Winter temperature – Minimum average between 4°C (39°F) and 7°C (45°F). Snowfall is quite rare and freezing is also rare



The annual rainfall is 2638mm **Considering the climatic condition the construction techniques are involved.**

CONSTRUCTION TECHNIQUES IN SIKKIM

It was a common practice in Sikkim to build residential buildings using wood/bamboo, until tourism industry got a boost in early nineties

- Such traditional constructions performed quite well during all the ground shaking during the earthquake, is Sikkim is spread over the seismic region of the Great Himalayas. Thus, Sikkim falls into earthquake prone regions in India.
- Most major old buildings in Sikkim are made of stone masonry with mud mortar Generally stone masonry buildings suffered substantial damages during the earth shaking
- Presently, RC frame buildings with masonry infill are mostly used in private as well as government constructions
- There is no formal design practice in Sikkim even for RC frame buildings.
- Except for a very few RC buildings involving major projects, analysis and design are generally not carried out: The structural drawings are designed based on previous experiences of engineers using a few thumb rules.

Most of the new RC buildings in Gangtok suffered varying degree of damages during this earthquake: including the existing secretariat building, however no complete collapses were seen.

TRADITIONAL CONSTRUCTIONS

- Traditional construction in Sikkim consists mostly of typical bamboo houses, known locally as Ikra same as what is otherwise known as Assam type housing
- Typically, Ikra houses are single story structures consisting of brick or stone masonry walls up to about 1 m above the plinth
- This masonry supports the walls consisting of bamboo woven together with wooden frame and plastered with

cement or mudplaster

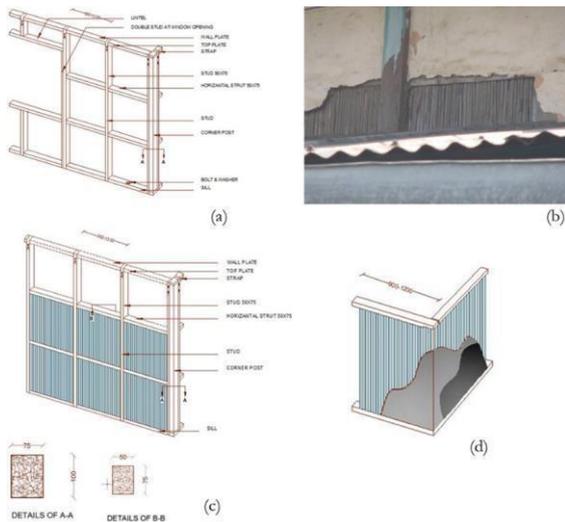


Figure – 1 Traditional Construction

Source: <http://db.worldhousing.net/building/154/>



MATERIALS AND METHODOLOGY
DIFFERENT STYLES OF TRADITIONAL
CONSTRUCTION TECHNIQUES IKRA HOUSE

- Roof generally consists of GI sheets supported on wood/bamboo trusses which in turn connects the parallel walls laterally.
- Bamboo superstructure is connected to the masonry foundation walls using steel angles and flats with bolts and nails.
- There were no reports of any significant damages to Ikra structures during earthquakes

Figure – 2: Bamboo strips plastered with mud or cement Bamboo posts without bracing: susceptible to shaking and accidents. Bamboo posts with diagonal bracing of splt end bamboos.



- This type demonstrates some of the basic principles of earthquake safe construction of nonengineered buildings.

There's appropriate sitting and location on firm soils along with good building configuration.

- Its form and shape in plan and elevation; location and size of major structural elements; number, location and size of openings; and connection details of non-structural elements with main structural system.
- Such houses have a proper integral action due to which they act as a single unit. This can be owed to the proper connection between the elements

LEPCHA HOUSE

The Lepchas of the eastern Himalayas in India have developed this art of ancient architecture which is closely bound to nature and their respective environment. Vernacular materials are used for the building and the characteristics of their local surroundings are taken into consideration.

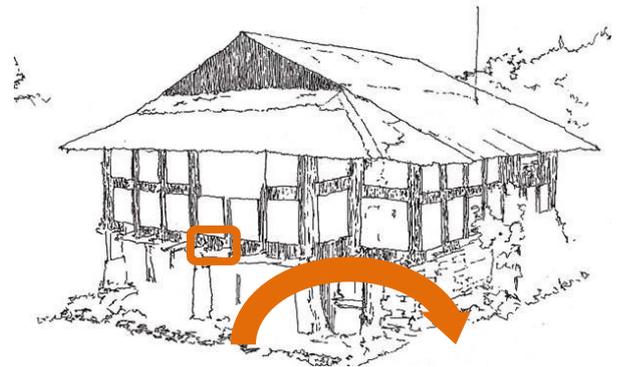
The main structure of the Lepcha house is of wood and uses the principal of center of gravity as its basis. The house is constructed square in shape. The size cannot be tampered with addition or subtraction of rooms once it's finished building. The base of the house has a huge center pillar made of one solid tree i.e. "KAAOO DAMPHU". The outer bars of the tree are peeled off and the wood is roughly dressed. Accordingly, eight additional center pillars are placed surrounding it in three rows with equal spacing in between.

They are known as "KAADEN DAMPHU". These nine pillars are each made from the entire tree length. There are other additional supporting pillars called "KAADOOM DAMPHU". The four pillars supporting the cooking space are known as "THOP DAMPHU". The front part of the house is on alleviated land. All of the pillars are placed on top of a round stone called "KAADEN LONG". This elevated pillar structure prevents the house from sliding when hit by natural calamities. These nine gigantic pillars of the whole tree size and length show the most marvelous and devious art form of building a Lepcha house.

Notches are made on all four sides of these nine huge tree size pillars, then they are raised and long cross beams, called "DOONG", also made from an entire tree length, are inserted through these notches, thereby holding the pillars together and preventing them from falling down. In the joints of the notches, wooden pegs or wooden wedges are nailed so that the inserted wooden cross beams do not loosen or come out. These pieces of hard woods which are set in to join two wooden planks tightly are called "AYAOK ZO ZA". Not a single iron nail is used by the Lepcha in building this gigantic house.

- Lepcha house made up of stone, timber, bamboo.
- It has designed to be earthquake resistant building on ancestral knowledge transmitted from generation to generation.
- The flooring planks, beams, joist beams, cross

beams, rafters, battens used in the house are all very thick and roughly smoothed and dressed with axe and knife.



- 4 to 5 feet
above ground,
rectangular in
shape made of
Bamboo.

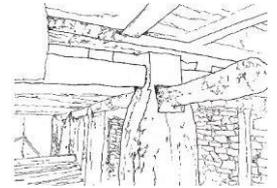


Figure – 4 lepcha construction technique

BHUTIA HOUSE

The Bhutias normally reside in cluster, similar to how the Lepchas and the Limbus do. The housing pattern among the Bhutias has drastically changed since iron-roC., stone-chip sand cement culture I R. C. Culture 1 have included inside Sikkim after black-paved serpentine road construction started. In this respect B. R. c., Bacon and Greed made claim their unprecedented success in changing the material traits of the Sikkimese for the last few decades. Jingling sound of the Bells of the mules and ponies on the uneven brittle path are no longer heard. No youth can dream hundreds of pack animals going either upward towards Nathu la and onwards towards Lachun. Evidently the housing pattern has been changing fast wherever one can lay down motorable roads. Most of the houses of the Bhutias and Lepchas are two storied rectangular structures.

These houses are constructed on taller-stone foundations and they are often supported by poles made up of tree trunks. The ground floor of each house is partially enclosed where domestic animals are especially cattle are kept. Houses made of wood and bamboo splits plastered with mud. The roof is thatched with reed, straw and bamboo and the walls of these houses are often made up of clay matenals. The technique of building houses by the Nepalese is different from that of the Bhutias about which we are not going into detail at present. Anyway, from the aforesaid description of traditional house-model of the Bhutia In Sikkim it shows that traditional houses deserve stone-mud- wood culture in the area where rain-fall in not adequate above 10 thousand feet. Since the Britishers introduced corrugated tlll, presently roofs are in many cases particularly in eastern

Sikkim. covered by the corrugated iron-sheets. It means the housing model undergoes changes according to the availability.

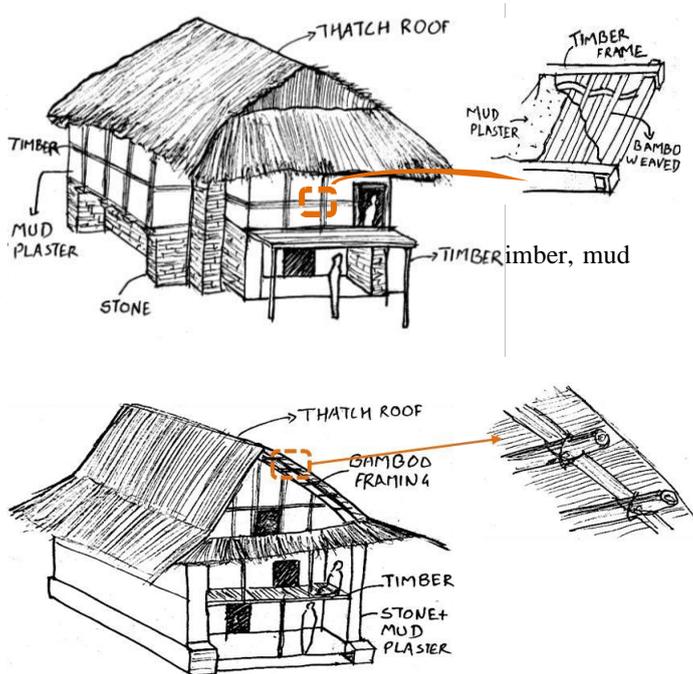


Figure 6: (a) Nepali house in Sikkim

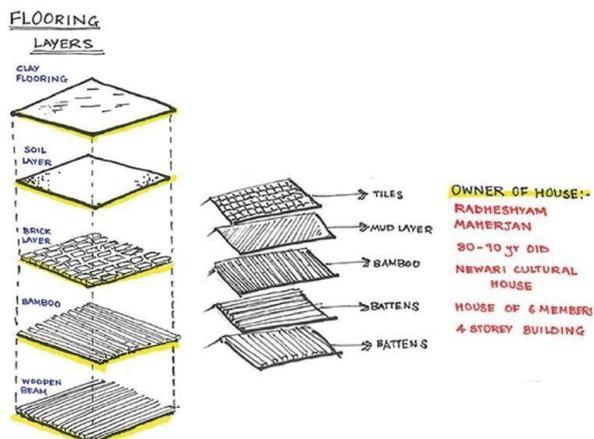


Figure 6: (b) Material of Nepali house in Sikkim

TRADITIONAL MUD HOUSE.

- Mud is used for construction in rural areas. Why? It is readily available and also widely accepted.
- In this mud house, walls above sill level are made with mud. The COB Technique is used extensively.
- Fiber glass tiles, interspersed with Mangalore tiles, provide

adequate lighting inside the house.

- Shahabad stone flooring used here is economical compared to normal cement concrete flooring

STONE MASONRY HOUSE

This structure is constructed with two types of walling - Random Rubble Masonry in ground floor. Cement Concrete blocks in first floor. The roofing is with precast RCC panels over precast joists for the ground floor and Micro concrete tiles for the first floor. Roof water harvesting is provided to supplement the water needs in view of its scarcity in the region.

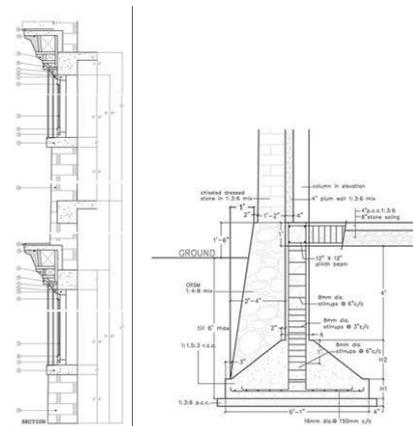


Figure 7: Strip section and foundation detail Source:

<https://www.abhinavmishra.co.in/rabong>

TRADITIONAL MUD HOUSE.

Mud is used for construction in rural areas. Why? It is readily available and also widely accepted.

In this mud house, walls above sill level are made with mud. The COB Technique is used extensively. Fibreglass tiles, interspersed with Mangalore tiles, provide adequate lighting inside the house. Shahabad stone flooring used here is economical compared to normal cement concrete flooring.

LATERITE HOUSE

Laterite is a brick-like stone. It has red or brown superficial deposit of clay or earth, which accumulates on the rocks' surface.

The walls made with laterite stones are strong and cost saving. The micro concrete tiles used for the roof are durable, economical as well as light-weight.

Bethamcherla stone flooring used here is an alternative to the normal

artificial stone flooring and provides an elegant look

WATTLE & DAUB WALLING HOUSE:

This one here is a traditional Sikkim house. It is constructed using Wattle and Daub walling in between the Stabilized rammed earth columns, hence the name. What's more, it is economical and long-lasting.

The rammed earth columns are provided with vertical bands. These are, in turn, monolithically cast with horizontal bands at plinth and roof level. It helps make the structure stable and earthquake resistant.

CONCLUSION

The conclusion behind my research is to preserve the traditional techniques of Sikkim which will enrich and retain the culture. Traditional earthquake resistant techniques are ignored in favour of modern construction techniques.

This research reflects the importance of merging traditional techniques with modern technology using sustainable materials, site and climatic conditions and aesthetical features.

ACKNOWLEDGEMENT

I express my gratitude to everyone who supported me throughout this project, most importantly Ar. Arson Subba from UD and HD Dept, Govt. Of Sikkim. And Ar. Diavan

from Sikkim And army officer Ranvir Singh.

I sincerely and wholeheartedly thank my parents, Ketaki and Aditi for their unwavering belief and support throughout this project.

REFERENCES

- I. <http://www.thesis.bilkent.edu.tr/0003007.pdf>
- II. http://www.ijmer.com/papers/vol2_issue2/BW22422426.pdf
<https://aachuley.wordpress.com/2011/06/14/lepchas-and-their-art-of-building-earthquake-resistant-traditional-house/>
- III. <https://www.abhinavmishra.co.in/rabong>
- IV. <http://www.bvmengineering.ac.in/misc/docs/published-20papers/civilstruct/struct/101078.pdf>
- V. <http://db.worldhousing.net/building/154/>
- VII. *Book- Vernacular Architecture Sikkim with Bamboo and Stone*
- VIII. *Book- The culture heritage of Sikkim*

A.C.T.I.V.E. – Altering Cognition Through Interactive And Voluntary Engagement

Kevin Kaushik Shah, Snehal Gaikwad

Rachana Sansad's Academy of Architecture (Aided), Mumbai (2020-2021)

Emails: kevins16@aoamumbai.in, snehalg@aoamumbai.in

Abstract: Cities are constantly under transformation causing appropriations in the natural sociability, built form, space and environment of the cityscape. Such alterations have an impact on the well-being and cognitive abilities of the people. The instance of the Koli community in Versova Koliwada, Mumbai which faces extreme socio-cultural and environmental vulnerability is taken as a case for study. The daily routines of habitant users groups & their cognitive behaviours are mapped and compared based upon the variables of WHODAS 2.0 questionnaire. The study finds out that there are overlaps between the places of occurrences of social and cognitive stimulation, and a majority of these activities occur in and around the livelihood common areas which are volatile in condition.

Keywords: Social Engagement, Environmentalism, Cognitive Functioning, Community participation, Behavioral mapping, Active participation, Versova Koliwada.

I.INTRODUCTION

With the nature of the city canvas shifting rapidly towards growth and urbanism, the lives of the people are becoming more and more neglected and directionless. Although cities might be constantly expanding and reforming in terms of industrial, economic and demographic changes, the overall well-being of the people in the cities is compromised and on the side of degradation. Work culture is slowly taking over the major part of the lives of people in urban centres, shifting boundaries of public and social arenas. Increasing sense of (not) belonging & relatedness plays a very crucial role in affecting and determining the social status of a person. The scarcity of financial, spatial, and physical resources for the

city commons creating a larger social divide - an urban paradox.

Social engagement - a preamble bond:

Social engagement is one's involvement or participation in social activities of a community or society with various

members involved. Social engagement often leads to social interactions among participants. The leading conceptions of adult functioning portray

well-being as a primarily private phenomenon.¹ On the contrary, well-being and health, which are correlated, are

subjected to other determinants, such as social systems and life circumstances. A cumulative formation of people, spaces, and motives together formulate the structure of social engagement. The social relations of a person cause stimuli for producing meaningful social interactions. This exchange of ideas and dialogues with one another is the primate form of communication for maintaining relationships.

Cognition on the other hand is a process of receiving, perceiving and interpreting a set of information that the mind intakes. For performance and activation of such processes, an exchange is crucial without which the mind has nothing to interpret.

Cognitive Functioning:

Cognitive capacities refer to memory, thinking, reasoning, problem-solving, planning and processing speed and are also broadly described as aspects of human intelligence. Abilities such as reasoning, information processing speed and the higher-level planning and executive function appear to decline more with normal ageing and have been described as 'fluid' abilities or 'mechanic abilities'. Abilities involving the accumulation of knowledge and

¹ Social Psychology Quarterly, Vol. 61, No. 2 (Jun., 1998)

expertise appear to increase slowly through adulthood and are less vulnerable to ageing.²

Socio-cognitive interrelationship:

Formal and informal participation in social activities are important influences in shaping cognitive abilities. The process of socialization challenges the brain and keeps it active. Effective social involvement and interaction are known to safeguard against the development of depressive symptoms. Low psychological resources negatively influence physical functions and cognitive wellbeing.

Space as an agent between social engagement & cognition:

The quality of experiences that a space provides, decides how we perceive information. Most importantly spatial configurations are the base grounds for interactions allowing cross discussions and exchange of thoughts, ideas thus forming the basis for mental stimulation and cognitive activation.

2. Bronfenbrenner’s ecological system’s theory :

The author recognizes multiple layers in a developing life that interact and affect the internal capabilities. The theory looks beyond individual development, taking into account wider influencing factors and the context (or ecology) of development.³ The theory identifies four major settings or systems of arrangement, each containing the next, arranged in the order of impact that they have in the life of an individual. The four systems are: Micro system; Meso system; Exo system and Macro system.

III. TOPIC OF RESEARCH

Scope:

The scope of the study is limited to communities with already existing social and cultural & cohesion settings. The analysis is based on the lens of social engagement and cognitive functioning and their overlaps.

Limitations:

The study is limited to a selected community/neighbourhood in Mumbai, focusing on micro scales, hence can be subjective in nature. The past/traditional environmental, family and social structures of the community are reviewed based upon available literature and surveys conducted on site. The study is independent of the clinical conditions/diagnosis that the respondents might be going through. The responses and observations are made irrespective of the pharmaceutical conditions of the respondents.

Research Question:

The social nature in the city of Mumbai is constantly under transformation because of rapid urbanization. What is the role of social engagement and community environment in fostering the cognitive abilities of a socially declining urban contingent?

Research Aim:

To understand the correspondence between social engagement and cognitive functioning in a culturally rich community setting. To analyse the impact of the contextual environment and changing life patterns on the social lives and cognitive abilities of the community.

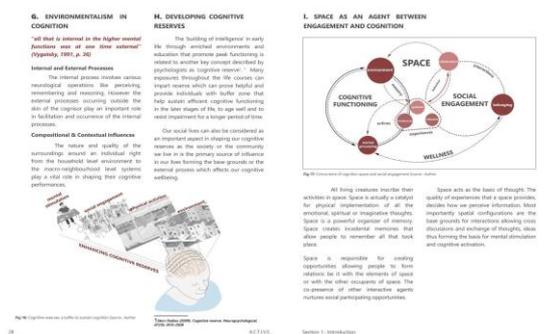


Figure 1: Space as an agent for socialization & cognitive enhancement; source: Author

II. LITERATURE REVIEW

1. Sociocultural theory of cognitive development by Lev Vygotsky:

The theory exemplifies the importance of society and culture in shaping and developing an individual. Family, friends, teachers, and society which form the primary agents of interaction for an individual, play a crucial role in the development of his/her sociocultural, learning and cognitive skills. The main assertion of the Vygotsky theory is that social interactions with people in a particular environment are prime influences of cognitive development in children right from an early age.

² Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline. *Developmental Psychology*, 23(5): 611–626. By Baltes Paul (1987)

³ Guy-Evans, O. (2020, Nov 09). Bronfenbrenner’s ecological systems theory. *Simply Psychology*

and intersections to provide findings for the research question. (Figure 2)

Site Selection: The study of existing social fabric of Mumbai, with respect to social engagement, cognitive functioning patterns and the play of environmentalism in socio-cognitive development lead to the formulation of the following criteria:

- The zone should be located in the city of Mumbai.
- The zone should portray a strong cultural presence binding its habitants together.
- Prevalence of common areas on the site, providing potential opportunities for social engagement.
- Evidence of transformation in the generic built form of the zone from the traditional existence.
- The socio-economic and livelihood character of the majority site habitants should be similar.
- The day to day livelihood, social and recreational activities of major site habitants should be concentrated within the geographical boundaries of the site.

Versova Koliwada shows the presence of strong cultural prevalence with major parts of the community involved in common activities of livelihood. Urban transformations are also evident within the setting, providing an opportunity for revival of the already existing but vulnerable social context. Hence, Versova Koliwada is selected as the final site for further study.

Research process:

Qualitative and quantitative research was carried out to achieve the aim of the study. A set of variables were decided for the evaluation of the site options. Each option was evaluated based upon the degree of presence of the selected variables. A comparative analysis between these options was done, and the most relevant option was selected for further studies. The chosen site was assessed in terms of its macro settings using various mappings. A comparative assessment of the past and present micro and macro social spaces was done to understand the impact of transformations on social patterns. To uncover the social and cognitive aspect of the community, daily lives of various prevalent habitant groups were studied in detail ranging from their livelihood, social, traditional, leisure and household patterns.

Cognitive responses from a limited number of respondents (Table 2) were taken through discussions and observations and ranked between high and low using WHODAS 2.0 Framework. (Table 1) These cognitive understandings were compared with the social presence on the site in terms of their association, places of occurrences

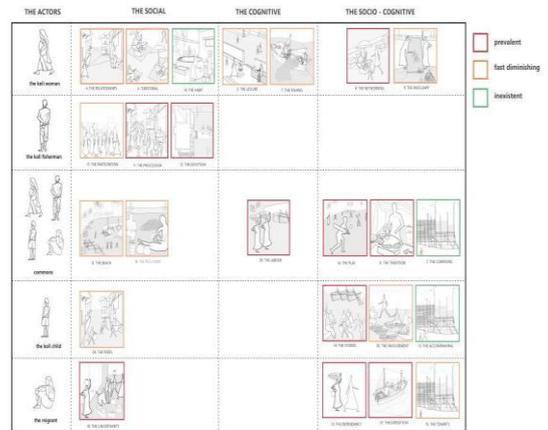


Figure 2: State of socio-cognitive activities on site; Source: Author



For comparing the presence and relation between the social and cognitive aspects in response to the context of Versova Koliwada and the hierarchy of the Koliwada, the structural framework of the WHODAS 2.0- Manual for WHO Disability Assessment Schedule is used for the purpose of collecting verbal responses from the respondents on site.

WHAT IS WHODAS 2.0 ?
 WHODAS 2.0 is a practical, generic assessment instrument that can measure health and disability at population level or in clinical practice. WHODAS 2.0 captures the level of functioning in six domains of the:

Cognition – understanding & communicating
 Mobility – moving & getting around
 Self-care – hygiene, dressing, eating & staying alone
 Getting along – interacting with other people
 Life activities – domestic responsibilities, leisure, work & school
 Participation – joining in community activities

WHY WHODAS 2.0 ?
 For all six domains, WHODAS 2.0 provides a profile and a summary measure of functioning and disability that is reliable and applicable across cultures, in all adult populations. It also provides a common metric of the impact of any health condition in terms of functioning.

LIMITATIONS :
 The structure of the WHODAS 2.0 by World Health Organization is only used as a reference and for formulating the variables of comparison. Some of the variables are modified/ altered depending upon the contextual need.

Also, the responses are recorded in a pictographical format and not filled in the WHODAS 2.0 tabular format. One or two respondents from each identified categories are interviewed on behalf of the entire user groups and their responses are depicted in the form of graphical comparisons representing their respective user typologies. The responses may vary upon individual to individual and time to time.

PLEASE NOTE: When scoring WHODAS, the following numbers are assigned to responses:		Score
0	No Difficulty	
1	Mild Difficulty	
2	Moderate Difficulty	
3	Severe Difficulty	
4	Extreme Difficulty or Cannot Do	
S1	Standing for long periods such as 30 minutes?	
S2	Taking care of your household responsibilities?	
S3	Learning a new task, for example, learning how to get to a new place?	
S4	How much of a problem did you have in joining in community activities (for example, festivities, religious or other activities) in the same way as anyone else can?	
S5	How much have you been personally affected by your health problems?	
S6	Concentrating on doing something for long minutes?	
S7	Walking a long distance such as a kilometre (or equivalent)?	
S8	Washing your whole body?	
S9	Getting dressed?	
S10	Dealing with people you do not know?	
S11	Maintaining a household?	
S12	Your day-to-day work/school?	
Overall Score		0-100
H1	Overall, in the past 30 days, how many days were these difficulties present?	
H2	In the past 30 days, for how many days did you feel unable to carry out your usual activities or work because of any health condition?	
H3	In the past 30 days, not counting the days that you were totally unable, for how many days did you feel unable to do your usual activities or work because of any health condition?	

Table 1: WHODAS 2.0 Questionnaire. Source: WHO

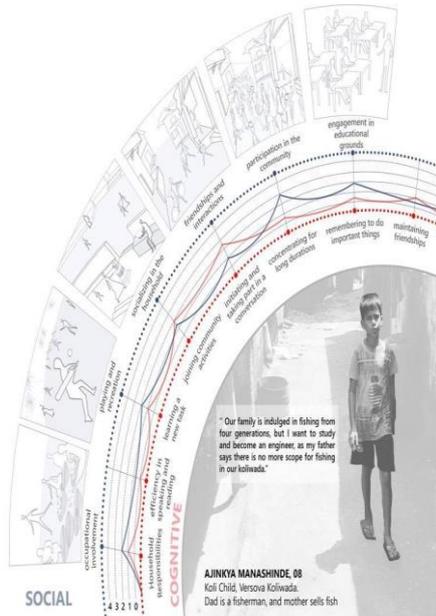


Table 2: Social v/s cognitive comparison of a koli child; source: author

Apart from the individual user group understanding and comparison between the social and cognitive frontier, the environmental aspects of the community are also analysed with respect to how socially inclined the community environment is. The common livelihood and public spaces of the community are assessed in terms of their condition, nature, accessibility and social nature. A comparison between the impacts of these common communal amenities in the past and now indicated gradual change that the community has undergone over the years.

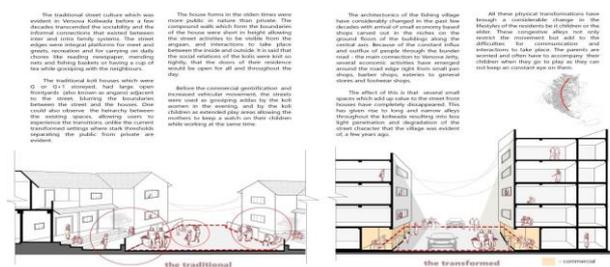


Figure 3: Traditional v/s transformed social nature of street in Versova Koliwada; source: author

RESULTS & TABLES

Social environment :

Area and Activity mapping highlighted that the major user groups have most of their daily activities concentrated around the beach, the fish market area and the Pandurang Ramle Road - the central axis. There are very less purposeful social grounds available in Koliwada, hence most of the occupational routines become important social and interactive places where they get a chance to engage with the user groups. The streets play an important role due to lack of space and inclusive nature of the kolis, however with the current nature of the central street any kind of social engagement is intermittent. (Figure 4)

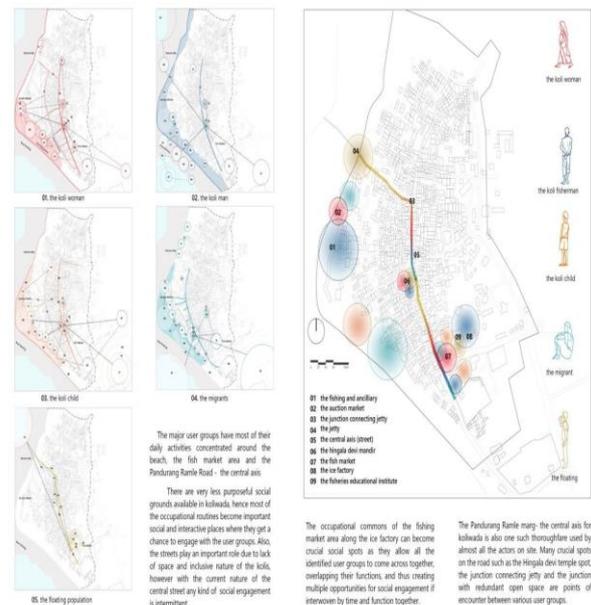


Figure 4: Cumulative social mapping for different user groups on site; source: author

Cognitive environment :

Almost all the user groups have overlapping occupational areas but the social and physical engagement spaces are different. The kolis are pessimistic in involving the migrants in communal activities but permit them for occupational support. The overlapping areas however are used by the user groups at different time cycles, not allowing merger between their usage patterns and hence not optimizing the true potential that these spaces have for becoming social and cognitive activity points. (Figure 5).

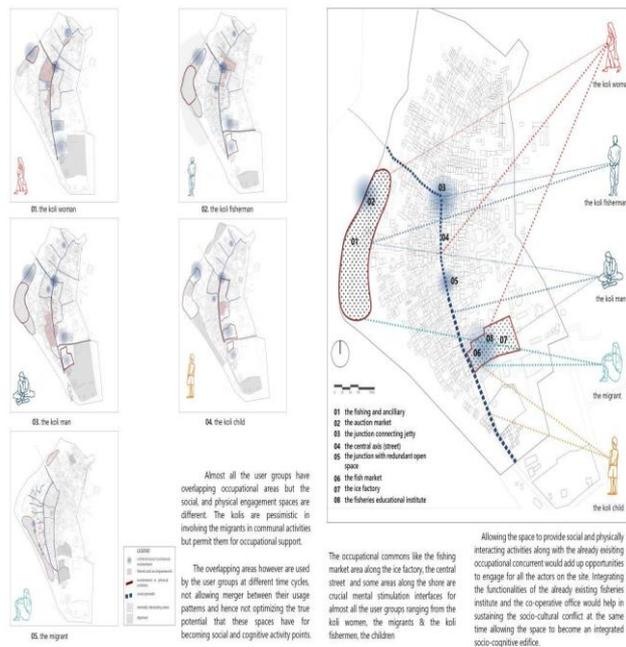


Figure 5: Cumulative cognitive mapping for different user groups on site; source: author

To summarize the cumulative research process with Versova Koliwada as the space specimen, it is realised that social engagement acts as a strong contingent in fostering the cognitive functionalities in the context of Versova Koliwada. The environment or spatial nature plays crucial roles in conditioning of the socio-cognitive processes. Increased or reduced instances of social engagement among the community are directly linked with the mentally stimulating capacities. Also, socialization tends to activate internal as well as external processing of mind.

After comparing the social and cognitive capacities of the users across site, it is evident that the process of cognition almost never occurs to a user in isolation. All the mental stimulations occur in spaces which are socially bound, through the means of interactions with other actors.

For example: A koli fisherwomen informed that she never knew how to use a mobile phone until a few years back, when all the women in the market started using one, she also had to upgrade in order to keep up and socialize. With deeply knit and intrusive livelihood patterns occupying most of their time, the kolis have no other means of mental stimulation and hence reduction in the social nature of the community shall directly impact the cognitive abilities since engagement is the primary base for stimulation for the kolis.

CONCLUSIONS

The nature & frequency of social engagement and interactions have a direct association with cognitive functioning capacities throughout lifetime in the context of Versova Koliwada. Environment fosters and activates engagement and mentally stimulating processes. The activities of different user groups which once used to coincide allowing engagement and interactions to happen are diverging in time and use.

ACKNOWLEDGEMENT

I am extremely grateful to a number of people who have helped me at different stages of the completion of the project. I would like to thank my guide Professor Snehal Gaikwad for constant motivation and critical guidance. A special thanks Bombay 61 Studio, to provide their valuable insights about Versova Koliwada.

REFERENCES:

- i. *Journal of Gerontology: SOCIAL SCIENCES* Copyright 2003 by The Gerontological Society of America 2003, Vol. 58B, No. 2, S93–S100
- ii. <https://academic.oup.com/psychsocgerontology/article/58/2/S93/557846?login=true>
- iii. Chanda, S., Mishra, R. *Impact of transition in work status and social participation on cognitive performance among elderly in India. BMC Geriatr* 19, 251 (2019)
- iv. *Impact of transition in work status and social participation on cognitive performance among elderly in India | BMC Geriatrics | Full Text (biomedcentral.com)*
- v. *Growing up in Rural vs. Urban Poverty: Contextual, Academic, and Cognitive Difference* by Michele Tine.

- vi.<https://www.intechopen.com/books/poverty-inequality-and-policy/growing-up-in-rural-vs-urban-poverty-contextual-academic-and-cognitive-differences>
- vii.Anstey, K. (2016). *Enhancing cognitive capacities over the life-span*. In KENDIG H., MCDONALD P., & PIGGOTT J. (Eds.), *Population Ageing and Australia's Future* (pp. 165- 184). Australia: ANU Press. Retrieved December 18, 2020
- viii.[ch08.pdf \(anu.edu.au\)](#)
- ix.Ettekal, A., & Mahoney, J. (2017). *Ecological systems theory*. In K. Pepler (Ed.), *The SAGE encyclopedia of out-of-school learning* (Vol. 1, pp. 239-241).
- x. <http://sk.sagepub.com/reference/the-sage-encyclopedia-of-out-of-school-learning/i3466.xml>
- xi.*Commoners as enclosers : Land tenure and conflicting claims in a koliwada : Shweta Bagh 2017*
- xii.(PDF) *Commoners as Enclosers: Land Tenure and Conflicting Claims in a Mumbai Koliwada | shweta wagh - Academia.edu*
- xiii.Gehres SW, Rocha A, Leuzy A, Loss CM, Viola GG, Zimmer ER. *Cognitive Intervention As an Early Non-pharmacological Strategy in Alzheimer's Disease: A Translational Perspective. Front Aging Neurosci. 2016; 8:280. Published 2016 Nov 29.*
- xiv. <https://dx.doi.org/10.3389%2Ffnagi.2016.00280>
- xv.*Gender, social engagement, and limitations in late life*
Patricia A. Thomas*Population Research Centre,
University of Texas at Austin, 1 University Station, 1800
Main Building, Austin, TX 78712, United States.
- xvi.<https://doi.org/10.1016/j.socscimed.2011.07.035>
- xvii.Bonnie M. Hagerty, Reg A. Williams, James C. Coyne, Margaret R. Early, *Sense of belonging and indicators of social and psychological functioning, Archives of Psychiatric Nursing, Volume 10, Issue 4,1996,Pages 235-244, ISSN 0883-9417,*
- xviii.[https://doi.org/10.1016/S0883-9417\(96\)80029-X](https://doi.org/10.1016/S0883-9417(96)80029-X).
- xix.(<https://www.sciencedirect.com/science/article/pii/S088394179680029X>)
- xx.*Social and Psychological Functioning* Bonnie M. Hagerty, Reg A. Williams, James C. Coyne, and Margaret R. Early.
- xxi.[https://doi.org/10.1016/S0883-9417\(96\)80029-X](https://doi.org/10.1016/S0883-9417(96)80029-X)

Parametric Architecture - Horizons of Future

Lata S. Adwani, Ar. Ramiya Gopalakrishnan, Dr. Vaidehi Lavand, Ar. Kanchan Shinde

SMEF'S Brick School of Architecture, Pune

Email: lataadwani83@gmail.com

Abstract: Parametric structures are emerging as a new trend in the field of construction industry due to availability of modern technology and tools. This advanced technology enables designers to explore parametric structures based on the thinking of algorithms and parametric expressions involved in the designing of such structures. This research paper outlines how parametric architecture affects the neighbourhood community in Indian context. It also explores the parameters that contribute to the development of parametric structures in the context. It helps in understanding the difference in user experience and their response towards parametric structures and other vernacular structures in the context. These parametric structures are analyzed based on the user activity, approach of professionals and impact of these structures on the neighbourhood community.

This research paper helps in understanding different user groups and their approaches for the development of new emerging parametric structures in the context. At last, it summarizes the future scope of parametric architecture in Indian context.

Keywords – Parametric architecture, User experience, Visual perception, Design elements

INTRODUCTION

In the past few decades, technology has played an important role in shaping the construction industry. Availability of modern technology and tools have benefitted the architects to explore complex geometries with less time and more ease. With the help of computational tools, the manpower needed for any design project has decreased substantially. Parametric design is the design which is evolved with the use of relationships of parameters between the design elements to define a form (Monedero, 2000). Parametric design appeared in the field of architecture in the seventies, with the need for methods to describe curves through parametric equations. In 1967 Steve Coons was the one who proposed the definition of skewed surfaces by the subdivision in compound patches of four edge curves defined by similar equations for easier operation (Alvarado & Muñoz 2012).

Parametric structures are gaining popularity in the world because of its dynamic shape and complexity. Architects have also started adopting these newly developed construction technologies to make their designs more aesthetically appealing. India being a developing country has also begun to acquire these new technological advancements in the field of construction. However, the development of parametric structures is limited to certain cities in India like

Mumbai, Delhi, Ahmedabad, etc. Mumbai, one of the major cities in the Indian context has started construction of parametric structures and attracting the local people and tourists in the city due to its dynamic form and design elements. As these structures are attracting different user groups, it has an impact on the neighbourhood community. These structures are developing day by day and contribute to the overall development of the city.

Most of the research in this field is aimed at understanding evolution of parametric design in foreign countries. However, In a country like India which has a rich cultural background, the response of people towards such new parametric structures will be interesting to understand. The transition from local cultural context to newly developed parametric structures is critical and therefore needs to be designed sensitively. The positive approach from the neighbourhood community is very important for successful execution and working of such structures. People are fascinated by the appearance of parametric structures and thus visual perception of structure plays a major role in attracting the local people and tourists in the area. The visual perception of a structure form could be integrated while designing parametric structures with respect to the context. The relationship of visual perception with parametric design is critical and should be better understood while executing in urban places or built environments. A possible way to make these structures more efficient, effective, context sensitive is by integrating parametric design and visual perception in a holistic manner (Tamalee Basu and Mainak Ghosh 2017).

Aims and Objectives of the study - The aim of this research is to understand user approach towards parametric architecture in Indian context. The objectives of this study can be stated as -

- To examine user perspective about the existence of such structures and future possibilities within the context.
- To study how different parameters affect the user experience and their approach towards parametric architecture.
- To study the factors that contribute to the development of parametric structures in the city.

LITERATURE REVIEW

Parametric Architecture

Since the past few years, digital media has influenced the architectural field in terms of the whole design process involved while designing any project. With this digital technology conceptual design has experienced a new way of expression. This design process leads to an advanced design style known as parametricism (Schnabel 2007). Parametric design includes evaluation of form with the use of parameters that determines association of components involved in a design. (Monedero 2000). Parametric design can be defined as an exploration process of complex relationships between the elements of geometric concepts (Woodbury 2010).

The emergence of parametric design

In the earlier research done on the parametric designed structures, the research was mostly focused on the study of the design process while developing parametric structures. It also studies how parametricism has evolved since years to assist architects and other professionals related to this field to explore their designs more in depth in terms of complexity. Furthermore it also focuses on the study of how parametricism has changed the overall scenario from the past and how the parametric structures are emerging as a modern trend and thus would become an integrated part in the field of architecture. The significance of such structures was put forward with the help of an example of a Sydney opera house which is considered a masterpiece by many architects and engineers today (Nadine Al-Bqour 2020). Therefore design of such structures could generate notoriety and make the area inviting to the local people and tourists.

METHODOLOGY

As parametric architecture is evolving day by day, the architectural field has to adapt and improvise accordingly. While proceeding with the research, a questionnaire was prepared to understand people's point of view on the improvisation of such design philosophies. These questionnaires were then circulated among two groups of people which consisted of practicing architects and common people. The lens through which both the selected groups look towards parametric architecture was studied. Architecture is all about the experience of users, their needs and their well-being. Therefore to study approaches of different user groups from common people, quantitative methodology has been explored. A questionnaire was prepared for the common people based on the parameters that affect the people's response towards parametric structures. As we looked towards the common people we had to consider these people lacked the technical and detailed knowledge of the subject. They would connect to such structures through visual perception and the kind of feeling and emotions such structures generated

in them. An attempt to record the amount of comfort and linkage they would feel visiting such spaces was made through questionnaires. As parametric structures are emerging as a new trend in rich cultural Indian context, there are some limitations for its execution. There is a need to understand real challenges faced by the professionals during handling the project of parametric structures on and off site. Therefore the professionals were appointed with the questions which filtered their approach towards the new design methods. It was of utmost importance as this was the sample group which could also determine the conceptual and practical value of such designs. Architecture professionals always have a chance to test such designs on site and does a reality check. They are also capable of deducting a conclusion based on their experience on what would be their preference if subjected to choose between the two styles of architecture. Whether it be a practicing architect or a training architect as with insight of the subject their opinions were of great value to the research. These questions were directed in order to determine the vision of professionals about the developing trends of parametric architecture.

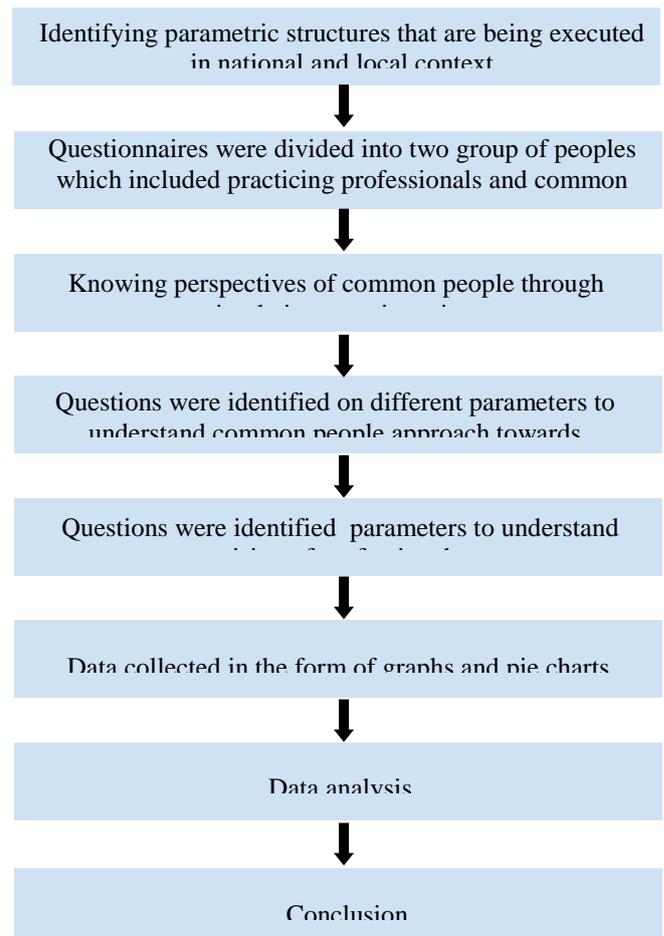


Figure - 1 - Flow chart explaining flow of methodology

RESULTS

Among the group of common people chosen for the survey, responses from 60 people were recorded. The participants selected for conducting the surveys consist of youngsters with different professional backgrounds, thus providing flexibility of thoughts within a group of people which guides in finding required results through various lenses.

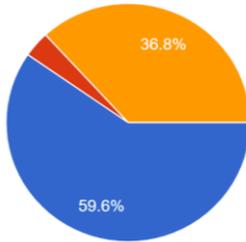


Figure 2 - Results of respondent's preference for visiting parametric structures versus conventional structures

In this question participants were provided with some pictures of parametric structures and conventional structures. Participants were asked to choose their place of interest to visit from the given pictures. 3 photographs were provided in which 1 photograph was of Indigo deli cafe in Mumbai (image 1.1) and two other photographs were of other conventional cafes in Mumbai. As shown in Fig 2, the results from the pie chart shows that the majority of the people prefer to visit Indigo cafe because of its dynamic form and volume which makes space more interesting.



Image 1.1 - Indigo deli, Mumbai

Source-<https://parametric-architecture.com/indigo-deli-by-sameep-padora-and-associates/>

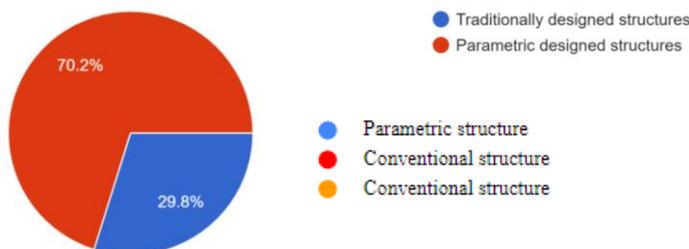


Figure - 3 Pie Chart showing percentage of people interested to invest in parametric structures

The respondents were asked to take a decision on what kind of structures they would like to invest in future. This question was put forward to know if the people are likely to invest in parametric structures or not if compared to conventional structures. The results from the pie chart (Fig 3) shows that the majority of people are likely to invest in parametric structures rather than traditional designed structures.

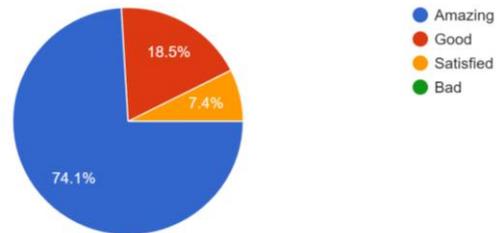


Figure - 4 Pie Chart showing user experience after visiting parametric structures

To understand the experience of different user groups, a question was put forward to the participants to know if they have visited any such parametric structures and how do they feel about being in a place which has dynamic form and aesthetics. The results from the pie chart (Fig 4) shows that the majority of the people have amazing experience during visiting such structures and would like to visit such structures again.

To understand the vision of common people about building more such parametric structures in the future, a question was put forward to make their choices. Almost all the participants demand for bringing more parametric structures in the future in the Indian context. At the end of the survey, it was observed that most of the people feel that parametric architecture has a lot of scope for creativity in the field.

DISCUSSION

Interviews were conducted among a group of practicing professionals to understand their point of view. The group consisted of professionals of age group of between 30-50 years. It was observed that availability of skilled laborers and economical restrictions are the major factors that affect the development of parametric structures in India. In the discussion the average practicality of the parametric structures noticed was between 50-75 %. Most of the professionals believe that parametric architecture is affecting positively to the context and they would like to hire new architects with parametric thinking into their firm. From the discussion it was observed that most of the professionals think that parametric structures can be successful if designed sensitively considering existing fabric of surroundings and climatic considerations and also think that parametric architecture has huge scope in the Indian context as it opens new doors of inventions in the construction industry.

CONCLUSION

Through this research, some insightful discussions were derived from the professionals and common people from knowing parametric structures to its advantages and needs in the construction field. After receiving positive response from the professionals and common people, the main conclusion can be drawn is that parametric architecture despite having limitations in the Indian context can contribute to brighter future opportunities in the construction field.

ACKNOWLEDGEMENTS

I am solemnly thankful to my guide Ar. Kanchan Shinde, Dr Vaidehi Lavand, Ar. Ramiya Gopalakrishnan for providing valuable guidance, inspiration and expertise that greatly assisted the research and helped me arrive at required inferences and conclusions.

REFERENCES

- i. *Basu T. Ghosh t. (2017) Visual Perception of Space and Parametric Design: A Brief Discussion, Houston, texas. GSTF.*
- ii. *Suyoto W. Indraprastha. A (2015) Parametric Approach as a Tool for Decision-making in Planning and Design Process. Case study: Office Tower in Kebayoran Lama. Bandung, Indonesia. Procedia.*
- iii. *Bqour A. N (2020) Parametric Thinking for Designing structures in Contemporary Architecture, USER.*
- iv. *Hazbei. M, Cucuzzella. C, (2019) Comparative analysis of architectural aesthetic in façade verses interior space in parametric designed building. Montreal, Quebec, IDEAS.*
- v. *Assasi R. (2019) Parametric Design, A Historical and Theoretical Overview. Toronto, Ontario, ACETA*

Sustainable facade for commercial buildings

Madhur Agrawal, Ar. Preeti Kale

Dr. D.Y. Patil College of Architecture, Akurdi, Pune.

Email: madhuragrawal1208@gmail.com

Abstract :Nowadays it becomes very essential to practice sustainability. As you know most of the buildings have full glass façade which trap heat; make human discomfort and increase the consumption of air conditioning. The aim of this research paper is to make people aware of the right façade design for their climatic region. So The objective of this paper to study the different types of material and technologies and how to reduce the mechanical sources of ventilation also, it should be cost-effective, durable, climate-responsive, and aesthetically pleasant which helps us in designing the most sustainable façade for commercial buildings.

Key words: Sustainability; carbon footprint; human comfort; climate-responsive; façade; thermal comfort;

I. INTRODUCTION

These days most of the commercial building just adopting the western façade technologies; Providing glass façade is become very common but it adversely affecting environment. Energy consumption in commercial building increase sufficiently. More no. Of Air conditioner are widely used to make human comfort but it affecting the people health it makes peoples sick and people becoming dependent on mechanical mean of ventilation. The connection between indoor to outdoor atmosphere is become less. For good health human need good natural light and ventilation by designing sustainable façade we can achieve good human comfort and it also decrease the energy consumption and carbon footprint. For different climate zone different strategy is used. As this research paper is limited to Pune, Maharashtra region only. Façade is one of the building elements which can contribute to consume energy and human comfort within building. Energy and natural resource are depleting rapidly, so it is becoming important to study and designing façade which reduce the energy consumption and makes human comfort. By studying the climate of Pune, we come to know that Pune has hot semi-arid climate, using the strategy for this region will give us most suitable sustainable faced for commercial building. Façade must follow these functions:

- Provision of view to the outside.
- Resistance of force from the wind load.
- Bearing its own weight.
- Implementation of daylight strategies to Minimize use of artificial source of lighting.
- Protection from solar heat gain (harmful radiation).
- Protection from noise.
- Resistance to rainwater and moisture penetration.

II. MATERIAL AND METHODOLOGY

Selection of right material for the sustainable façade designing plays major role. In sustainable façade design there are two important factors to consider are as follow:

- Improve thermal performance of building envelops.
- Minimize thermal bridging.

Thermal bridging inside a wall happens wherein a fantastically conductive cloth, including a steel help, penetrates the façade's insulation layer. This may notably affect the thermal overall performance of the wall, and lower its powerful thermal resistance (Lawton et al., 2010). Thermal bridging can occur in all sorts of facades. Thermally unbroken aluminum mullions in curtain walls are rather conductive and transfer warmth from the outdoors to the indoors, lowering the general thermal performance of the facade. Fabric choice also has an environmental effect. It is becoming increasingly essential to pick materials that have the least poor effect on the surroundings. The existence-cycle assessment method may be used to determine environmental impacts of fabric selection, in which material contents, production techniques, energy necessities, and waste are analyzed to identify the real value of a cloth, reflecting the total amount of its environmental effect (ISO, 2006). Selecting materials based totally on the embodied strength information is also the correct approach for thinking about environmental effects. The embodied electricity is the quantity of power required to extract, method, transport, set up, and recycle or remove a fabric, and is commonly measured in keeping with mass or volume of the fabric. While evaluating the embodied energy of facade systems, the measurements have to be based totally on location in preference to mass or quantity, considering the embodied energy of character additives and materials of the façade. Different types of sustainable façade technologies, both currently used as well as futuristic approaches will be studied in detail. Analysis of the thermal behavior of different façade systems and materials along with case studies of façades from varying climatic zones will be carried out.

III. CASE STUDY

The selected buildings have been already evaluated using one of the score structures or standards for high-overall performance homes, and their power overall performance statistics (metered or simulated) become available. The

selected homes had been occupied for at least 2 years and feature as a minimum 5 floors. To make bigger the evaluation, six buildings with exceptional plan profiles (rectangular, square, L-shape, and i-shape), electricity-saving techniques, and building envelope substances are selected.

The homes decided on for are as follows:

- ITC Green Centre, Gurgaon
- Wipro Technologies, Gurgaon
- Infosys, Hyderabad
- Volvo-Eicher Corporate Headquarters, Gurgaon
- Indra Paryavaran Bhawan, New Delhi.

From the chosen case research except for Indra Paryavaran Bhawan (IPB), power consumption records were acquired thru simulation at the same time as IPB constructing energy performance records has been obtained thru power audit of metered intake.

1. ITC Green Centre, Gurgaon.



Figure 1 View of ITC Green Centre, Gurgaon

ITC Green Centre, located in Sector 3, Gurgaon, was one of the first buildings in India to adopt green building practices and is still considered a benchmark for green buildings. ITC Green Centre achieved the twin aims of allowing abundant natural light and reducing heat gain in the interiors by using advanced high-performance glazing solutions (HPCB, 2010; ITC Green Centre, 2017). With a built-in area of 15,799 m² (of which 9294 m² is air-conditioned and 6505 m² is non-air-conditioned), the ITC building includes features such as solar thermal technology, reflective high-albedo roof paint, minimal exterior lighting, separate smoking rooms with an exhaust system, and zero water discharge. More than 10% of the building materials were refurbished from other sites, and 40% of the materials were obtained from within 500 miles of the project site.

2. Wipro Technologies, Gurgaon



Figure 2 View of Wipro Technologies, Gurgaon.

Wipro technologies, Gurgaon, was honoured by means of the US green building Council in 2005 with a leadership in power and Environmental layout (LEED) platinum award (fifty-seven factors), which makes it the second-highest platinum-rated green building in the international and the best platinum-rated green building in India. The primary focus of the design is the inverted cone strategically placed at the pass junction of roads, which presents visibility to the building. The open-to-sky panorama courtyard is the most hanging characteristic of the constructing, which keeps it cool at some stage in summers because the courtyard partitions obtain mutual colour and continue to be cooler than the outdoor walls. Furthermore, all of the open office areas neglect the courtyard, which consequently permits appropriate get admission to sunlight hours and maximizes the outside view. The courtyard acts as a multifunction tool, mild nicely, microclimate generator, and social area (The 3C organization, 2017). A discounted common warmth conductance from the envelopes and features together with terrace gardens, excessive-performance glazing with top-of-the-line visual mild transmittance, exterior mild cabinets, overhangs on all of the windows, green chillers, efficient lights, and sufficiently daylit indoors spaces with photo sensor controls make Wipro technology an exemplary energy-efficient building (fifty-one% savings over the ASHRAE base case; ASHRAE, 2013). Furthermore, the wooden used for the development of the constructing turned into sourced from shipwrecks at Jamnagar port (layout and development, 2016).

3. *Infosys, Hyderabad*



Figure 3 View of Infosys Hyderabad

Software development Block 1 (SDB-1) in the Infosys campus, Hyderabad, has cooling systems, particularly a variable air extent (VAV) device and a radiant cooling machine with a committed outside air gadget, within the halves of the building. Hence, the Infosys campus was the primary radiantly cooled building in India, which resulted inside the world's biggest HVAC side-via-facet assessment. Therefore, the constructing is surprisingly instrumented to measure the have an impact on of those two systems. Other techniques followed to reduce strength intake consist of suitably orienting the building (north-south orientation) and optimizing the WWR ($< 30\%$) to reduce solar heat benefit. The usage of external shading and mild cabinets maximizes the quantity of daylight inside the dwelling region and reduces glare. Capabilities consisting of natural air flow, an ECBC-compliant building envelope (Srinivas, 2005), water-efficient landscaping, low-electricity green constructing substances, solar panels, electricity-efficient fixtures with occupancy sensors, and wastewater recycling and reuse enabled SDB-1 to gain a 5-celebrity rating from GRIHA (GRIHA, 2018).

4. *Volvo-Eicher Corporate Headquarters (VECH), Gurgaon*



Figure 4 Volvo-Eicher Corporate Headquarters (VECH), Gurgaon

VECH, positioned in area 32, Gurgaon, turned into designed with the aid of Romi Khosla layout Studios. The constructing received the arena structure Award and LEED platinum rating in 2012. VECH turned into meant to be a nation-of-the-artwork metallic building with the minimal possible usage of energy and assets in its creation and operation (Singhal,

2014). The VECH building has specific diagonally braced steel structure units outside the main constructing envelope, at the back of which square-fashioned building blocks made almost entirely of glass and metal are located to the east and west of a significant circulate middle. The building structure is designed to have column-unfastened area, which increases the quantity of workspace available for offices, thereby allowing better sunlight hours penetration in the constructing and providing flexibility for future realignments and reuse of the building area. Furthermore, a series of double-curved louvers are hooked up in the constructing. The louvers are willing at certain angles for reflecting the sunlight such that an excellent mild depth is achieved during the office space. Therefore, negligible artificial light is needed within the workspaces (Romi Khosla layout Studio, 2017). A large share of reused substances and a very excessive percentage of renewable substances, mainly railway sleepers and tiles crafted from 30% recycled content, had been used throughout the construction of the constructing. The HVAC system runs below the floor and comprises a heat recovery device that reduces the air-conditioning load of the constructing by 30% (Khosla, 2017). Moreover, all the lighting paintings on movement sensors, and the bathroom and kitchen water is recycled.

5. *Indira Paryavaran Bhawan (IPB), New Delhi*



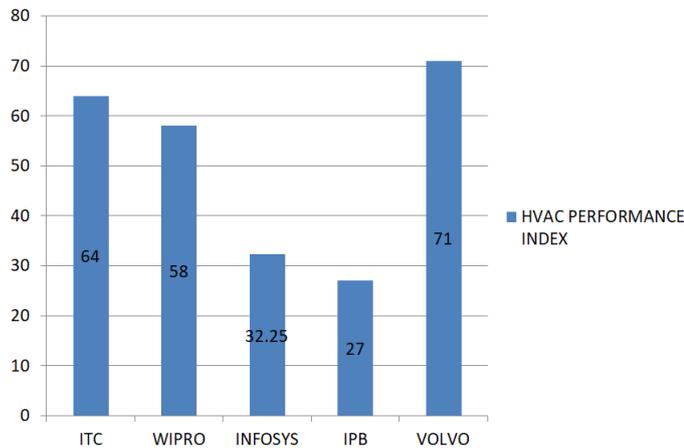
Figure 5 View of Indira Paryavaran Bhawan (IPB), New Delhi

IPB has the very best green score in India and is situated at Aliganj, Jor Bagh road, New Delhi. The constructing has applied strength and water communication measures to comply with GRIHA's five-big name certification and the LEED platinum rating. The building has blocks facing the north-south route, with a massive open-to-sky court inside the centre, which permits pass ventilation and deep penetration of daylight into the indoors workplace area. The constructing is oriented such that it conserves herbal areas and trees, which reduces adverse environmental effect (Prashad and Chetia, 2014). Other passive design functions integrated inside the constructing for decreasing its operational power necessities consist of shaded landscaped regions to reduce the ambient temperature, insulated walls and double glass in fenestration to reduce warmth switch, use of recycled and domestically

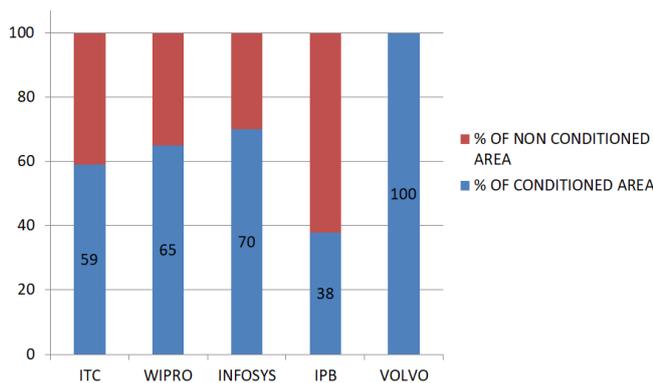
available substances, and a user-friendly built environment (GRIHA, 2017).

fenestrations, and shaded windows can effectively reduce the HVAC load of buildings in composite climate.

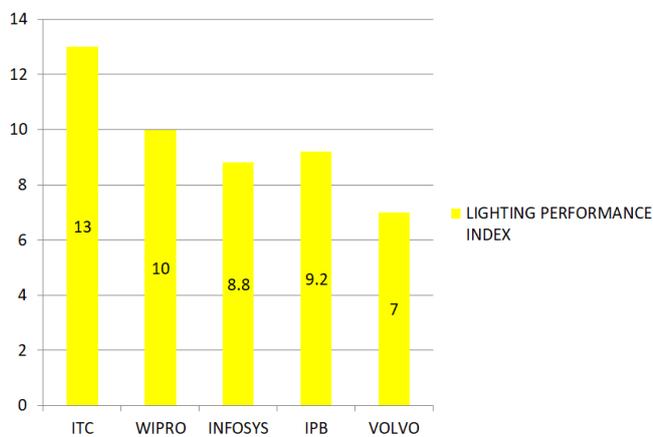
IV. RESULTS AND TABLES



Graph 1 HVAC performance index



Graph 2 Comparison of percentage of air-conditioned area in selected buildings



Graph 3 Lighting performance index

Building envelope: The use of insulated (low U-value) walls, an insulated roof, high-performance dual-pane glass in

Building plan configuration: Placing service areas with limited openings as thermal buffers on the west side and minimizing the surface-area-to-volume ratio are some of the strategies for controlling the heat gain and consequently reducing the cooling load. Moreover, placing the service core along the facade allows natural ventilation and lighting.

Mixed-mode ventilation system: The mixed-mode ventilation system can effectively reduce the energy consumption for cooling. The effectiveness of ventilation can be improved using special design elements, such as atriums and landscaped courtyards, which can increase the penetration of daylight into the plan.

WWR: A very low WWR reduces the cooling load. However, it also reduces the availability of natural light inside the building, which increases the lighting and heating load. The case studies indicate that the cooling and lighting loads of a building are reduced if the WWR is less than 40% and the maximum plan depth (between external facades) is 15 m.

	ITC	Wipro	Infosys	IPB	VECH
Year of completion	2004	2005	2011	2014	2012
Significance	Platinum rated by LEED 52/69	Platinum-rated by LEED 57/69	Platinum-rated by LEED	Platinum rated by LEED	Platinum rated by LEED World Architecture Award
% of air-conditioned space	59	65	70	38	100
Building configuration					
• Orientation	Long axis of the building oriented NE-NW.	Square plan facades in the NE, SE, NW, and SW	N-S orientation	N-S orientation	NE-SW orientation
• Placement of core	Central, East, and West	Central, East, and West	Central	Central and West	Central
• Typical floor area (m ²)	2042	1726	4073	319	1246
• No. of floors above ground	6 (2B + G + 5)	6 (2B + G + 5)	6 (G + 5)	8 (4E + 7)	6 (2B + G + 5)
• Floor-to-floor height (m)	3.6	3.6	3.6	1.1-3	3.6
• Aspect ratio	1.1	1.1	1.2-4	16	1.2-5
• Compactness ratio (perimeter/area)	9.9	9.5	9.7	15	17.5
• Plan depth (m) overall	24	13	18	15	17
Window parameters					
• Overall WWR (%)	33	35	25	20	80
• Shading device	Few windows shaded with horizontal louvers	Horizontal louvers	Recessed window	Box	Recycled railbays sleepers used to make the double-curved louvers
• Sill level (m)	0.3	0.8	0.5	0.8	0.0
• Window height (m)	2.1	1.6	1.8	1.8	Full length.
Building envelope materials					
• Wall assembly U-value in W/m ² K	250-mm AAC block with 70-mm stone cladding and 12.5-mm plaster made. U-value: 0.607	Fly-ash-based AAC block blocks U-value: 0.63	Wall insulation and cavity wall with insulation U-value: 0.36	AAC block masonry wall and fly-ash-based plaster and mortar U-value: 0.34	Cavity wall clad with tiles U-value: 1.1
• Roof assembly U-value in W/m ² K	120-mm RCC roof with a 76-mm ISO board in the interior U-value: 0.335	75-mm extruded polystyrene reduces heat transmission by 50%. Roof finish with high reflective material Solar reflective index (SRI) > 78 U-value: 0.31	Roof with insulation U-value: 0.33 Cool roof: 2.6 million ft ² area covered with a white roof Reduction of approximately 5% in the HVAC energy	150-mm RCC slab with insulation and local stones U-value: 0.5	Roof garden U-value: 0.25
• Glazing type U-value in W/m ² K	Double-glazing window (6-12-6), SC = 0.28, and U-value = 1.81 W/m ² K	6-mm glass + 12-mm air gap + 6mm high-performance glass (ST150), light blue grey, U factor of 1.81 W/m ² K. 21% reflectance and 39% transmittance Reduction in the heat gain by 15-20%	Double-glazing with argon gas U-value less than 1.2 W/m ² K Low SHGC with low-e glass SHGC: 1.8	Double-glass windows with a high efficiency, visible light transmittance (VLT = 0.6), and U-value (1.8) Light shelves for allowing the entry of diffused sunlight.	Double-glass windows U-value: 2.1 SHGC = 0.697
Occupancy & energy consumption					
• Working hours	10 h (5 days per week)	10 h (5 days per week)	8.5 h (5 days per week)	10 am-5 pm (5 days per week)	10 am-5 pm (5 days per week)
• Occupancy	NA	1300 people	2600 people	1000 people	NA
• HVAC type and capacity	Central, 2850 kW capacity, 18 m ² /TR COP: 6.1	Central, 2285 kW capacity, 25 m ² /TR COP: 6.5	Central, 1400 kW capacity, 75 m ² /TR COP: 7	Chilled beam system of HVAC, geothermal technology for heat rejection, 563 kW capacity, 45 m ² /TR COP: 6.7	HVAC under the floor reduces energy consumption by 30% 2335 kW capacity, 15 m ² /TR COP: 6
• Lighting fixtures	T5 and CFL lamps (daylight sensors)	Light shelves, T-5, and CFL	Light shelves, T-5, and LED fixtures (daylight sensors)	Light shelves, T-5, and LED fixtures (daylight sensors)	Lights work on motion sensor and 95% are LEDs
• LPD ECBC recommends 10.8 W/m ²	7.2 W/m ² simulated	5.4 W/m ²	4.8 W/m ²	5 W/m ²	4 W/m ² Simulated
• Method of acquiring energy consumption data (in available literature)	13	10	8.8	27	7
• Lighting performance index (LPI) (kWh/m ² /year)	64	58	32.25	45.25 (75% reduction)	71
• HVAC performance index (kWh/m ² /year)	93 (48% reduction)	85 (53% reduction)	51.85 (71% reduction)	930 kWp SPV panels	96 (40% reduction)
• EPI (kWh/m ² /year)	ECBC energy benchmark: 179 kWh/m ² /year	Photovoltaic cells for emergency lighting	NA	441 Wp SPV panels	NA
• Renewable energy (kWp)					

Table 1: Showing the comparative analysis of buildings

V. CONCLUSION

According to case studies all facades create boundaries among the outside and indoors environment, offering building occupants with thermally, visually, and acoustically at ease areas. Sustainable facades ought to do extra; specifically, they must permit surest levels of consolation the use of the least quantity of strength. To acquire this excessive performance, designers want to recall many variables weather and weather-based layout methods, thermal overall performance, daylighting, sun shading, glare, moisture transport, materials and their environmental effect, and so forth.

VI. ACKNOWLEDGEMENT

I would like to specific my deep sense of gratitude from the bottom of my heart to my manual Ar. Preeti kale for her precious steering, thought and encouragement. Her eager and indefatigable indulgence on this Research Paper helped me to reach an irreproachable destination.

VII. REFERENCES

- i) Bano, F., Tahseen, M., 2017. Bioclimatic building design guidelines for Lucknow city: use of various climate analysis methods. *Int. J. Res. Appl. Sci. Eng. Technol. (IJRASET)* 5 (XI), 330–341. <https://doi.org/10.22214/ijraset.2017.11049>
- ii) ITC Green Centre, 2017. Retrieved March 23, 2017, from [glazette.com: http://www.glazette.com/upload/resources/tb_90520091157467157.PDF](http://www.glazette.com/upload/resources/tb_90520091157467157.PDF)
- iii) Srinivas, S., 2005. Green Building Congress 2005. IGBC Green Habitate, A newsletter on Green Building, October. (Retrieved November 22, 2017, from https://igbc.in/igbc/html_pdfs/newsletter/Green%20Habitat%20October%202005.pdf)
- iv) Comparison and analysis of energy consumption of energy efficient office buildings in different climate regions in China: case studies. *Front. Energy* 7 (30), 399–405. <https://doi.org/10.1007/s11708-013-0260-z>.
- v) The 3C company, 2017. Executed Projects: Wipro Technologies, Gurgaon. (Retrieved April 9, 2017, from The 3C company: <http://www.the3c.in/wipro-technologies.htm>)
- vi) Singhal, S., 2014, April 30. Volvo Eicher Corporate Headquarter in Gurgaon, Indi by Romi Khosla Design Studios. Retrieved December 07, 2017, from [aecafe.com](http://www.aecafe.com):

<https://www10.aecafe.com/blogs/arch-showcase/2014/04/30/volvo-eicher-corporate-headquarter-in-gurgaon-india-by-romi-khosla-design-studios/>

- vii) Romi Khosla Design Studio, 2017. Projects- Volvo-Eicher Headquarter. (Retrieved September 12, 2017, from ebuild.in: <https://ebuild.in/volvo-eicher-headquartersgurgaon-romi-khosla-design-studio>)
- viii) Raji, B., Tenpierik, M., Dobbeslsteen, A., 2017. Early-stage design considerations for the energy-efficiency of high-rise office buildings. *Sustainability* 9 (623), 1–28. <https://doi.org/10.3390/su9040623>
- ix) HPCB, 2010. Case Study: ECBC Complaint Building, ITC Green Centre, Gurgaon. (Retrieved February 11, 2018, from *High performance commercial buildings in India*: http://highperformancebuildings.org/case_study_ECBC_compgurgaon.php).
- x) Functions of Sustainable Façade, Sustainable Architectural Facades, https://www.grihaindia.org/grihasummit/tgs2016/presentations/16feb/Minni_Sastry.pdf

User circulation in multi-specialty hospital: A study of overall satisfaction and way-finding difficulties in lobby area

Manali Vaishnav, Rahul Chutke, Sharvey Dongde

Dr. B. N. College of Architecture, Pune India

Email: manalivbnca@gmail.com

Abstract: Hospital is a synonym for existence and is the basic need of the society. Multi-specialty hospitals are large, complex institutions that cater to multiple facilities under one roof. In such environments, organization of the spaces and movement of people is a very important factor that needs to be considered. These spaces are all about users and hence user's involvement has to be given importance which is generally disregarded. Therefore, the objective of this research is to study the user perception in a multi-specialty hospital with respect to their preferences about factors like way-finding difficulties and overall satisfaction level. This empirical exploratory study is conducted in three different multi-specialty hospitals in Maharashtra. Various types of survey methods assist towards finding the probable reasons for this identified issue.

Key words – Circulation, way-finding, hospital design, Maharashtra, multi-specialty

INTRODUCTION

Hospital is a synonym for existence and is the basic need of the society. It is a healthcare institution providing patients treatment with specialized medical and nursing staff and equipment. (World Health Organization, 2018)¹. There are many different types of health care facilities like general hospitals, clinics, teaching hospitals and etc. Multi-specialty hospital is one such provision of healthcare. This type of hospitals caters to many different specialty departments. They are large complex institutions that continually evolve. (Latimer, Gutknecht 2008)². These institutions are immense and highly sophisticated institutes and are compartmentalized entities with numerous layers of functional spaces.

Users and Hospital Circulation

Hospitals are by definition all about people and movement. They are very user centric institutions. (Shumaker and Reinzenstein, 1982)³. Therefore user's perception about circulation is very important. They are a type of buildings that have a lot of users to be served. In a hospital facility, there are many user groups. Some are more vulnerable than others, such as patients and visitors. But staff and medical groups are no less important. These user groups of a hospital are generally categorized into two: hospital staff and non-hospital staff. The environment may have different impacts on various users and thus becomes a source of stress for the vulnerable groups. This stress may unnecessarily interfere with patient's recovery and have an impact on activities of other user groups. (Shumaker and Reinzenstein, 1982)³. The non-hospital staff being new to the environment can be

affected more with the factors like indoor built environment, safety, cleanliness, ease of movement and etc. This non-hospital staff includes inpatient and outpatients, visitors to the patient and visitors to the staff, all of these being of different gender, age group, cultural and economic background.

In a hospital where patients' average stay is 3 to 4 days, as is a frequency and length of visiting hours, a lot of daily visitors produce confusion, annoyance and anxiety. (Patricia Ortega-Andeane and Javier Soria, 1988)⁴. In such cases signaling must organize the information about the setting providing users with clarity, availability and spatial orientation. Signaling is the use of certain mediums that serve to indicate or direct flow of people like signages, floor plans etc. Visitors must be able to identify where to go and how to get there using signals. If they cannot find signals, they have to ask for help, which is why provision of signs and symbols in the circulation zones is a very influential factor for the way-finding. (Patricia Ortega-Andeane and Javier Soria, 1988)⁴.

Importance of Circulation

Hospital design is also a very important factor that has to be considered in order to ensure a user centric environment. There are different ways in which hospital buildings in Maharashtra are planned.

Empirical studies have shown that excessively institutional environments of large medical centers have caused adverse outcomes in their users, amongst which way-finding, usually defined as spatial solving process has been identified as the biggest challenge. (Allison 2007)⁵. Many hospitals, even though considered modern are the product of continual and often badly managed growth over decades or centuries. As a result, Dutch architectural historian Cor Wagenaar has called many hospitals:

“.... Build catastrophes, anonymous institutional complexes run by vast bureaucracies, and are totally unfit for the purpose they have been designed for. They hardly ever functioned and instead of making patient feel at home, produce feeling of anxiety and stress.” (Healing by design, Ode magazine 2006)⁶.

The research of British Medical Association has shown that a good hospital can reduce patients recovery time, stress and level of discomfort.

Circulation zones are a very important and dominant factor for a good hospital design. These circulation zones in healthcare facilities are typically defined as spaces expressly dedicated for movement of people, equipment and supplies between internalized departments, and are an essential component of any care delivery system. (Carthey 2008)7. Circulation zones belong to hospital's public spaces; spaces where people using it can access them independently which include areas like entrance lobbies, entrance hall, reception areas, waiting rooms, corridors and vertical circulation zones. (Setola and Borgianni 2016)8. Hospital corridors are important to the functioning of multidisciplinary teams and quality of care delivery which is why these spaces need clean circulation. Another aspect of public circulation zones is the creation of positive entry experience that reflects one of welcome and hospitality. (Van Buren, Berger and Fauss, 2014)9. These public circulation spaces are the cultural and emotional heart of the hospital. The portions of this service need to be highly visible to arriving patients and visitors, with flexibility to handle no. of people at peak times and clear way-finding are all important. (Richard Sprow, AIA) 10. These circulation zones are associated with various essential health related outcomes including way -finding and spatial orientation and overall level of satisfaction. It is recommended that circulation zones in healthcare facilities be viewed as integral elements in campus and building planning process. (Jiang and Verderber, 2016)11. These have mostly two types of circulation pattern: radially planned and linearly planned. The design of these circulation zones may cause a significant impact on the user's perception and experience of that place. The spatial movement zones have a major contribution towards the first impression of any care setting and therefore a thoughtful examination of broad planning and design possibilities should be done.

“The planning and design of circulation zones may in fact significantly impact users' perception and experiences from the perspective of multiple stakeholders.” (Shan Jiang and Stephen Verderber, 2016)11

Objective

There are about 3239 hospitals in Maharashtra out of which 438 are urban hospitals according to the Ministry of health and family welfare, India. Unfortunately in Maharashtra there is not much importance given to the social and cultural characteristics of various users in hospital facility. Therefore a problem identified within a broader environmental satisfaction project was the evaluation by its users.

The main objectives of this study are:

1) To study the user perception of circulation in a multispecialty hospital with respect to way-finding difficulties

2) To evaluate user's overall satisfaction level based on various factors.

METHODOLOGICAL FRAMEWORK

This is an exploratory research aimed to study various circulation patterns in a multispecialty hospital and way-finding difficulty. Most of the research papers say that way-finding difficulties are a very common problem. After reading the related available literature, it was identified that 35% of the hospitals where way-finding difficulties were faced by people daily.

Out of the 35% hospitals, most of the hospitals were found to be linearly planned and therefore all the samples chosen were linearly planned hospitals. The samples included three hospitals in Maharashtra: Srimati Kashibai Navale hospital, Pune; MGM Hospital, Aurangabad and MJM Hospital, Pune.

Unfortunately in Maharashtra there is not much importance given to the social and cultural characteristics of various users in hospital facility. Therefore a problem identified within a broader environmental satisfaction project was the evaluation by its users. Questionnaire instruments are the best way where a researcher gets complete involvement from the user. A questionnaire was included in the methodology of the research to understand the users perspective.

Activity mapping of circulation spaces was another part of the research which helped in translating and organizing these circulation spaces into plans which were the base of the research.

The questionnaire instrument consisted of 9 questions focusing mainly on:

- Way-finding difficulty
- Aid used for way-finding
- Maximum travel time from entrance lobby To OPD's
- Overall satisfaction level dependent on various factors like services, planning and waiting time.

The questionnaire also included general questions like the gender of the user, purpose of their visit to the hospital, no. of times the user has visited the hospital, reason for choosing the hospital and etc. These questions helped in the segregation of users into two categories: hospital staff/ non- hospital staff and first time visitors/regular visitors.

QUESTIONNAIRE

- 1) What is the purpose of your visit to the hospital ?
- 2) Is this your first visit to the hospital ?
Yes/No
- 3) Why did you choose to come to this hospital ?
 - a) Near your house
 - b) Good doctors
 - c) Good service
 - d) Good environment and layout
- 4) What is the maximum time you had to wait in the hospital reception ?
- 5) Was it easy to reach the place where you are standing now ?
- 6) How many times did you have to ask for help while wayfinding ?
- 7) What helped you the most in finding the way ?
 - a) Signs and symbols
 - b) Hospital staff
 - c) Other visitors
 - d) None of the above
- 8) How much time does it take for you to reach this place from reception?
- 9) Overall satisfaction level

1	2	3	4	5
---	---	---	---	---

Figure 1: Questionnaire Instrument

Respondents who were not hospital staff were given the questionnaire. The questionnaire focused on two main criteria's: way-finding difficulty and overall satisfaction level. The filtration was also done on the basis of no. of times of visit to the hospital. First time visitors were asked about way-finding difficulties while the visitors who had been to the hospital one or more time were asked questions about the overall satisfaction level. Each of the three hospitals had around 100-150 visitors per day therefore 9-10 randomly selected respondents who were non staff were given the questionnaire.

Activity mapping was done by observing the circulation spaces and movement pattern in the hospital and then converting it into tree diagrams. Observation and the documentation of these circulation spaces in form of pictures also proved to be helpful. It helped in finding the problems that led to way-finding difficulties in hospitals. The tree diagrams helped in studying the movement of people from the main entrance lobby to the OPD's. The activity mapping also helped understand the probable points where people were coming across confusion while way-finding.

The first case of SKN Hospital, Pune had a central circulation spine from the entrance lobby with branches of corridors connecting to the OPD area. The waiting areas were provided in the branched corridors. (See Fig 2)

The second case of MGM Hospital, Aurangabad had a main corridor running parallel to the entrance lobby, this main corridor had OPD's placed on either sides and waiting area was provided in the entrance lobby. (See Fig 3)

The third case of MJM Hospital, Pune had main corridor running parallel to the entrance lobby and OPD's on one side only facing the waiting area which was in the entrance lobby. (See Fig 4)

All the three are linear circulation pattern.

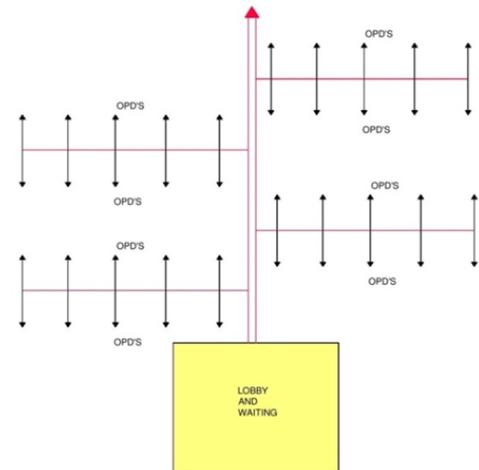


Figure 2: SKN Hospital O.P.D layout



Figure 3: MGM Hospital O.P.D layout

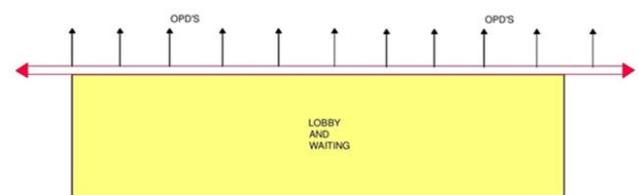


Figure 4: MJM Hospital O.P.D layout

DATA ANALYSIS

All the three hospitals were studied and the data received from the questionnaire survey was analyzed. (See Tables below which shows the answers given by users).

Case 1: According to the data collected through the questionnaire in SKN Hospital, it was found that 30% of the respondents found circulation to be complicated out of which majority were females. 40% of the respondents who were

majorly males came across way-finding difficulties 1 or more times. (See Table 3)

Case 2 : After using the same method for collection of data in MGM Hospital , it was found that 40% of the respondents found circulation to be complicated out of which maximum were females. 45% of the respondents who were majorly males came across way-finding difficulties 1 or more times. (See Table 1)

Case 3 : Similarly in MJM Hospital , it was found that 10% of the respondents found circulation to be complicated who was a female. 13% of the respondents who were majorly females came across way-finding difficulties 1 or more times. (See Table 2)

The highest satisfaction level noted was 5/5, which was because of the good service, environment, layout and doctors. The percentage of people with highest satisfaction level in SKN Hospital, Pune was 70% because of the good service, environment and doctors , in MGM Hospital it was 22% because of the good environment and layout and in MJM Hospital it was 40% had the because of good layout. The lowest satisfaction level noted was 2/5, which was because of long waiting time and way-finding difficulties. The percentage of people with lowest satisfaction level in SKN Hospital, Pune was 20% because of difficulty in circulation and way-finding , in MGM Hospital it was 22% because of long waiting time and difficulty in way-finding and in MJM Hospital it was 25% had the because of long waiting time .

(See Fig 5)

Table 1: MGM Hospital

KEYWORD	R1	R2	R3	R4
GENDER	M	M	F	F
PURPOSE	Relative	Relative	Relative	Visitor
FIRST VISIT ?	No	No	Yes	No
CHOICE OF HOSPITAL	good doctor, service, environment	Recommendation	good service	good service, environment
MAX WAITING TIME	15 min	2+ hours	1/2 hour	10 min
EASY ACCESS ?	yes	yes	yes	no
HOW MANY OBSTACLES ?	0	0	3	no
WHAT HELPED WHILE WAYFINDING	signs and symbols	signs and symbols	staff	signs and symbols
TRAVEL TIME	5-10 min	10 min	1/2 hour	1 hour
SATISFACTION LEVEL	5	3	3	5

KEYWORD	R5	R6	R7	R8	R9
GENDER	M	F	F	F	F
PURPOSE	OPD Consultation	Relative	Relative	Visitor	student
FIRST VISIT ?	No	No	Yes	No	No
CHOICE OF HOSPITAL	good doctor, service, environment	good doctors	good doctor, service, environment	good doctors	good doctors
MAX WAITING TIME	15-20 min	1-1 1/2 hour	1/2 hour	5 min	10 min
EASY ACCESS ?	yes	yes	yes	no	no
HOW MANY OBSTACLES ?	0	0	3	no	2
WHAT HELPED WHILE WAYFINDING	signs and symbols	signs and symbols	other visitors	staff	signs and symbols
TRAVEL TIME	5 min	10 min	1 hour	10 min	15 min
SATISFACTION LEVEL	4	3	2	2	4

Table 2: MJM Hospital

KEYWORD	R5	R6	R7	R8
GENDER	F	M	M	F
PURPOSE	Visiting Doctor	Relative	OPD Consultation	Visitor
FIRST VISIT ?	yes	yes	yes	yes
CHOICE OF HOSPITAL	good layout	good doctors	recommendation	good environment
MAX WAITING TIME	5 min	1 hour	1/2 hour	1/2 hour
EASY ACCESS ?	yes	yes	yes	no
HOW MANY OBSTACLES ?	3	1	1	2
WHAT HELPED WHILE WAYFINDING	none	staff	staff	staff
TRAVEL TIME	15 min	10 min	10 min	15 min
SATISFACTION LEVEL	4	4	4	3

KEYWORD	R5	R6	R7	R8
GENDER	F	M	M	F
PURPOSE	Visiting Doctor	Relative	OPD Consultation	Visitor
FIRST VISIT ?	yes	yes	yes	yes
CHOICE OF HOSPITAL	good layout	good doctors	recommendation	good environment
MAX WAITING TIME	5 min	1 hour	1/2 hour	1/2 hour
EASY ACCESS ?	yes	yes	yes	no
HOW MANY OBSTACLES ?	3	1	1	2
WHAT HELPED WHILE WAYFINDING	none	staff	staff	staff
TRAVEL TIME	15 min	10 min	10 min	15 min
SATISFACTION LEVEL	4	4	4	3

Table 3: SKN Hospital

KEYWORD	R1	R2	R3	R4
GENDER	M	F	F	M
PURPOSE	Relative	Relative	Relative	Relative
FIRST VISIT ?	yes	No	Yes	No
CHOICE OF HOSPITAL	near the house	good doctor, service	good doctor, service, environment	good doctor
MAX WAITING TIME	1 hour	5 min	1/2 hour	5 min
EASY ACCESS ?	yes	yes	yes	yes
HOW MANY OBSTACLES ?	1	1	0	0
WHAT HELPED WHILE WAYFINDING	signs and symbols	signs and symbols	guided	staff
TRAVEL TIME	15 min	20 min	10 min	10 min
SATISFACTION LEVEL	5	3	5	5

KEYWORD	R5	R6	R7	R8	R9	R10
GENDER	F	M	M	F	F	M
PURPOSE	Relative	Visitor	Relative	Relative	Relative	Relative
FIRST VISIT ?	no	yes	yes	yes	yes	yes
CHOICE OF HOSPITAL	good service	near the house	good doctors	good doctors	good doctors	good environment
MAX WAITING TIME	15 min	15 min	5 min	0	10 min	15 min
EASY ACCESS ?	yes	no	yes	no	no	yes
HOW MANY OBSTACLES ?	0	1	0	0	0	1
WHAT HELPED WHILE WAYFINDING	signs and symbols	staff	signs and symbols	staff	staff	staff
TRAVEL TIME	10 min	15 min	10 min	10 min	15 min	15 min
SATISFACTION LEVEL	5	4	5	4	3	4

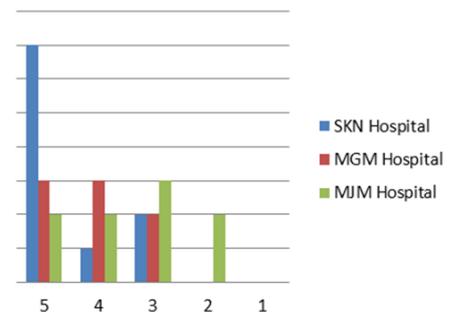
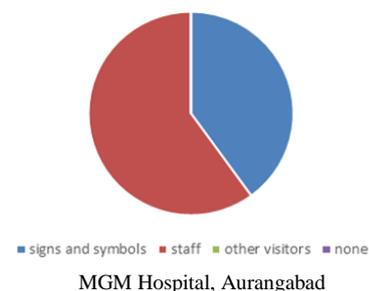


Figure 5: Overall satisfaction level in all the three hospitals

The visitors were also asked questions based on aid they had to use while way-finding. The answers for this particular factor in all the three hospitals were very different. According to the data collected with the help of the questionnaire maximum visitors did not use signaling as an aid while way-finding, the reason being less availability of signage. Observations done also proved that circulation corridors had very few signage. According to the pie charts and the readings in Table 1 majority of the people using signage was found in MJM Hospital, Pune, when it should have been the case for all the three hospitals. Signage are the most reliable and permanent aid for way-finding, whereas hospital staff and other visitors are less reliable and temporary. (See Fig 6)



MGM Hospital, Aurangabad

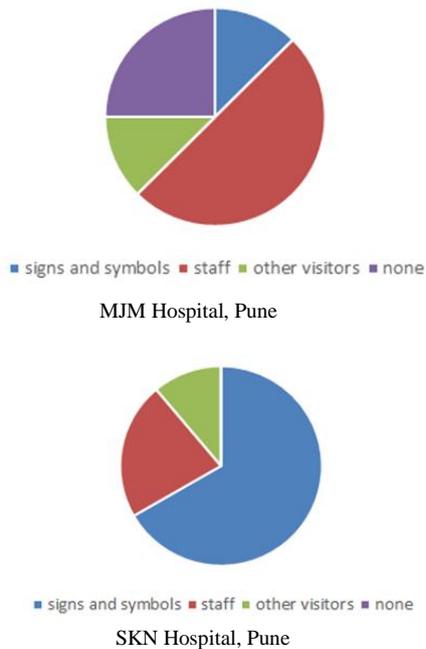


Figure 6: Pie charts showing percentage of aids used by people.



Figure 7: Images of corridors with very less signage taken in SKN Hospital, Pune

DISCUSSION

The findings of all the three cases were summarized. All the three hospitals had an average of 4/10 visitors who found circulation complicated, all of them being females. 5/10 visitors on an average came across way-finding difficulties 1 or more times, majority of them being females. People found circulation complicated

because of the long travelling time which ranged around ½ hour to 1 hour.

After the data collected from the questionnaire was analyzed, few of the statements written by architectural experts and historians mentioned in the literature review were reflected in the results. These statements were mostly on the lack of good circulation design, way-finding difficulties and etc. These statements formed the base of this research. The study was done considering way-finding difficulties in hospital circulation as an assumption or hypothesis. All the results and readings from the data analysis were found to be in favor with the hypothesis for all the three multi- specialty hospital samples taken in Maharashtra.

Most of the users who were asked to fill the questionnaire had come across problems while moving around and had faced difficulties in way-finding. The activity mapping also clearly explains the complexity level of each of the hospitals and the probable points of confusion that users came across while way-finding. After looking at those tree diagrams which showed the circulation pattern, the probable reason for way-finding problems and spatial dis orientation could be identified as not only the circulation design but lack of visual means of signaling.

Signaling with the help of virtual media, signs and symbols and etc. also play a very essential role in way-finding along with the planning of circulation. When findings about aids used while way-finding were analyzed from the survey instrument, it was seen that in almost all the hospitals user's faced problems in signaling. Majority of the users asked help from either the hospital staff or the other visitors many number of times. Also from the observations that were done regarding the signaling, weak means of signs and symbols we spotted in all the three cases. There were plenty of signs and symbols in MGM Hospital, Aurangabad but majority of them were ignored because of their level of complexity. SKN Hospital, Pune had a very few signages that showed directions, only name boards were found. MJM Hospital, Pune had signs and symbols which were out of the user's visibility range.

CONCLUSION

After the discussion of the data analyzed and observations done, the study is narrowed down to a few conclusions:

- 1) Multi-specialty hospitals in Maharashtra are not designed considering the user's perception with respect to the overall satisfaction level and way-finding difficulties.
- 2) The percentage of users coming across difficulties in way-finding and spatial orientation is high and hence should not be neglected.
- 3) The reason for way-finding difficulties in a multi-specialty hospital is not only its poor circulation layout and design but also the lack of signages in the public circulation zones.

To ensure the comfort and safety of the users, the planning of circulation spaces should be given the first priority in the design process of a multi-specialty hospital. This can generate better satisfaction levels by the users which in turn can create a positive impact on the recovery of the patient's health and reduction in stress and anxiety levels.

Provision of appropriate signages along the public circulation spaces i.e. lobbies, waiting areas, reception, etc. and in the internal spaces i.e. wards, operation theatre complexes, etc. should be done to accelerate and ease the movement of users.

FURTHER SCOPE

Hospital being a service provided for the people will always need to evolve. This research will provide a base for other researches that can be done on different typologies of hospital design in various other states of the country. It can also be used as a base for evidence-based design (process of basing design decisions about the built environment on research to achieve the best possible outcomes). (Van Buren, Berger and Fauss, 2014)⁹. It will help in the improvement of the overall healthcare facilities of the country. This research can also help the designers and architects in addressing the circulation spaces through the user's perspective.

REFERENCES

- i. "Hospitals": World Health Organization. Retrieved 24 January 2018.
- ii. Latimer, H. S., Gutknecht, H., Hardesty, K. (2008). *Analysis of hospital facility growth: Are we super sizing healthcare ? Health Environment Research and Design. 1, 70-88*
- iii. Allison, D. (2007). *Hospital as city: Employing urban design strategies for effective way-finding. Health Facilities Management, 20, 61-65*
- iv. *Healing by design Archived 17 October 2007 at the Wayback Machine – Ode Magazine, July/August 2006 issue. Accessed 10 February 2008.*
- v. Carthey, J.(2008). *Reinterpreting the hospital corridor: "Wasted space" or essential for quality multidisciplinary clinical care? Health Environments Research & Design, 2, 17-29*
- vi. Setola, N. & Borianni, S.(2016). *Designing public spaces in hospitals, New York, NY: Routled*
- vii. Richard Sprow, AIA (The American Institute of Architects): *Planning Hospitals of the Future*
- viii. Jiang, S. & Verderber, S. (2016). *Landscape therapeutics and the design of salutogenic hospitals: Recent research. World Health Design, 8, 40-51*
- ix. Deanne VanBuren, Assoc. AIA, LEED, AP, NOMA; Yuval Berger, MSW, RSW and Kimberley Fauss, JD: *Peace in Place Project: Building Healing Spaces*
- x. Patricia Ortega-Andeane and Javier Urbina-Soria : *A case study of way-finding and security in a Mexico City Hospital, School of Psychology, U.N.A.M.*
- xi. Shumaker, S. and Reizenstein, J. *Environmental factors affect in patient stress in acute hospitals. In G. Evans (Ed.) Environmental ~. New York: Cambridge Press, 1982.*

Translation of Political Ideologies into Architecture: A Case of Democratic Architecture

Manasi Bhuskute, Aarti Verma

Manasi Bhuskute, manasibhuskute17@gmail.com

Aarti Verma, aarti.verma@bnca.ac.in

Dr. B. N. College of Architecture, Pune Fifth year, B. Arch, 2016 - 2021

Abstract: *Political ideologies influence architecture. Nazi architecture or Communist architecture are a few examples that express the national identity, ideology and propaganda. These anti-democratic examples illustrate that architecture can bring about social change. Today, several infrastructural projects are happening in India that search for democratic identities. The paper explores interpretations of democratic architecture and its need in Indian context. The research methodology adopts a case study research to analyze relevant public buildings. The findings suggest metaphorical interpretations of democracy can be conveyed through certain architectural characters. The research asserts the role of architecture as a catalyst for an efficient democratic society.*

Keywords: Political ideologies, Democracy, Architecture, Built environments, Public buildings, Social change

INTRODUCTION:

Architecture leaves a long-lasting impact on its surroundings. Throughout history it is seen that built environments have been used to support and lead several activities of individuals and masses. The built environments for different regions, during different periods vary distinctly and have their own unique characteristics. The Nazi architecture and the Rationalist-constructivist Russian architecture are notable examples where fascist and communist ideologies, the radical opposites of democratic idea, have established an identity through certain architectural language.

Anti-Democratic Architecture

Totalitarian architecture, a product of fascist ideologies flourished under the Nazi reign. Extreme monumental forms, monotonous and extensive repetition of elements, were used to dominate masses and suppress individuality as seen in Figure 1. (Lane, 1986) Anti-liberal and extreme nationalist ideologies were successfully conveyed through the built forms.

Constructivist and rationalist styles emerged between world wars in Russia and portrayed the communist philosophy, through modern materials like steel, reinforced concrete and glass along with dynamic, geometric forms. (Hum 54 The Urban Imagination, n.d.). Figure 2 illustrates the cultural center for trolley workers built in 1928. These workers' clubs were public buildings for workers. However, they were designed to showcase the industrial prowess of Russia rather than function as welcoming public spaces.

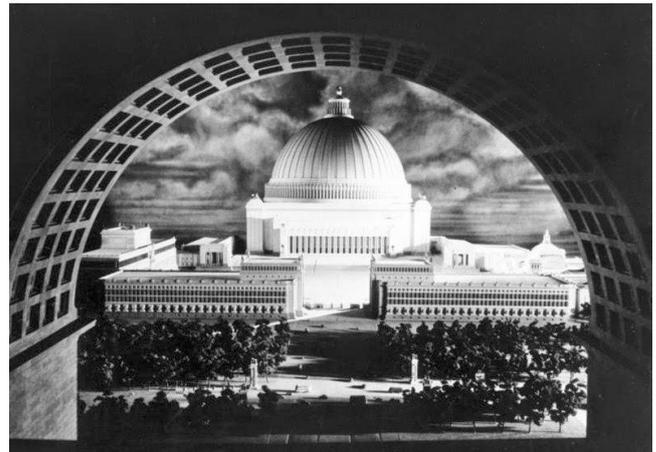


Figure 1, Volkshalle (Hall of People) as envisioned by Adolf Hitler
Source: The Guardian



Figure 2, Rusakov Workers' Club, Konstantin Melnikov
Source: ArchDaily

These examples show how architecture and planning have been used to showcase prospects, goals and power of a nation. The built environments have taken shape as direct translations of respective anti-democratic political ideologies. Architecture has been used to manipulate common people physically and psychologically. This shows the power of architecture to act as a catalyst for a social change. Thus, a need for architecture that translates the ideologies of democracy is evident to impact a positive change in society.

Relevance of Democratic Architecture

Democracy needs physical spaces for efficient functioning and certain organization of space can positively or negatively influence the democratic function. (Parkinson, 2012)

In a democracy the decisions are taken by the people or their elected representatives. When an informal, creative and loose dialogue happens in the early stages of decision-making process between common people, a democracy can sustain itself longer. (Parkinson, 2012). Public spaces that allow this free interaction in an urban environment and provide access to all citizens have been given significant importance in a democratic society by several architects and theorists.

The research focuses on exploring the built environment of public spaces that allow such dialogue between individuals. Spaces like plazas, libraries, open spaces, galleries, exhibition spaces, community centers etc. come under the scope of the research. Formal public spaces like administrative campuses, institutions, courts etc. are not considered. The study also aims at defining the architectural characteristics of public buildings that translate the ideology of democracy and benefit the relation between community and architecture.

MATERIAL AND METHODOLOGY

Definitions of Democratic Architecture

The concept of democratic architecture has been analyzed by many architects and theorists. Democratic architecture evolves through organic process. The buildings of democracy stand at ease and provide environments that are of human scale to which people can relate. They are deeply rooted in native context and give opportunity for a dynamic range of individual expressions. (Wright & Pfeiffer, 1984)

Democratic architecture orients people towards the idea of democracy and makes them want this system of governance. (Runting, 2018) It encourages confrontations between people and stays in the background. It is in a continuous process of change. (Runting, 2018) The architectural environments are such that people feel intimate belonging towards them, yet the environments are impersonal.

Barcelona Pavilion: The symbol of democratic architecture

The German Pavilion designed by Mies van der Rohe in Barcelona is an example of political symbolism and is considered as a metaphorical symbol for democracy. The structure plays with spatial and visual perceptions of visitors through use of reflective polished surfaces. This, along with amorphous built – open boundaries create a sense of multiplication of spaces. The circulation pattern is fluid and allows explorations by users. (Rudolf, ca. 1996) The pavilion rejects the axis established by the site and has asymmetric arrangements. This metaphorically relates to a sense of freedom by rejection of authorities. (Virketis, 2016 - 17) The design is a shear contrast to the totalitarian German architecture and hence is a symbol of contemporary democratic architecture.

Examples in Indian Context: Case studies

The following projects have been analyzed to arrive at an architectural vocabulary for democratic built environments in Indian context. Spatial organization, quality of circulation, scale and proportions, open-built relationship, volume and form are the parameters used to analyze the case studies.

1. Designs by Charles Correa

The design philosophy and the architectural style of architect Charles Correa have a similar bearing with the above definitions. The designs reflect an innate understanding of Indian culture and cater to several layers of Indian society which further instate their democratic value. (Correa, 2012) Thus, his designs can be considered a foundation for democratic architecture of India. Goa Kala Academy, Jawahar Kala Kendra and Bharat Bhavan, Bhopal have been studied to analyze the vocabulary for democratic architecture.

2. Krishi bhavan by Studio Lotus

The facility developed for farmer's empowerment has spaces for knowledge exchange and community engagement. The design aims to create a "lively point for public life". The perceptions of the built form and its open – built grammar have been analyzed. (ArchDaily, 2020)

3. Avadh Shilpagram, Lucknow

The project by Archohm is designed for the local arts and crafts in Lucknow. It hosts shops for craftsmen and artists and is a public space built for the community. (ArchDaily, 2016)

4. Incidental spaces in Indian Streets

Spaces like footpaths, parks, roadside seating areas have been studied to understand the organic character of democratic architecture.

RESULTS AND TABLES

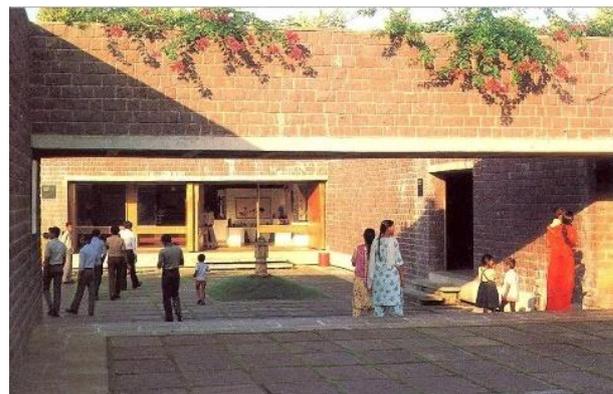


Figure 3, Spatial Plurality observed in Bharat Bhavan, Bhopal Source: ArchDaily

Buildings by Charles Correa have spaces ranging from open to sky courts to closed private areas. His writings state the significance of amorphous boundaries between built and unbuilt areas and spatial plurality. (Correa, 2012) The courts (Figure 3), provide visual rest areas which enhance ease and human comfort. Visitors are not dominated by pre-established circulation patterns which symbolize a sense of freedom.



Figure 4, Front Elevation, Krishi Bhavan
ArchDaily

Source:

Krishi Bhavan, has a porous ground floor which accommodates circulation till the center of the structure. This gives a sense of penetrability. As seen in Figure 4, the porosity and earthy color schemes neutralize the monumentality of the building which make the design of human scale.

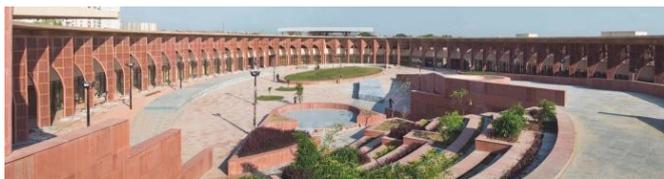


Figure 5, Central landscape, Avadh Shilpagram
Source: ArchDaily

Avadh Shilpagram appears to be an elongated, monumental, mass at first glance. However, the jali patterns and the arches break the monumentality. The central landscape as seen in Figure 5 allows the visitor to view the top parts of the structure at comfortable eye levels. These elements make the structure more proportionate to human scale.

The incidental spaces in Indian streets are adaptable and flexible. Footpaths are extensively used by beggars, vendors, surrounding residents or transitory citizens. Incidental spaces around temples, traditional *paars* etc. are exploited by a wide range of informal activities. Such organically evolved spaces allow access to everyone. Their adaptability builds intimate connections with individuals.

DISCUSSION

Following built environment characteristics have been derived from the above discussion. They have been classified as tangible and its respective intangible translation. Physical features or elements that define the democratic character come under tangible aspects. The intangible aspects refer to the mood or metaphorical interpretations of the respective tangible aspects.

TANGIBLE		INTANGIBLE
Human scale		Relatable Comfortable
Non - monumental		Non - authoritative
Porous		Penetrable
Spatial amorphous boundaries	Plurality, Interconnected spaces, multiple options for circulation	Ease, openness Sense of freedom
Adaptable use, allowing different activities as per need		Dynamic, ephemeral

Table 1, Tangible and intangible characteristics of democratic architecture

Monumentality of a structure is broken by using elements with smaller proportions that respond to human scale, as seen in Avadh Shilpagram. This evokes feelings of comfort in people and is perceived as non-authoritative. Porosity in the mass of the structure as seen in of Krishi Bhavan leads to a realization that the built mass can be penetrated. This makes the building seem accommodative and accepting. A built environment evokes feelings of openness and ease when a range of open to sky and closed spaces are present. This metaphorically relates to a sense of freedom and is observed in the designs by Charles Correa. Since a democracy is in a continuous process of change, the ideal democratic architecture should have adaptable and flexible characters like the organic incidental urban spaces. This gives the space a dynamic and ephemeral quality and builds intimate connections with the users.

The above tangible and intangible aspects create an architectural vocabulary that translates the ideology of democracy.

CONCLUSION

Research concludes that a detailed study of democratic architecture and its components can provide clues towards developing an architectural vocabulary on democratic architecture in contemporary times. Such a democratic design can support the democratic performance of a nation and bring about positive social change.

ACKNOWLEDGEMENT

I would like to thank my mentor, Professor Aarti Verma for encouraging me to study this topic. I am very grateful for her valuable guidance throughout the research process. I would also like to thank my family, friends and my seniors who inspired me in the process.

REFERENCES

- i. ArchDaily. (2016, August 25). Avadh Shilpgram / Archohm. Retrieved from ArchDaily: <https://www.archdaily.com/793889/avadh-shilpgram-archohm>
- ii. ArchDaily. (2020, June 17). Krushi Bhawan / Studio Lotus. Retrieved from ArchDaily: <https://www.archdaily.com/941738/krushi-bhawan-studio-lotus>
- iii. Correa, C. (2012). *A Place in the Shade: The New Landscape & Other Essays*. Hatje/Cantz. https://books.google.co.in/books?hl=en&lr=&id=S477mS0wS0cC&oi=fnd&pg=PR1&dq=a+place+in+the+shade&ots=BMpRsb_y-f&sig=EeKqyaA4qmRESluyy_J_lgQTkWQ&redir_esc=y#v=onepage&q=a%20place%20in%20the%20shade&f=false
- iv. Hum 54 The Urban Imagination. (n.d.). *Communism and the USSR in Art: Moscow Constructivist Architecture Tour, Visiting the Club*. <https://hum54-15.omeka.fas.harvard.edu/exhibits/show/moscow-constructivist-architec/visiting-the-club>
- v. Lane, B. M. (1986). *Architects in Power: Politics and Ideology in the Work of Ernst May and Albert Speer*. <https://www.jstor.org/stable/204134?seq=1>
- vi. Parkinson, J. R. (2012). *Democracy and Public Space : The Physical Sites of Democratic Performance*. Oxford: University Press. https://books.google.co.in/books?hl=en&lr=&id=xlDenWbN-7AC&oi=fnd&pg=PP1&dq=democracy+and+public+space+john+parkinson&ots=vfeyiIMKdL&sig=1KTbqKiwjN00l0LpbqwoecUYE0Q&redir_esc=y#v=onepage&q=democracy%20and%20public%20space%20john%20parkinson&f=false
- vii. Rudolf, P. (ca. 1996). *CONVERSATION AT 23 BEEKMAN PLACE*. (P. Blake, Interviewer) <https://www.paulrudolphheritagefoundation.org/interview-peter-blake>
- viii. Runting, H. (2018). *Desire for Democracy*. Doctoral Thesis. <https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1202584&dswid=-7116>
- ix. Virketis, L. (2016 - 17). *The Barcelona Pavilion: Mies' Building or Political Manifesto?* . https://issuu.com/lukasvirketis/docs/essay__updated_
- x. Wright, F. L., & Pfeiffer, B. B. (1984). *Frank Lloyd Wright Collected Writings Volume 4 (1939-1949): 004*. New York: Rizzoli International Publications. https://www.google.co.in/books/edition/Frank_Lloyd_Wright_Collected_Writings/_rGnvQEACAAJ?hl=en

ARCHITECTURE IN MINES

Miss. Manasi Thakre

Smt. Manoramabai Mundle College of Architecture, Nagpur, Maharashtra

Email: manasithakre999@gmail.com

Abstract: As future architects we aspire to explore. But we forget about the balance to maintain in nature. So, why can't we explore the potential and improve the whole environment of the industrial wasteland. The re-development of industrial wasteland can be regarded as an opportunity of economical development, social progress, and environmental improvement. All this can be done by Rehabilitation and reclamation. The brownfield redevelopment means taking to revitalize the lost grandeur of once booming area. Coal mining areas after mine closure need to be seen from the developable prospects.

Key words – Brownfields, rehabilitation, redevelopment, industrial wasteland, reclamation, revitalize, developable

I. INTRODUCTION

Architecture in mines has been an impractical concept but not totally in vain or futile. The usual, landscape design on the used area or the water plotted in the pit is what we generally know.

Coal mining is the process of extraction coal from the ground. Coal is valued for its energy content and since 1880s, has been widely used to generate electricity. Steel and cement industries use coal as a fuel for extraction of iron from iron ore and for cement production. Coal mining has had many developments over the recent years, from the early days of men tunneling, digging, and manually extracting the coal on carts to large open cut and long wall mines. The coal mining industry has a long history of significant negative environmental impacts on local ecosystems, health impacts on local communities and workers, and contributes heavily to the global environmental crisis, such as poor air quality and climate change. For these reasons, coal has been one of the first fossil fuels to be phased out of various parts of the global energy economy.

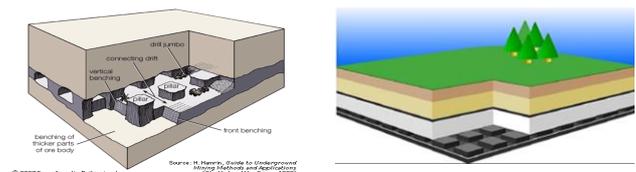
There are generally two methods of mining, namely, Surface mining and underground mining. Also, there are two methods

for the extraction of mining, that is, longwall mining and bord and pillar mining.



1. **Longwall Mining:** Longwall mining is a form of underground coal mining where a long wall of coal is mined in a single slice. Almost 80% of coal can be extracted or obtained from this method of coal mining.

Fig. Longwall Mining Technique



2. **Bord and Pillar Mining:** Bord and Pillar mining is one of the oldest methods of mining. It is a method in which the mined material is extracted across a horizontal plane while leaving pillars of untouched material to support the overburden leaving open areas or rooms underground. Only 40% of coal can be extracted, obtained from this method of coal mining.

Fig. Bord and Pillar Technique

Once the production of the mine stops, a small labour force remains behind to shut down and decommission the site. This involves removing completely the machinery that can be or need to be removed. A lot of such non useful mines are the converted into water bodies or landscapes. But the water that is deposited becomes so polluted with chemicals that I cannot be used, not for drinking or even for any domestic use. The landscape could never fully be restored to its original topography, although with today's technology it could come very close, but it could never be the same. Forestation or agriculture can be a possibility with a less percentage to agricultural process.

All this can be done by Rehabilitation. If we consider building temporary structures, the life span still has a question mark to it.

So using this land other than for landscape or as a water body would have a temporary life to itself.

II. MATERIAL AND METHODOLOGY

1. **Land Rehabilitation:** Land rehabilitation is the process of returning the land in a given area to some degree of its former state, after some process (industry, natural disasters, etc.) has resulted in its damage. Many projects and developments will result in the land becoming degraded.

2. **Mine Rehabilitation:** Rehabilitation management is an ongoing process. After mining finishes, the mine contoured to flatten them out, to further stabilize them against erosion. If the ore contains sulfides it is usually covered with a layer of clay to prevent access of rain and oxygen from the air, which can oxidize the sulfides to produce sulfuric acid.



Fig. Mine Rehabilitation examples

Landfills are covered with topsoil, and vegetation is planted to help consolidate the material.

Dumps are usually fenced off to prevent livestock denuding them of vegetation

Water can be harvested from the mine as well (mines are often filled with water once the mine has been shut down and the pumps no longer operate).

3. **Mine Reclamation:** Mine reclamation is the process of restoring land that has been mined to a natural or economically usable state. It creates useful landscapes that meet a variety of goals ranging from the restoration of productive ecosystems to the creation of industrial and municipal resources.

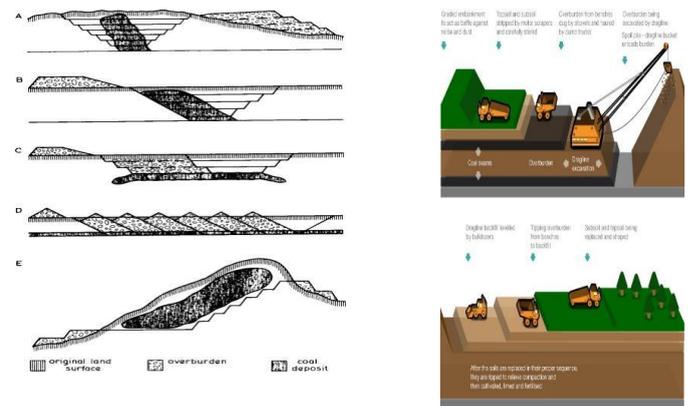


Fig. Mine reclamation

4. **Forestry Reclamation Approach:** A new approach to reforestation has been promoted by state mining agencies and the Office of Surface Mining Reclamation and Enforcement (OSMRE) to support forested land uses under SMCRA. The guidelines can be summarized in five steps:



Fig. Mine reclamation through Forestry approach

i. Create a suitable rooting medium for good tree growth that is no less than four feet deep and made of topsoil, weathered sandstone, and/or the best available material.

ii. Loosely grade the topsoil or topsoil substitute established in step one to create a non-compacted growth medium.

iii. Use groundcovers that are compatible with growing trees.

iv. Plant two types (or more) of trees: early successional species for wildlife and soil stability, then commercially valuable crop trees.

v. Use proper tree planting techniques.

5. Holistic Approach: When the top successional species or for local environment is not forest due to local microclimate conditions, reclamation may be better accomplished by establishing rangeland.

- Grade the best available material to the required topography, establishing keylines.

Alternatively, once those first three steps are accomplished and well-established, the livestock grazing can be reduced or eliminated to allow medium and higher successional species to take root and continue the forestry approach.

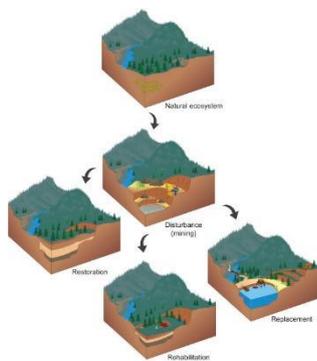


Fig. Mine land reclamation through holistic approach

III. RESULTS AND TABLES

1. The Redevelopment of Industrial Wasteland in Resource – Exhausted Mining Area:

i. What is the reason of the wastelands caused by industries?

- Mine closure and production suspension.
- The natural change of city area situation.

ii. The expansion of the lands can be valued on account of these values:

- Economic value
- Historic and cultural value
- Ecological value

iii. To establish a good environment, we should take the following measures: restoring and protecting ecological environment of wasteland, protecting biological diversity, maintaining the uniqueness and integrity of nature and landscape.

a) Take advantage of old mining in the land development as well as to avoid large-scale demolition and reconstruction.

b) They should not only delimit the protection scope of industrial heritage sites, but also prepare for the corresponding industrial heritage conservation planning which should be integrated into the master plan of city construction.

1. Foundations for Housing on Reclaimed Mine Lands:

i. Tolerance of Structures:

STRUCTURE	DESCRIPTION
RIGID	Rigid Precast concrete, concrete block, or unreinforced brick exterior walls; masonry or plaster interior walls; slab-on-grade acts as combined flooring and building support
SEMI-RIGID	Reinforced masonry or brick reinforced with exterior steel-tie bars; window and door openings reinforced to resist angular distortion; slab-on-grade isolated from walls.
FLEXIBLE	Steel or wood framing; exterior siding of brick veneer with articulated joints or panels of metal, vinyl, or wood; interior walls of gypsum board or wood-base panels; vertically oriented construction joints; strip

	windows or metal panels separating rigid wall sections with 25-foot spacing or less; all water pipes and drains into structure with flexible connections.
SPLIT	Split Walls or rectangular sections move as units (flexible joints at 25-foot spacing or less between units); suspended floor isolated from walls (probable cracking of slab accounted for in design).

ii. **Placement of Structures:** A valley fill will not constitute an ideal housing site. If one has the choice of placing a building over a valley fill or a reclaimed bench over a mine pit with a level bottom, the bench area will be a better choice. The total depth of fill, the vertical settlement, and the associated horizontal movements are all likely to be less over the bench area. However, one should ensure that the buildings are over the stable bench with a reasonable setback from the out-slope, yet are far enough from the highwall. If housing is to be constructed on an older bench, it is critical to keep the home and any water outflow from the home – away from step out-slope areas.

iii. **Foundation Alternatives:** There are three basic approaches to substructure design for unstable ground:

- a) Carry the foundation to firm bearing, as with deep piers or piles.
- b) Provide a substructure sufficiently strong and stiff to resist or bridge potential ground movements.
- c) Provide flexible or adjustable connections between the foundation elements and the superstructure.

Possible Foundation options :

1. Perimeter Wall Foundations
2. Stiffened Ground-Slab Foundations

3. Pier or Pier-and-Pad Foundations
4. Adjustable Foundations

IV. DISCUSSION

The re-development of industrial wasteland can be regarded as not only an opportunity of economic development, social progress, environmental improvement in urban renewal, but also an opportunity to reshape the image of the city. We just have to initiate and to acquaint it.

REFERENCES

- i. Virginia Cooperative Extension – Powell River Project – Foundations for Housing on Reclaimed Mined Lands.
- ii. Kirkwood, N. (2001). *Manufactured sites: Rethinking the post-industrial landscape*. New York, NY: Taylor and Francis.
- iii. Coal Mining Risk Assessment and Coal Recovery Report - Barugh Green Road Roundabout Barnsley West.
- iv. Powell River Project/Virginia Cooperative Extension publications: Available from Powell River Project (www.cses.vt.edu/PRP/) and Virginia Cooperative Extension.

Façade Design of High-Rise Housing Building in Warm and Humid Climate with the focus on Mumbai

Author 1: Mohini Rajendra Sathe, 4th Yr. B.Arch. SSMS COA

Email: mohinisathe1212@gmail.com

Author 2: Ar.Shubhashree Upasani, Asst.prof.SSMS CoA

Email: sdupasani10@gmail.com

Abstract: Façade is face of the structure. Along with the aesthetical value it should act as barrier against climatical condition. As increasing urbanisation and technological development there is increasing tendency to use innovative façade technology, hence started gaining more importance in structural system and its location as the city centres.

The approach of the research is to analyse existing concepts, design strategies, materials, façade treatments used for highrise buildings in warm and humid climate with the case of Mumbai. The study guided author to draw conclusion and result with a further scope of sensitive and climate responsive façade design.

Keywords: Building façade, warm and humid climate, Thermal comfort, Techniques and design strategies

I. INTRODUCTION

The development of infrastructure around the world has great impact on urban environment (cities), hence its effects on natural environment around. This effect creates major concern for sustainable design practises to improve the performance of the internal spaces.

Façade is defined as the outside or all the external faces of the building. It refers to a one side usually the front side of the building, which is known as building envelope. These façade has always been a design element of a building, which distinguishes one building from other. Façade can be designed in many shapes and sizes. . It should be designed, considering the aspects such as aesthetics, structural stability, material and most important climatical condition.

In high-rise building the exterior walls are often suspended from the floor slab. E.g. curtain wall glazing, metal cladding, vertical gardening etc. In the warm and humid climate the main concern is to reduce the heat gain and provide a comfortable environment within. To deal with such a climatical condition various design strategies and materials are used.

II. MATERIAL AND METHODOLOGY

In the procedure of data collection for this analytical type of research is to collect data about the climate, materials and the case study of buildings from warm and humid climate, city Mumbai. The climatical data for the city is

available in the climate database in web study and the material data for that climate is available in the research paper related to warm humid climate.

The secondary data such as drawings of each building will be obtained which include plans, elevation and sections. The basic information about the building, the location, orientation, material and design strategies used for that building will also obtained from research papers and through web browsers.

Climate study

- Solar radiation
- The intensity of solar radiation is high during summer and moderate during winter.
- Orientation
- The east and west walls receives a maximum solar intensity in summer. Shading the east and west wall is challenge. East and west wall heats significantly in summer.
- Overhangs may not be enough. The entire east and west wall have to be shaded to protect from strong summer solar intensity.

Shading devices

- Deep Porches and verandas
- Windows

It is a very important component of building envelope. It provides physical and visual connection to outside. It also allows heat and light inside and adds beauty to the building. The main purpose of building window is to provide Thermal and visual comfort the occupants.

- Vertical Shading (Shading of walls)

It is the most advisable form of shading to cut the intensive solar heat gains for east and west wall especially in summer.

Vertical green walls - Plants have an additional cooling Advantage as well as blocking light, they evaporate air passing through their leaves.

Jails-The gap between the jails let the air and sunlight through a wall, while diffusing the glare of sunlight and cutting the intense heat. They act as element of enhancing and beautifying the façade of building.

(Source- (<http://high-performancebuildings.org/>))

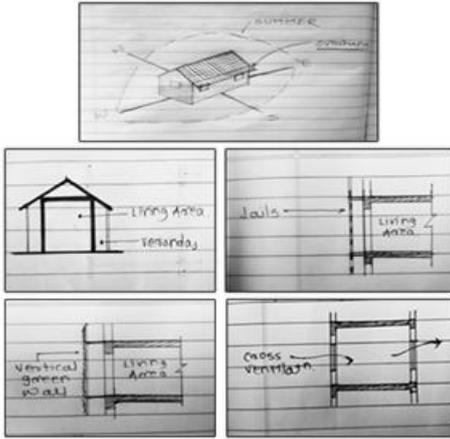


FIG 1 .Sun path diagram, Design strategies used in warm and humid climate

(Source 1 (<http://high-performancebuildings.org/>) source 2- (susan, 2019)

Construction material

- Material with heat storage capacity is used for wall construction. Material which requires longer time to heat up and less time heat loss are used in this climate.
- Use the material which reflects heat
- Commonly used materials for façade design are Brick -Brick provides an energy efficient building envelope due to its thermal mass. It helps to reduce heating and cooling loads potentially reducing HVAC system size (capacity).Brick is also a fire and impact resistant, and provides significant sound proof benefits.

Concrete -Concrete facades are perhaps one of the most commonly chosen options for architectural facades. A material which is constructed by rough solidification and rigid finish is termed as a concrete façade.

Aluminium Metal cladding -Very low specific weight. It can be easily shaped, rolled, drawn, extruded, welded and therefore it is the ideal metal for construction. Aluminium is very resistant against various forms of corrosion

Glass -There are many types of glass used in building industry for façade i.e. tempered glass, laminated glass, toughened glass,colored glassed, reflective glass etc. (Source- (AFS Architectural facade and solutions))

III. RESULT AND DISCUSSION



FIG 2 Pali palms, Bandra

The linear side of the building is oriented along east direction. The service core is also located at east side. As we know the east side receives maximum solar radiation, as a response to the local climate aluminium jalis are used for its property to reduce heat, corrosion resistant and light in weight.

Overhangs are provided with continuous open able glazing know as screen. They allow sunlight inside and provide ventilation within the building at the same time overhangs are used to reduce the excessive heat and maintain thermal comfort in interior space.



FIG 3. Antilia, south Mumbai vertical gardening (source- https://en.wikipedia.org/wiki/Antilia_building and <https://www.alamy.com/stock-photo/antilia.html>)

It is a 27 story private residence. There are several gardens are provided at various levels which distinguish one zone from other zones (e.g. parking area, meeting are from private residence).

The external walls at certain level are covered by hydroponically grown plants which is supported on trellis (a frame of lattice work used as a screen or as support for climbing plants) which is commonly known as ‘vertical green wall’. Green wall helps in filtering the air and limits the need of air conditioning. Plants act as energy saving device which absorbs sunlight and maintains the interior space cool in summer and warm in winter.



FIG 5 .world one at lower parel Overhangs and glazing in the façade (source- (Jay Berman, 2016) The building is 442 m high. The shape of the building is designed considering wind flow and the local climate of

the city. The cloverleaf plan of the building provides adequate light and ventilation. Overhangs are provided with open able glazing, high performance E glasses are used for glazing. Overhangs are used to reduce the excessive heat and maintain comfortable environment within.

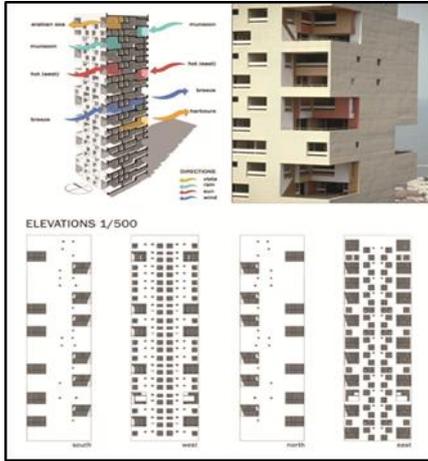


FIG 4 Kanchenjunga at cumballa hill
View of terraces, orientation of structure showing wind flow and sun path and elevation of all the sides. Source- (shankar, 2018)

The building is 84 m high. It is oriented along east to west direction to receive sea breeze and to give view of the city. The east to west sides receives maximum solar radiation and heavy monsoon rain to deal with this problem terraces are provided. The tenements are planned in various levels so the terraces are at different level to keep out the sun and to receive cool breeze. Terraces are painted in vibrant colour red and yellow.

In this warm and humid climatic zone main task is to reduce heat gain in interior space. There are many strategies that help to reduce the heat gain such as thick walls, courts, water bodies Etc. But it is not always possible to provide these strategies in such a high-rise building. Hence the new strategies are evolved with technological development. Local materials are getting replaced by new materials e.g. glass, metal, concrete that gives strength as well as provides aesthetical look to the structure.

IV. CONCLUSION

The utilization of innovative façade technology in façade designing, facade should provide comfort to the user. Proper use of material combination with sustainable design strategies such as vertical green wall, cross ventilation, jails will help us to adopt comfortable, fresh environment within building then it will act as sustainable design.

ACKNOWLEDGEMENT

I would like to express special thanks to my guide Prof. Shubhashree Upasani maam and Prof. Anuradha Joshi maam for their guidance and support in completing the research paper.

REFERENCES:

- i. (n.d.). Retrieved from <http://high-performancebuildings.org/>: http://high-performancebuildings.org/pdf/ECM5/ECM5_Technical_information_Warm-Humid.pdf
- ii. "Pali Palms / SEZA" Arch Daily. (2017, December 25). Retrieved October 12, 2020, from Arch daily: <https://www.archdaily.com/885972/pali-palms-seza> ISSN 0719-8884
- iii. AFS Architectural facade and solutions. (n.d.). Retrieved from architectural-facade-solutions.com: <https://architectural-facade-solutions.com/landingpage/aluminium-cladding/#:~:text=There%20are%20various%20types%20of,lasi%20for%20a%20long%20time>
- iv. Archdaily. (2011, August 12). Archdaily. Retrieved November 2020, from Archdaily.com: <https://www.archdaily.com/151844/ad-classics-kanchanjunga-apartments-charles-correa>
- v. Jay Berman, P. C. (2016, October 17). council of tall building and urban habitat. Retrieved October 2020, from skyscrapercenter.com: <https://www.skyscrapercenter.com/building/world-one/9337#tab-research>
- vi. LLP, P. C. (2019, February 20). ARCHITECT. Retrieved October 2020, from architectmagazine.com: <https://www.architectmagazine.com/project-gallery/world-one>
- vii. Shankar, S. (2018, September 24). Slide share. Retrieved November 3, 2020, from slideshare.net: <https://www.slideshare.net/ShivangiSrivastava81/kanchenjunga-apartments-a-case-study>
- viii. Sumita Singh. (2015, August 14). slide share. Retrieved September 2020, from slideshare.com: <https://www.slideshare.net/SumitaSingh8/warm-and-humid-climate>
- ix. susan, G. (2019, February 17). Issue. Retrieved September 2020, from issue.com: https://issuu.com/greeshmasusan/docs/role_of_building_facades_in_sustain

Achieving Functional Efficiency Through Flexible Housing Options.

Author ¹: Moullie S.Jain (moulliesj@gmail.com)

Author ²: Prof. Mahesh Bangad (mahesh.bangad@bnca.ac.in)

Name of institution: MKSSS's Dr. Bhanuben Nanavati College of Architecture, Karvenagar, Pune.

Abstract: *Housing being a fundamental need is a topic of major discussion and experiments in the field of architecture. With time technology crossed the traditional approach to housing majorly in urban lives and people have become more adaptable to changes as per availability and requirement.*

With the increasing constraint of space every inch in the city matters. Flexibility allows users to choose the most suitable solution and thus this research aims to explore the subject of functional efficiency through flexibility and adaptability for residential architecture ranging from construction, interiors, mobile furniture to modern technology-driven housing spaces following changing needs of users.

Keywords: Housing, flexibility, adaptability, functional efficiency, urban housing

INTRODUCTION

House is not just a building or material space, it is a system of activity. And space requires being flexible to adapt to the changes, in other words, flexibility is the ability of a space to arrange, adapt and reorganize as a response to user needs. Any changes in house users affect the space requirement, but the problem is that they are unpredictable and uncontrollable for example family size and family structure modifies with time without a fixed pattern. House types have developed over years and are adaptable to various factors such as nature, social and cultural conditions, economic situations, etc.

This paper aims to understand different points as - how the use and occupancy of the space are directly getting influenced by time. How the user group is influenced by the factor of flexibility. With the increase in population, space constraint is a matter of concern in urban areas, thus to cater to this interestingly while incorporating functionality to the residential space is a challenge. There is a need to understand the relationship between space occupancy and varying lifestyle.

To explore various ideas and ways in which this subject of flexibility has evolved during past years by the designers. Views of people, and how ready they are to accept changes, or are they holding back considering it to be a risk to their traditional housing pattern. Is this change useful and important and if it is then in what ways?

SCOPE AND LIMITATIONS

The scope of research is limited only to the residential space as it has a variety of functions altogether and a large period is been spent in the house compared to other areas making it the major topic to concentrate on. The area survey is limited to Pune City, being second in the country on regards to ease of living, a hub of IT sector with a huge amount of youth crowd. The age group considered for the survey was between 18-55 in 4 divisions as per their way of thinking and how acceptable they are to risk and experiments.

METHODOLOGY

Primary research was conducted by going through various research papers and articles connecting to the subject of research in detail. Various documented projects, news articles, and ideas around the globe were gone through related to this subject to understand how the world is working towards the subject and at what position we are. An online questionnaire survey was conducted with the help of Google forms at the Pune City level to understand the mindset of people and how acceptable they are to new experiments if it could be beneficial to them. It helped to understand the problems, requirements, and acceptability of user groups thus suitable solutions can be adapted as per convenience.

SURVEY AND RESULT

An online questionnaire survey was conducted among 68 recipient from various areas of Pune city and thus the results are worked out from the responses of those participants, this was just to get the idea and thus more intense survey could be carried out for further research and to be more precise.

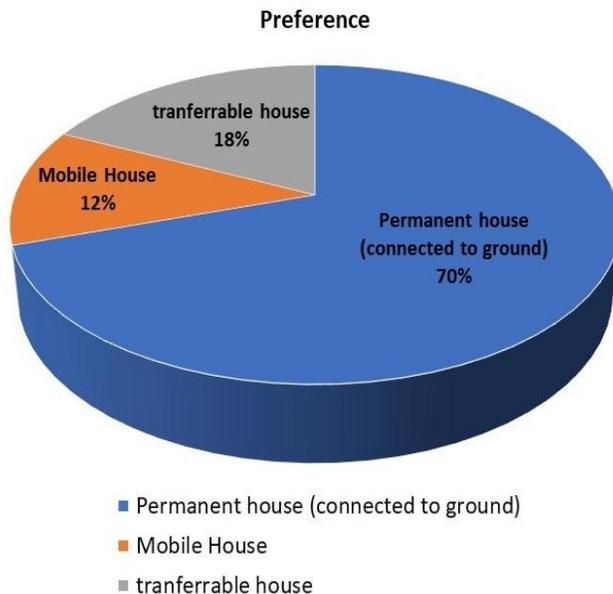
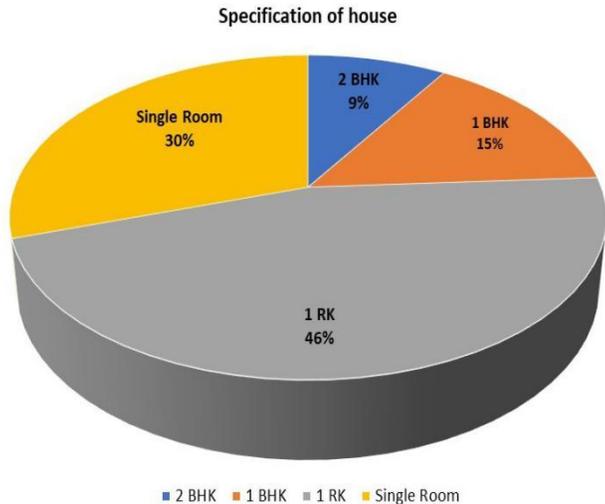
Age: The participants were divided into 4 groups as per the age i.e., (18-25,26-35,36-45,46-55) wherein the first group most the most receptive ones ready to accept the new technique-driven houses while the fourth group was happy with their current situation(conventional housing) and were not ready for any kind of changes or modern techniques with a sense of risk involved in change.

Area: The major areas of the survey were Deccan gymkhana, Karve Nagar, Shivajinagar, Kothrud, and S.B. road.

Occupation: Most of them were college students or people with a job only 3 of them had their own business.

42% of them owned their house whereas about **58%** were living on a rental basis.

More than **60%** agree with the fact that the nature of residential space has changed with time. And about **75%** of them believe feel that the space available is not enough as per their requirement.



Most of them, more than **80%** of them agreed that they faced a budget issue while finalizing or buying a house in Pune, thus had to compromise on some of the other points like the location of the house, area requirements, surroundings, facilities, etc.

Surprisingly almost **95%** of them preferred to have transformable interiors that are, their internal walls should be changeable or could be folded, rolled, or may slide and not the permanent walls, they all wished to have more of an open plan, as the city life is sort of denser which sometimes makes it suffocating thus the home is the only place expected to be peaceful.

When asked to rank how helpful it would be to have convertible(multi-purpose) furniture concerning saving up space on the scale (of 1-5) it was in between 3 and 4, thus making it clear that about **70 %** of them think that it would help.

EVOLUTION OF FLEXIBLE ARCHITECTURE

In 1914 a constructional system was proposed by Le Corbusier, named "Dom-Ino". It was made up of concrete slabs and was supported on columns and a staircase, a two-story unit. The developed prototypes were structural modules, ready frames, which only needed walls and windows. This spatial flexibility was named "plan Libre" Le Corbusier.

At the "Weissenhof Housing Exhibition" in Stuttgart Le Corbusier used the "domino" system in 1927, in the designs of two buildings an open construction plan allowing for any layout of functions, designed sliding walls connecting spaces and built-in furniture with hidden beds were used, making space multifunctional.

Le Corbusier's drawing of "The 4 compositions" from 1929 best explained the free building plan, illustrating the systematization of single-family houses. Starting with a freely shaped plan the architect then introduces the limitation of the plan to the form of a rectangular prism, then the idea of a free plan of each floor of the building, incorporated into an independent construction. Finally, Le Corbusier created an illustration of "Five Points of Architecture" combining all ideas.

Erik Freiberger designed the project of experimental homes in Kalleback. As a prototype of flexible and prefabricated solutions of living space a house was built in 1960. Consisting of 3 levels of reinforced concrete platforms the building was supported by pillars and three staircases, in which electric and sanitary installations were placed. As a result, the available area tripled, which was then divided into 18 building plots, located on both sides of the staircases. The idea was to build prefabricated individual single-family houses of various sizes and shapes, along with accompanying gardens, located on subsequent levels of the building.

In the 1930s, Johannes Van den Broek made a design attempt to create flats adaptable to the different needs of family members. The architect tried to accommodate more residents in the apartment using fold-out beds and dividing the space with sliding walls in a way that ensures isolation and privacy. From the 1950s, in Poland, Halina Skibniewska worked on a model of a flexible flat. They used to be known as "Inflectional apartments" and "Changeable flats", which were then introduced into residential buildings at the "Sady Zoliborskie" estate in Warsaw. In

apartments, a wall units system was used to apply flexible division of space with folding interior furnishings.

The Lazzarini Pickering studio designed the businessman's apartment in Monte Carlo where they used Flexible elements. The furniture is an integral part and also the walls are movable. The table can transform into a cupboard, the cupboard can change into a screen, screen into the door. Everything is designed in a very minimalist, economical style, doesn't require time to keep everything in order.

"Transformable House" is a holiday home in Sagaponac, New York, developed by Stephen Kanne its form can be open when visitors come to rest and close when they leave. The exterior of the building is simple, clean, geometric, hides many possibilities in its complex interior. It integrates with the natural environment, changes by sliding, folding, and rotating elements. The reorganization of the form allows changing not only the appearance but also the functions of individual rooms.

Portable houses can be transported or moved by wheels to them. One such design is "Loft cube" by Werner Aisslinger. It

has a flexible interior with sliding walls complimented with multifunctional equipment. The most important is the ability to change the location of the object. "Loft cube" is a modern, minimalist living space for people who are living temporarily in large and populated cities. It is modular. One segment can function alone or could be connected vertically or horizontally. Unfortunately, this is an expensive solution, not mend to be for an average user.

The mass-produced cheaper available alternatives are container boxes inserted into a modular grid. It is easy to move and combine them. Another such example of using modular and prefabricated structures is the project of student houses called "Space box", created in Delft, Utrecht, Eindhoven. These are small units for the young people in need of their own private space.

"Artin" a Polish company designed, produced, and patented a portable Mobile house called "Dodo House". It is equipped with the latest technologies. As told by producers, the house not only saves and stores energy but also uses wind turbines. It does not require connection to the sewage network as it is equipped with a system of purifying used water. There are six variants available to choose of the house, ranging from 23 to 145 sq m. The price of a house is comparable to that of flats in a multifamily building.

FLEXIBLE HOUSING SPACES (depending on nature and scale of changes)			
Changeable location (transferable structure) 1. Modular home (consist of multiple sections) 2. Portable home (can be transported) 3. Mobile house (can move by itself) 4. Autonomous home (includes new technologies)	Changeable size (flexible building structure). 1. Expandable home (structural expandability). 2. Divisible home (structural division). 3. Transformable home (structural changeability).	Changeable function (free plan) 1. Rebuildable interior (traditional partition walls) 2. Partitionable interior (system of movable partition walls) 3. Divisible interior (system of movable units)	4. Convertible interior (system of convertible and sliding partition walls) 5. Open space interior (space undivided physically) - i). Multifunctional interior (several functions) ii). Transformable interior (changeable functions)

POSSIBLE OUTCOME

The degree of flexibility depends on how easily and quickly the changes could be made and are absorbed. This depends mainly on the building structure and the size of the available space. Based on the presented examples, we can systematize the types of flexibility depending on its nature and scale of changes accepted by the users. The basic division includes the ability to change: location, size, and layout of the interior as per the comfort and requirement of the users.

CONCLUSION

Nowadays, people use portable computers and mobile phones, listen to music from the mini player, stores documents and photos in a virtual cloud, and have instant food, mobility of

objects has become everyday life, and the mobility, adaptability, and flexibility of buildings is just a step ahead.

ACKNOWLEDGEMENT

I would wish to express my deep gratitude to Prof. Mahesh bangad, for his patient guidance, enthusiastic encouragement, useful critiques, and for keeping my progress on schedule for this research work. My thanks are also extended to my elder brother and friends for their help in conducting the questionnaire survey.

REFERENCES

- I. Tatjana Schneider and Jeremy till - Flexible Housing: Opportunities and limits, June 2005, Pg no. 157-164. (https://www.researchgate.net/publication/228348236_Flexible_housing_Opportunities_and_limits)
- II. Seyed Reza Hosseini Raviz and others - Flexible Housing: The role of Spatial Organization in achieving Functional efficiency, Archnet-IJAR, vol. 9, issue 2 (2015): 65-76. (https://www.researchgate.net/publication/240916951_Flexible_Housing)
- III. Hassan Estaji- A Review of flexibility and adaptability in Housing design, International Journal of Contemporary Architecture "The New ARCH" Vol. 4, No. 2 (2017): 37-49. (https://www.researchgate.net/profile/Hassan-Estaji/publication/319059598_A_Review_of_Flexibility_and_Adaptability_in_Housing_Design/links/598d9f280f7e9b07d22bda07/A-Review-of-Flexibility-and-Adaptability-in-Housing-Design.pdf)
- IV. Monika Magdziak - Flexibility and adaptability of the living space to the changing needs of residents, February 2019, Pg. No. 2-7. (https://www.researchgate.net/publication/331314074_Flexibility_and_Adaptability_of_the_Living_Space_to_the_Changing_Needs_of_Residents)
- V. Dusan Katunskya, Carsten Brausch, Pavol Purcz, Jana Katunskaa, Iveta Bulova - Requirements and opinions of three groups of people (aged under 35, between 35 and 50, and over 50 years) to create a living space suitable for different life situations, Environmental Impact Assessment Review Volume 83, July 2020, 106385. (<https://www.sciencedirect.com/science/article/abs/pii/S0195925519305645>)

Title of Paper: Study on Upgrading Infrastructure In Mirkarwada Fishing Harbour(Ratnagiri)

Author: Mrunal Deepak Pandit¹

E-mail Id: mrunal.pandit09@gmail.com

¹SSMS College of Architecture, Pune, Maharashtra, India
Fifth year B.Arch.

Abstract: Fish farming is rapidly growing industry in India. Maharashtra state is one of the leading fish producing states. It is losing its importance because of low- maintenance and no-fixed income. Mirkarwada is one of the fishing village of the Ratnagiri city. Over the years, the Mirkarwada port has been confronted with the problems of lack of offshore and onshore facilities. This paper, focuses on provision for these facilities to upgrade this harbor to higher grade. This will help to revive the existing fishing community by upgrading their facilities to promote fishing industry, its culture and heritage and act as an urban catalyst.

Keywords – Culture of Fishing Community, Harbour Design, Socio-economic upgradation

INTRODUCTION

India is the world's second largest nation, accounting for over 4.39% of annual fish production. Maharashtra has a coastline of 720 km contributes of 15-20% of total fish production in country. There are only three fishing harbour in Maharashtra i.e., two major ports (Sassoon dock and Bhaucha Dhakka, Mumbai) and one minor at Mirkarwada Ratnagiri. From post-independence period onwards Mirkarwada has been using as a fish landing center on fair conditions. The harbour proposal was sanctioned by central government of India in 1976 and the work commenced in 1977. The important works like construction of breakwater, jetties, quays, sloping hard etc. were completed by 1987-88, but ancillary works such as internal roads, water supply etc. is yet to be completed.

Owing to delay in the works, the revised proposal with an estimated cost of over 1,800 lakhs has been submitted by the State Government of Maharashtra to the Central Government of India. Since the major works of this harbour were almost completed, the local fishermen have started making use of Mirkarwada harbour since 1988-'89. Presently, there are over 600 fishing vessels operating from this harbour and around 10,000 people's livelihood directly dependent on fishing activity

The Mirkarwada harbour is considered as a major step to revive the sizeable fishing community of Ratnagiri.

LITERATURE REVIEW

“Growth and economic significance of fisheries co-operatives at Ratnagiri and Sindhudurg districts” in Chapter 3, **Significance and problems of fisheries co-operatives in India.**” In this research paper, the author explains that our country is very **rich** in case of **natural resources**. If we **exploit them** then it will **solve many economic and social problems** very easily. One of those natural resources is water from which there are many revenue generating occupations. **Fishing** is one of them which plays an **important role in economic sector**. This paper significantly explains about the fisheries **importance** in various sectors like **food, employment opportunities, foreign earning, national income**. Even though it is an **economically and socially important sector and generator** it is being **neglected by government**. Hence, **author** has concluded that there is **need of such structures** that would **enhance the community**; occupation leading to **economic growth** of country.

The annual magazine published by **central marine fisheries research institute** states that apart from Gujrat, Maharashtra has a longest coastline of 720 km. Still has **only 3 number of total ports** of which **2 are major (Sassoon dock and new ferry wharf) and 1 is minor port (Mirkarwada Ratnagiri)**. It mentions about the major and minor fishing harbour which deals with **need of infrastructure development** for harbour according to **issues faced by local fishermen**.

Governance challenges for fishing activity in Ratnagiri town paper gives an insight about the area selected for the project. The **current scenario, issues, socio-economic status of fishing communities in Ratnagiri town** is stated. The **role of state fisheries department** and policies of government in the increasing need of local fishermen for the sustainable structure and the **basic infrastructure facilities** are stated. The **author** has documented the **discussion with local fishermen societies** and the proposal made by **government** which is **not yet implemented**. The **need to develop the Mirkarwada harbour** through the **issues. Basic training facility, infrastructure provision to fish market** is some of those issues to be resolved according to the author.

Fishing harbours in Maharashtra: an overview with special reference to Mirkarwada fishing harbour (Ratnagiri district)

Mukesh p. Bhendarkar, Sharad s. Pawar, Amarpali gajbhiye, Karan Ramteke Harsharvardhan joshi have studied about the harbours in Maharashtra. The **importance of Mirkarwada** in Maharashtra's maritime

status and the need of development of the harbour, the strategies to be put forth for the harbour is described. Author says facilities like cold storage and ice-making garbage collection and disposal must be proposed inside the harbour. This article helps to significantly think about the facilities inside the harbour to make structure more sustainable.

In Selective inclusion and exclusions authors Ratoola kundu, Geetanjoy sahu have discussed about Fishing and its unequal growth are one of the important points. The importance of Mirkarwada fishing harbour in city and its economic growth over the last two decades has increased. The lack of facilities like no access road to the harbour and untreated discharge of waste into the sea are the problems discussed by author. Author says there is a need of basic facilities to improve the traditional fishing community to expand the role of fishing sector. The important reservations in and around Mirkarwada such as informal fish market and some public toilets need to be developed and plan is the conclusion of author.

MATERIAL AND METHODOLOGY

The research method is descriptive type. The onsite surveys and facts have helped to collect primary data. The research papers, magazines and data collection has led to analyze the Current situation in Mirkarwada and identify the research gap.

GUIDELINES OF FISHING HARBOUR

A fishing harbour is a complex of facilities that act as an

Fig 1: coastal fisheries harbour

interface between capture of fish and its consumption. Indian port act 2010 and the major port trust act 1963 are two major laws at union level which govern the port sector of India. Fisheries infrastructure should consist of a safe mooring area, provision for utilities and boat servicing (water, fuel, workshops), fish handling infrastructure (ice supply, cold storage, sorting areas, processing facilities), marketing infrastructure (local market, road to nearest city market or connection to a major road or airport). Village landing centers are at lower level with basic facilities for fishing. It



can handle fresh fish of low volume and equipped with shallow bay, road access and fresh water supply. Next to this, minor fishing harbour which are handling fresh fish of low volume. It needs protected bay, beach landing, fresh water, fuel supply from drums, protected area for fish auction, ice supply by traders and facilitated for minor repair of vessels. Coastal fisheries usually involve artisanal fishermen operating on one to two-day trips from home. Vessels typically consist of large motorized canoes and decked and undecked fishing vessels with a maximum length of about 20 metres. These vessels would either be beached or moored in calm spots, such as bays and coves. In some cases, a proper port may be needed if the landings are high volume.

STUDY AREA

Mirkarwada in Ratnagiri district of Maharashtra is a fishing village where more than 90% population is involved in fishing activity. Ratnagiri has been operational since October 1986 and designed to cater the requirements of 390 mechanized fishing vessels. The need for developing a Mirkarwada fishery harbour has been felt in view of the increased level of fisheries and relative activity in terms of increase in the fleet size and quantum of fish landings.



CURRENT PROBLEMS OF MIRKARWADA FISHING HARBOUR

Fig no 2: Google Image of Harbour

In Mirkarwada there is lack of infrastructure and hygiene which can be improved.



Fig 3: Existing Infrastructure

In existing scenario there is no proper entrance constructed. No safety provisions are made at entrance. Even the internal roads are of low maintenance. The vacant land in the site is used for parking near the shades. The net repairing process is carried out on landing pier itself. It affects the vehicular traffic at peak hours. Vehicular circulation is done on landing pier itself. No fuel station is provided, no shades are provided which becomes difficult for the users during climate changes. Land silting is also a problem that creates a dead corner. The shades are built on encroached land by the user in the site. Temporary shades are built on that land which are unplanned. The materials used for shades are light which can be easily dismantle. The drain is filled with the waste thrown on the dock which does not allow water to drain down to the sea. There is no other drain on the site which result in silting as small pockets on the site.

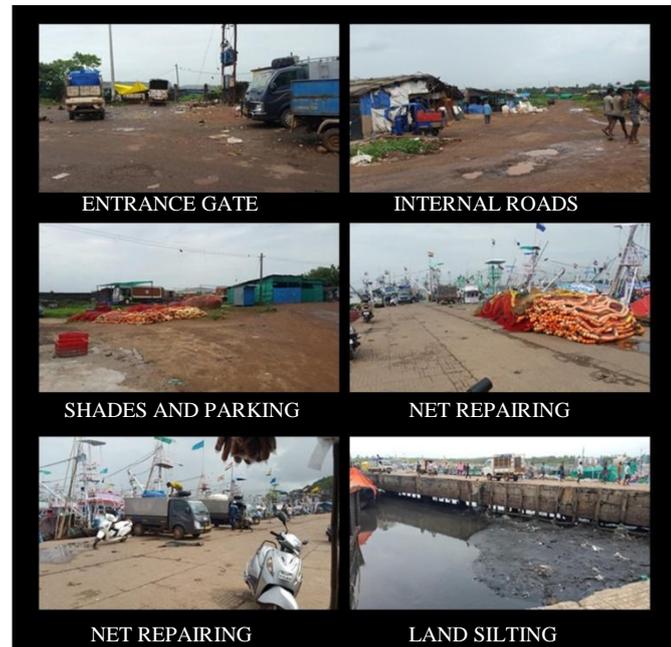


Fig 4: Onsite photography
ASSESSMENT OF HARBOUR COMPONENTS

The fishing harbour is built on virgin land which is government authorized. Land use of the area, environmental conditions of the site, access to the site, availability of water, existing and future industrial development, dust settlement on fish and fish products, rainwater collection systems, fouling of harbour basin and groundwater aquifers are well assessed in the planning stage itself and addressed during construction. HTL/LTL demarcation, policy legal and administrative

framework, environmental impact assessment is studied. Considering the requirement for the fishermen, the following facilities can be proposed:

Construction of northern breakwater	Restaurant
Construction of wharf	ETP plant
Construction of jetty	Public Toilet
Construction of Auction Hall	Exhibition hall
Net mending sheds	Observatory deck
Fishermen Rest sheds	Promenade
Boat repair	Shops
Admin office	Training block

CONCLUSIONN

Mirkarwada being the only minor port in the state needs to developed the offshore and onshore facilities in a synchronized manner. This study is focused to assess the additional facilities to be added to upgrade this harbour to higher grade and give a grade of hope to develop the harbour Further into tourist spot.

ACKNOWLEDGEMENT

I would like to express my gratitude from the bottom of my heart to my guide Prof. Shubhashree Upasani, Prof. Harshada Bramhe, Prof. Hrishikesh Puranadare for their valuable guidance, inspiration and encouragement. I would also like to thank my friends and all those who have indirectly guided and helped me.

i. REFERENCES

- ii. www.shodhaganga@inflibnet
- iii. <http://www.cmfri.org.in/marine-fisheries-census>
- iv. <http://urk.tiss.edu/images/pdf/Governance-Challenges-for-Fishing-Activity-inRatnagiri.pdf>
- v. <http://www.cmfri.org.in/marine-fisheries-census>
- vi. <http://www.fao.org/3/i1883e/i1883e.pdf>
- vii. https://www.researchgate.net/publication/290558516_Selective_inclusions_and_exclusions_Land-use_planning_and_development_in_Ratnagiri

Need Based Architecture: Use of Its Principles In Urban Housing

Mrunmayee Paranjape, V yr B.Arch

mmparanjape98@gmail.com

Abstract: Cities have always seen variety of housing typologies. Need based architecture is a stream which is always looked upon as habitat for the people from economically backward group. Problems related to infrastructure, sanitation are often discussed with respect to slums. But is it just that or is there anything more beyond this prejudice?

There are certain principles which are used while building these settlements. These principles may not be stated anywhere. But there is some order in this chaos. Some parallels can be drawn if we observe these settlements carefully.

In 21st century cities are expanding rapidly and so is the population. Cities today are facing major space crunch. Aim of this study is to find out some commonalities between informal settlements to understand the planning principles. Out of these some can be used while designing urban housing in order to minimize the area of unit.

Keywords: Compact housing, Informal settlement, Multi-functionality, Minimum Habitable Area, Need-based architecture, Space scarcity.

II. INTRODUCTION

The world today is facing many urban issues. On larger level we often hear people discussing large scale conflicts like political wars between certain countries, problem of refugees. There are some serious environmental issues like global warming, climate change, increasing stress on natural resources.

India is having issues such as poverty, religious conflicts, unemployment, and lack of infrastructure. If we look at all these problems a common thread can be passed through all these points. That thread is constant increasing population. It is clearly one of the reasons behind all the issues world is facing today. India is the second most populated country in the world with nearly a fifth of the world's population. According to the 2019 revision of the world prospects population stood at 1,325,642,280. During 1975-2010, the population

doubled to 1.2 billion. The Indian population reached the billion marks in 1998. India is projected to be the world's most populous country by 2024, surpassing the population in China. (Office of the Registrar General & Census Commissioner, 2018)

Man has three basic needs namely food, clothing and shelter. Need of food increases with increasing population. Habitable land then gets utilized for agriculture to fulfill the need of food. Currently 50% of the world's habitable land is used for agriculture. Only 1% of habitable land is urban and built up. When a country is housing such high population density of people per square kilometer is high. According to the UN data, India as a whole has a population density of 420 people per square kilometer, which ranks 31 st in the world In Mumbai population density is 21000 people per square kilometer.

Generally habitable area consumed by each person in any family is directly proportional to their family income per year. Clearly people from higher income groups consume more are space per person compared to people from middle or lower income group. In lower income groups dwelling sizes are smaller with are of approximately 10-20 square meter. In middle income group average dwelling size is nearly 40 square meters. In higher income group it is approximately 90 square meters. (Kozhenova, 1998)

Here the concern is that when there will be very less land left in the world for habitation, who will claim that land? Can this land distribution be only left to the economic condition of any human being? Can we then really afford the luxury of consuming more habitable area than our requirement?

One of the solutions to this issue can be compact housing. Consumption of minimum habitable space for each person may help in even distribution of available habitable space for everyone, no matter what one's economic condition is.

IV. LITERATURE REVIEW

Informalising Architecture- The Challenge of Informal Settlements

Informal settlements which have grown up globally out of immediate need for shelter and community and are legally precarious transgress established codes of land tenure, urban planning, design and construction. Their condition requires transgression, even if they are subversion through necessity rather than by design.

Around a billion people live in informal settlement. This is the major reason due to which cities have absorbed the massive urbanization of the past half century. Informal settlement transgresses formal rules because they have few options. Informal construction transgresses some definitions of architecture, and our engagement with it requires modes of practice that transgress normalized boundaries of architectural practice and ideology.

While dealing with incremental upgrading of informal settlements, the range of issues there calls for precisely the kinds of innovative spatial strategies that architects are best at. The challenge for an architect is to enter the complexities of incremental urbanism.

This paper talks about the formation and need of informal settlements. Densely populated informal settlements in growing cities are extremely essential in order to house the constantly increasing population in the urban areas. It also states that this growth needs to be monitored by architects and urban planners. (Dovey, 2011)

III. RESEARCH METHODS

This research has three major parts to it. First part is finding out principles of need based architecture if there are any. Second part is categorizing the principles further based on the factors governing these principles. And then comes the third part which involves listing down the principles which can be used in urban housing leaving aside the factor of economic condition of the user.

i. To understand the principles of need based architecture

Settlements in different cities show different characteristics. Climate plays very important role in formation of these settlements. Factors such as maximum and minimum temperature, humidity, rainfall,

proximity from sea or any other water body govern the characteristics of the dwelling. Thus building material, size of the openings, position of the openings, distance between two units, width of common passage, floor height differs with the context. There are other aspects like occupation of that particular family, size of the family, average family income, lifestyle which differs with culture of that community and context or area. (Smith, 2007) Case studies selected for this research topic therefore have different climatic and contextual background. One of the area selected for study in a part of Dharavi near Sion station i.e. Naik wasti. Climate there is hot and humid. Another area is a part of Datta wadi settlement near Dandekar bridge in Pune. Pune falls under moderate climate region. Economic condition of the residents in Dattawadi is comparatively better than the residents on Naik wasti. Comparative study of both these cases considering different factors is throwing light on principles of need based architecture. The main aim was to observe that area of the settlement and drawing the parallels if any.

ii. To understand the space requirement and population growth in the city.

This research started with the main issue of scarcity of habitable space in the metro cities. Constant growth in population is one of the main reasons behind this. To understand this in depth factual data needs to be studied in detail. Paper is focusing on Indian cities, mainly Mumbai and Pune. Hence the official demographic data of Indian cities can be used to validate the argument.

iii. To analyse if there are any principles which can be implemented in urban housing

A. Qualitative data

B. Quantitative data

Quantitative data includes all the figures related to the research topic such as area of each dwelling, cost of construction materials, DPH and PPH values. Analysis of quantitative data alone is not enough to prove any principles of need based architecture.

IV. Analysis & Results

Table 1 : Comparative analysis of case studies

This comparative analysis tells us the difference in the condition of both the slums; Naik wasti, Dharavi and Datta wadi, Pune. After visiting both the settlements they are compared on the following basis.

	Dharavi, Mumbai	Dandekar pool wasti
Selected area	Naik wasti, near Sion station	Datta wadi
Context	Railway station with dense residential area around	Near the river with residential and educational area around
DPH	119/hectare	87/hectare
PPH	717/hectare	520/hectare
Average unit size and no of users	2.8 m x 2.8 m family size - 6-7	3.5 m x 4 m family size - 5-6
Occupation of the family members	Shop owners,	Maids, factory workers
Materials of construction	Brick, concrete, Asbestos sheet	Concrete, brick, asbestos sheets
Infrastructure available - Electricity - Water supply - Drainage system - Road Network	Electricity available No direct water supply in the units no drainage system pedestrian network available	Electricity available water supply on alternate days drainage system available road network for two wheeler.
Space utilization in the units	Single room which is used as kitchen and living room, mezzanine floor for as bedroom	One room which is used as Living room and bedroom. And one more room which is kitchen.
Use of common area	Common passage is used as storage space Staircases to mezzanine floor of each unit are starting from common passage.	Common area is used as two wheeler parking. There are small temples in these common areas.
Area specific aspects	Two ends of the lane open out on the main roads. These two are the only connections connecting Naik wasti to the outer area.	Two ends of the lane open out on the main roads. There are multiple Sub- streets connecting Dattawadi to other areas.

This comparative analysis tells us the difference in the condition of both the slums; Naik wasti and Datta wadi. These settlements belong to different climatic zones. This can be the

reason behind difference observed in position of windows, provision for ventilation, interior arrangement of spaces etc.

Apart from the climatic difference there is one more factor which is affecting some basic characteristics of these settlements. That factor is difference in economic condition. Residents in dharavi belong to much lower income group than the residents in Dattawadi. That reflects clearly in some of the fields in above table 1. Size of units, DPH and PPH values and available infrastructure proves this economic difference.

Plans and sections of lane no. 2 of Naik wasti are analysed to understand the space utilization in the units.



Figure 1 : Plan of lane no. 2 in Naik wasti, Dharavi

Units are arranged with common walls on two parallel sides and common passage and buffer space on other two sides. All the Doors, Windows open in the common passage. That passage is 1 meter wide. Staircases connecting to mezzanine floor start from the common passage reducing the clear space further.

Units consist of a single room which is used for different functions during different times of the day. There are no partitions in the spaces for different activities due to lack of availability of space.

Common passage between the units is 1.5 meter wide. Space above the passage is occupied by the landing of the staircases in the passage. Roof overhang of the units on both sides keeps the passage covered. It is also utilized as storage space by most of the families.



Figure 2 : Cross section through lane no. 2 in Naik wasti, Dharavi

In this cross section we can see that the maximum vertical space in the unit is utilized by constructing a mezzanine floor above. That space has height of 1 to 1.2 meter the mezzanine is only used as a sleeping space with small niches for storage in the corners or under the bed.

In apartment or flat typology users are familiar with the system in which there are different spaces for different activities. But people from economically backward class cannot afford this kind of luxury in terms of area. (Deshmukh, 2013)

Most of the units in Naik wasti, Dharavi have only one room with approximate area of 7-9 sq. m. Each unit is shared by approximately 6-7 people. Available space is used as living space and kitchen during the day and sleeping space during night. These spaces serve many purposes during different times of the day. Multi functionality is one of the principles which are commonly observed in informal settlements.

Main road level is 2 meter higher than the settlement. These two levels are connected with narrow steps. Start of the lane opening out on the main road is busy in the morning and evening time. But in the afternoon and at night it is used as a community space.

90% of the units have mezzanine floors. There is no space left on the ground floor of the units to accommodate the staircase. Ladders are commonly used to access the mezzanine. Very few have used staircases but those are also of the trade-riser ratio of 1:1. These ladders or staircases start from the common passage between the units. This helps in saving the space inside the units.

V. DISCUSSION & CONCLUSION

Out of the principles which are discovered analysing the data collected, there are few principles which are followed in order to keep the construction cost low considering the economic condition of the user. Thus these principles need

not be considered while designing compact urban housing

- a) **Shearing of services**
- b) **Use of common spaces for some activities**
- c) **Use of flexible materials for construction**

Following principles are relevant in saving on to the habitable area per person and thus can be considered while designing urban housing.

- a) **Minimum Space utilization per person**
- b) **Multi-functional spaces**
- c) **Incremental units**
- d) **Common walls between units**
- e) **Ventilation only on parallel sides of the unit**
- f) **Minimum area consumed in circulation**

VI. ACKNOWLEDGEMENT

I thank my college PVPCOA for giving me this opportunity of writing a research paper as a part of fourth year curriculum. I'm grateful to Mr. Shekhar Garud who guided me throughout this research.

I thank Milind Paranjape, Atharvi Netragaonkar, Aparna Kher for reviewing my paper time to time and giving me direction in completing this paper.

VII. REFERENCES

- [i] Adewale, B. (2015). *Designing to human needs. Global journal on humanities and social sciences.*
- [ii] Deshmukh, M. S. (2013). *Condition of slums in Mumbai. Voice of research.*
- [iii] Dovey, K. (2011). *Informalizing architecture - The challenge of informal settlement. university of Melbourne, 83-89.*
- [iv] Freidrichs, C. (Director). (2011). *The Priutt-Igoe myth [Motion Picture].*
- [v] Kaur, G. (2014). *Study of slums in India with special reference to Dharavi. IRJMSH, 159-163.*

[vi] Kielerstajn, R. (2018). *Evaluating India's slum redevelopment program: The case of Dharavi.*

[vii] LI, H. (2002). *Versatile space. DOA.*

[viii] Office of the Registrar General & Census Commissioner, I. (2018, March 03). Retrieved March 05, 2020, from <https://censusindia.gov.in/>.

[ix] Shatkin, G. (2004). *Planning to forget. Urban studies, 2469-2484.*

[x] Smith, C. E. (2007). *Design with the other 90%: Cities. Michigan: Cooper Hewitt.*

[xi] T, D. (2013). *informal vertical communities.*

VIII. APPENDIX

Figure 1 : Plan of lane 2 in Naik wasti, Dharavi4

Figure 2 : Cross section through lane no. 2 in Naik wasti, Dharavi 4

Table 1 : Comparative analysis of case studies3

Art in Progress: Reminiscing the art and heritage of the city

Mrunmayee Umesh Pawar, Prof. Ar. Pushpagandha Shukla

CTES College of Architecture, Chembur, Mumbai

Email: mrunpawar007@gmail.com ; gandha.shukla@gmail.com

Abstract: *Is there an art district in your city? The answer would probably be yes. Art districts are areas that predominantly contain different versions of art that co-exist and flourish. The Kala-Ghoda precinct in Mumbai is one such thriving art district and has a flourishing art scene in a heritage precinct. The precinct is rich in built heritage but two of the prominent structures located strategically are now sadly in a state of neglect and dilapidation. Integrating the concept of Heritage conservation with Adaptive Reuse through present-day architectural interventions for a thriving urban setting is a challenge. The methods that are used in addressing these challenges fulfil the need for preserving old heritage structures and provide an alternative to demolition and create a contemporary design. The paper majorly draws its strengths from the complexities and dilemmas of complex heritage considerations, and providing solutions to these challenges for public access, nurturing art aspirations, thriving urban centres in the contemporary world.*

Keywords – Art, Public art, Cultural districts, Historic precinct, Heritage conservation, Urban centres, Revitalisation, Art in Progress

INTRODUCTION

When one tries to understand art, there is no universal meaning or definition available in the popular culture. Why is that so? Because art can be so many things. It's not just a sketch but can spread to photography, mosaics, sculptures, videography, animations, and many other forms. As humans, we tend to find art in a form that seems delightful, but art can also show rage, sufferings and sorrows. Art is not just beautiful but can also be bizarre, controversial and disturbing and all of this art is not just limited to the closed walls of galleries and museums but is found in public buildings, on the streets, in the room and on the table. There are multiple forms of art amongst which Public art is one such art form that affects and moves our behavioural patterns. Every public art project not only creates an interactive process, but associates us to the city we live in, makes us relate to its history and enhances our economy. Along with this, there is Indian art, where we can witness multiple versions of art forms co-existing such as dance forms, paintings, musical forms, textiles, fairs and festivals, rock art, cinemas, handicrafts, etc. The varied versions of Indian art have been practiced and expressed in our culture from the ancient times: Prehistoric art of Bhimbetka to the contemporary art of Sudhir Patwardhan.

On the other hand, an equally parallel study explores on how art is expressed around the globe, where it not only exists in various forms but also used as a powerful weapon to address social political issues, speaking for human rights, protest art against the civic bodies, etc. for e.g., the black lives matter mural painted on the street of Washington DC which leads to the White House.

'Art is an uncommitted crime' said by the German philosopher Adorno, suggests that Art promotes the tools with which we can change or challenge the society. For e.g., Banksy, the Guerrilla Street artist. The study of this co-existing art forms has also been witnessed in the Bauhaus philosophy and its interpretation in modern art, whose core objective symbolized integration of various fields of art.



Figure 1: Kala Ghoda x Multiple Art forms, art works and artists.
(Source: Author)

Similar to this philosophy, some cities have prominent spaces where multiple versions of art and expressions coincide, they're known as art and cultural districts of the city. Art districts are spaces representing a particular era, style and communities. These districts predominantly allow the various versions of art to co-exist and flourish, to which people can relate to while art progresses. It is connected to integrated service industries such as art galleries, theatres, music ventures, cafes, boutiques, and numerous other services. The core pillars of any art districts are cultural facilities, art organisations, individual artists, art-based business and the local community. Art districts are unique to character, community, and resources available locally. Therefore, in modern times it becomes important for such art districts to grow into one's urban landscape as they have a significant impact on economic, cultural and heritage values of the city.

CONCEPTION

Art districts are precincts with a certain cultural, artistic and heritage background. There are different types of art districts

depending upon their existence, occurrence and most importantly their context. The research undertaken explores a certain formulation of conception through the study of art districts which have two major facets in common, i.e. Adaptive re-use and Heritage conservation. Adaptive reuse is a process of taking an old structure or site and paying homage to its history.

There are multiple reasons why adaptive reuse matters, as it protects the characters of our communities and keeps us tied to our roots. It also sheds light on neglected dilapidated structures to be given more functional use in today's time. The second aspect of the conception highlights heritage conservation of art districts under which heritage demonstrates interaction between people and places over time. Such heritage is important for our community and need to be preserved. Conservation is a method of maintaining the transition of a heritage structure where

necessary along with strengthening its importance. Heritage conservation significantly matters as it not only safeguards our history but also revitalizes a sense of identity and preserves our roots.

All of this is a premise of the conception and the continuation of cultural life is the fabric that we all seek for. Life continues, so

Parameters	Characteristic	Highlight of the district	Criteria for selection	How does it help the research
798 Art District	Epicentre of contemporary art district	Empty buildings are transformed into art galleries, industrial remnants act as dynamic structural features	<ul style="list-style-type: none"> Co-existence of various versions of artforms & spaces Similar neighbourhood characteristics according to the study of types of art districts Approach & application of adaptive reuse 	<ul style="list-style-type: none"> Found in historic city centre just like the Kala Ghoda precinct Preserves heritage significance Study of origin, development and decline Highlights alternative to demolition
Wynwood Art District	Multicultural Urban district	Lifeless warehouse buildings and streets into a vibrant outdoor museum	<ul style="list-style-type: none"> Co-existence of various versions of artforms & spaces Multicentred urban zone of the city Integration of multiple industries to the art field Approach & application of adaptive reuse 	<ul style="list-style-type: none"> Found in the abandoned city centre Helps studying relation of past, present, and future Helps understand how different versions of art from various eras can exist together Study of origin, decline and development of a district
Kochi Biennale	Rich Heritage Art District	Heritage structures and disused structures renovated as art galleries and exhibition spaces	<ul style="list-style-type: none"> Located in the heritage precinct city of Kerala International Art event of the country Co-existence of various versions of artforms & spaces Approach & application of adaptive reuse 	<ul style="list-style-type: none"> Although heritage, helps understanding the reusing of the neglected structures of the heritage precinct Helps reimagining the use of these structures for art events and for varied communities Promotes the heritage walk across the art festival
Lodhi Art District	Vibrant public art District	Conversion of building facades in the Lodhi Colony into an open public street art space	<ul style="list-style-type: none"> Open Public show Public Street art in the form of facade Murals & graffiti Opening up a residential colony for public as a form of open gallery almost throughout the year 	<ul style="list-style-type: none"> The architecture forms for a backdrop for these concepts Understanding necessity of walkability between art events in an art district

does art continue and so does an art district live, thrive or doesn't thrive. But the problem here is that the fabric often gets breaks and the breaking point is where the structures that house these art patterns and cultural elements in an art district become dilapidated. The whole art scene then becomes disturbing, to practice art and to allow it to flourish culturally for the city. Therefore, these dilapidated structures that are in the heart of the art district centre of Mumbai were chosen for a proposal where the art district gets revitalised and, in the process, the built forms also undergo a revival.

MATERIAL

The conception of the thesis helped to bring together two major facets of the art districts, i.e., adaptive reuse and heritage conservation. But to explore the working of this conception and its relation implications on art districts, four case studies are

Articles/ Books/ Magazines	Key idea of the article	Purpose of the article	Criteria for selection
'Community integral to preserve, restore heritage of a city' By: Express News Service Date: September 29, 2019	Importance of community involvement to revive the heritage of the city	<ul style="list-style-type: none"> Highlights the importance of community involvement to revive the heritage of the city Elaborates the original purpose of heritage precincts & heritage walks of the city Importance of documentation in the process of preservation Highlights importance of social beliefs 	<ul style="list-style-type: none"> To understand how a community based resource center works How the community is important in preserving and promoting the architectural & cultural heritage Understanding the importance of the heritage walks within a heritage precinct Various tangible & intangible aspects of community integration in preserving the heritage
'If a problem cannot be solved enlarge it' From: City Heritage Centre Website	Highlighting the city heritage centre of Ahmedabad	<ul style="list-style-type: none"> Preserving the heritage with Modern development center of a historic city center Highlights how it helps the community in preserving the heritage precinct Create awareness through the heritage center Puts light on the restoration of old Haveli in the heritage precinct 	<ul style="list-style-type: none"> How the community is important in preserving and promoting the architectural & cultural heritage Encouraging the state of dilapidated structures Adaptive reuse criteria of such heritage structures Understanding the heritage walks into the precinct
'Overwriting historic spaces in Modern cities' By: A. G. Krishna Menon Mag Publications Date: September, 2019	Highlights the intricacies of the development of historic spaces in modern cities	<ul style="list-style-type: none"> Exposes generic fault lines in urban planning in India Criticizing of current policies of prioritizing new developments over conservation of built heritage Examples of such scenarios happening over the years in the country 	<ul style="list-style-type: none"> For understanding the contrast scenarios of heritage structures & modern times The impact of modern development on historic precincts Challenges of development of historic spaces Outcomes of modern developments overwritten on historic spaces
'Buildings of the Kala Ghoda art district' By: IJER Mag Publications Date: May 20, 2009	Raise awareness about the importance of this precinct and its buildings and focus on its emerging role as an Art District	<ul style="list-style-type: none"> The book talks about the origins of the Kala ghoda precinct Talks about its urban context along with the Fort precinct Discusses the importance of the structures that contribute to the making of this district Talks about the coexistence of art district elements concentrated within the precinct 	<ul style="list-style-type: none"> To understand the importance of the precinct To highlight the focus on the context study of the art district To compare the structures of various art districts to the kala ghoda precinct To understand the emerging role of spaces that contribute to the heritage & social interaction in the district

studied. The selection of case studies is determined by particular **Table -2 Comparative Matrix of literature review.** (Source: Author)

set of criteria such as:

1. Identifying elements and functions of art districts
2. Similar neighbourhood characteristics according to the study of types of art districts
3. Approach and applications of adaptive reuse

On this basis, four case studies are presented, from which two case studies are of foreign art districts and two are Indian, which were mainly abandoned dilapidated districts of high heritage value. These art districts have been converted into spaces for public use. The case studies are presented in the form of a comparative matrix with major take away from each art district.

Table -1 Comparative Matrix of case studies of art districts
(Source: Author)

As the research paper has layers of understandings of multiple aspects of the art districts and its heritage value, the literature

review which was done consisted of four papers which were segregated into four majors, which included articles on:

1. Understanding communities: puts light on importance of community involvement to revive the heritage of the cities
2. Understanding heritage: which highlights the example of the city heritage centre of Ahmedabad and puts light on preserving the heritage with modern development
3. Historic spaces in modern cities which highlights the intricacies of the development of historic spaces in modern cities.
4. Buildings in Art districts which raises awareness about the importance of the heritage precinct & its building focusing its role in preserving city heritage.

METHODOLOGY

The research explores functions, spaces and activities that are for public access for the art district. In order to achieve that, the first method opted is the collection of primary and secondary data. Primary data collection focuses on the first-hand data collected from interview, surveys, talk with experts, site visits and community inputs. The secondary data collection includes data collected from online studies, newspaper articles, design proposals, etc. This further broadens the understanding and creating a design brief for the research. Three specific structured interviews were a part of the research, with Brinda Miller-chairperson of the Kala Ghoda Association, Chetan Raikar-structural engineer celebrated as a restoration specialist and Jatini Ambani- heritage conservationist. The structured interviews helped in creating the parameters for the research in defining the design intervention.

The second method opted for research is that of mapping of the context and understanding the layers of contextual studies. A base map study of the art district elements for the city of Mumbai was done, under which Museums and Cultural spaces (16), Art galleries (29), Art festivals (12) and events were mapped. On overlaying these mapped elements, there was a clear concentration of art district elements in the Fort Area in South Mumbai, which happens to be the Kala Ghoda Precinct.

SITE SELECTION

Kala Ghoda precinct in Mumbai, is a vibrant, crescent-shaped area with a concentration of historic buildings, restaurants, cafes and the thriving art scene of numerous art galleries, designer stores and cultural activities. However, Kala Ghoda was not always a vibrant centre of art and culture, but was known primarily because of its libraries and colleges with many of its historic buildings that are now in a state of neglect. Since it was founded, the Kala Ghoda precinct has dramatically evolved. The space today houses some of the major space elements of an Art district, a district that allows the co-existence and flourishing of these different genres of art which largely enriches the public and the art.

A detailed mapping process of the Kala Ghoda precinct is done to which helps the research understand the architectural built and unbuilt environment in relation to the emerging art district and derive at a site selection of core area within the art district.



Figure 2: Base maps study of Mumbai. (Source: Author)



Figure 3: Kala Ghoda Art district illustration. (Source: Author)

The mapping of the precinct includes art galleries and museums, art events and festivals, theatres and screening facilities, cafes and bakeries, libraries and book cafes, designer stores and boutiques. This detailed overlay map (Figure 3), of the Kala Ghoda precinct which highlights the core area that witnesses highest concentration of art spaces in the closet proximity. This is the core area selected from the art district which also happens to be the commencing spot for the annual Kala Ghoda Art festival. The study includes the heritage structures mapping

process (Figure 4), through which it can be determined that there are maximum percentage of Grade II Heritage structures in the precinct which allows the project to opt for adaptive reuse along with heritage conservation for dilapidated heritage structures.



Figure 4: Precinct mapping of the art district elements (above) & Map showing heritage grading buildings. (below)
(Source: Author)



RESULTS AND TABLES

The above research and study of the precinct mapping and the heritage structures mapping in the precinct resulted in the selection of the main site for this project. For site selection the above study of the core area is important as it helps in selection of two heritage and iconic structures for design intervention. one of which is in a dilapidated state – Watson Hotel and the other structure has lost its original purpose of existence – Rhythm House. They structures are located opposite to each other and share a common axis across the street and in their appropriate centre stands the Kala Ghoda statue.

Watson Hotel:

The Watson hotel in the district of Kala Ghoda is the first prefabricated, cast iron building of the city in 1867-69. The

structure is built across the Kala Ghoda art district. In the center of the arts and heritage area, the building of course provides much space for exhibits, festivals and galleries. The place is very capable of hosting a public space because it is already very busy and is open all year round. The structure,

located in Mumbai's Fort precinct, was a well-run hotel before in the 1960s at a significant corner of the Kala Ghoda node. After it ceased as a hotel, it was subdivided and rented out to many people operating shops and offices. The structure is not maintained and dilapidated in itself, although the structure is a classified Grade II-A Heritage.

Rhythm House:

Located in the lively and upscale Kala Ghoda neighborhood of Mumbai, Rhythm House is home to various cafes and art shops and has a special place in the heart of the many who visit it. The store was founded in the 1940s and has been around for more than seven decades and captures the imaginations and hearts of all people who visited. Rhythm House has been evolving with its consumers' needs for 68 years. The shop sold all sorts of commercial music from lacquered tapes, LP vinyl discs, cassettes and finally the compact disc. Sadly the shop can't change anymore. In the internet era, any house entertainment product can be consumed at home. This led to the end of the music store and in 2016 the music in the precinct died as the store announced its closing.

Both these structures, sit right in the heart of the precinct which hosts a pre-existing Kala Ghoda Art festival. The art festival is organised for a very little period of time in the month of February every year in the city. But the people of the city crave for this public activity which lights up the entire precinct weaving its heritage and art forms together. Therefore, this design intervention is a result of these multiple facets of the existing art and cultural district and its existing art festival. So, the interconnection of these two structures allowing the space to exist as an art district, it will contribute to the city's growth of art values.

The study of art districts, case studies and the contextual study helps to finalise the two structures for design intervention to be revived through the art in the precinct, open for the people of the city and let them contribute back to the art district.

DESIGN CONSIDERATIONS

The four major design considerations for the proposal are lying in the domain of:

1. The heritage value of the precinct and the structures
2. The current state of the structures selected for intervention
3. The location of both the structures in the art district
4. Deriving a connection: Between the Watson hotel and the Rhythm House.

Deriving a connection between the two currently dysfunctional structures helped to create a temporal space which is being carved out which becomes a strict pedestrian zone which becomes active during the festival times and throughout the year too. Doing this does not hinder in the streetscape heritage value of the precinct and help maintain its character.

The evaluation of the above considerations addresses the complexities of the art district and the design intervention proposed in this heritage precinct. It is difficult to come to complete conclusions of balancing restoration as versus newer design interventions. Any kind of a design intervention for an art district in a heritage precinct is filled with complexities, the

decision is would not be easy. So, the dilemma was to arrive at balanced decisions and to weigh the important considerations for arriving at a relevant proposal. Thus, with the considerations and analysis of the heritage precincts, certain weightages were evolved. The weightages presented are in the four conditionalities which give direction to the proposal for selecting an apt outcome.

The conditions were derived from studies and evaluation of various research articles, audits and proposals already conducted for such complex heritage precincts:

- The first condition states that these majorly dilapidated and dysfunctional structures to be demolished and redeveloped into newer structures. In such cases (cessed buildings) the redeveloped structures get higher FSI, so after the demolition, these structures are majorly proposed to be opened for commercial use. This would just add up to another building that could probably be a glass tower that completely differs from the original structure opposing the heritage value and to maximum the use of newer FSI provided for development. **This condition fails to respect the heritage value of the structure and would not fit in the scenario of the heritage precinct**
- The second condition considers existing structures being completely restored. The condition leads to high cost of restoration and estimates that could to be double the cost of redevelopment. Since the cost of such a proposal is highly ineffective and undesirable and that is exactly why the structures continue to remain untouched, dysfunctional and further dilapidating year by year. Even if the owners agree to fund for the restoration or the revival of these structures happens, this process would fail as the structures would ultimately be handed over to the owner. **This condition fails to respect the history and location of the structure as it won't open any part of it for the public.**
- The third condition however states about the part restoration and part additions and revival of the existing structures chosen for the design intervention related to the art district. This conditionality states that the structures which were previously contributing to the art district will be revived and can be made accessible to the larger public of the city. **In this conditionality, considering the art and heritage values of the structures they will add to the thriving the art district and the precinct.**



Figure 5: Image showing Waston Hotel, Kala Ghoda statue and Rhythm House. (Source: Author)

Understanding The Problems Faced And Recommends Solutions to Implement Traditional Facades In Modern Architecture

Nandita Tole, Prof. Ar. Seema Paulzagade

B. ARCH, Fourth Year, Associate Professor

DYP School of Architecture, Lohegaon

nanditatole223@gmail.com seema@dypatilarch.com

Abstract: Facades play an important role in showcasing the architecture and history of an area. This research paper provides an insight into the challenges faced while incorporating traditional façades into urban designs. Two cities which have strong architectural character which have rules and regulations implied upon Jaipur & Ahmedabad and two cities which do not have any rules and regulations regarding maintaining the historic structures surroundings, Shaniwar Wada, Pune and also Sindhpur, Gujarat where houses aged hundred years old are in abundance which are constructed in Wada architecture style & Bhori architecture. These houses when redeveloped or reconstructed can be built while adopting traditional facades contemporary to that period to preserve the history and character of that area or can also be restored. However, to cater to the rising population and urbanization, the buildings need to have more FSI leading to the construction of many multi-storeys buildings which destroys the neighborhood character.

Keywords: façade, policy, character, preserve, wada architecture, modern architecture.

INTRODUCTION

Elevation is the most common view used to describe the external appearance of any building. In this case we are considering a specific area surrounding Shaniwar wada & the area in Sindhpur where the type of architecture found is very old hence it is very similar to each other. So, when reconstructed, redeveloped or restored the external appearance can be kept similar to conserve and preserve the character of that area. By doing a case study on a similar historic place i.e., Jaipur & Ahmedabad where both come under world heritage UNESCO sites.

CASE STUDY 1

JAIPUR, RAJISTHAN: UNESCO, JHCPR (Jaipur Heritage Conservation & Protection Regulations), 2020

The policy in Jaipur that is by sub-clause (iii) of clause (g) of section 46 and section 336 & 337 of Rajasthan municipalities act, 2009 for city which states as follows:

i] Roles and responsibilities of technical heritage committee:
- To facilitate proposed adaptive reuse plan of heritage assets.
- To enter into agreement with private with conservation and adaptive reuse of heritage sites.
- to oversee the working of heritage cell.

ii] The heritage assets are categorized in three grades as follows:

- Grade-I: National importance, ASI protected and other similar heritage sites.
- Grade-II: State importance, state owned and other similar heritage assets.
- Grade-III: Local importance, private properties and other similar heritage assets.

iii] Building Parameters and Control Guidelines:

- Setback line: as per prevailing building line. No projection which is balcony or any covered area to be constructed on public street except where it is permitted by competent authority.

- Ground coverage area: Within plot or property area. The character of open spaces to be maintained as per originally constructed. No modification permitted.

- Height: Roads main bazars (15m) G+3 height. Internal (12m) G+2 height. No coverage of veranda allowed and also no construction above shops (ekdhalya).

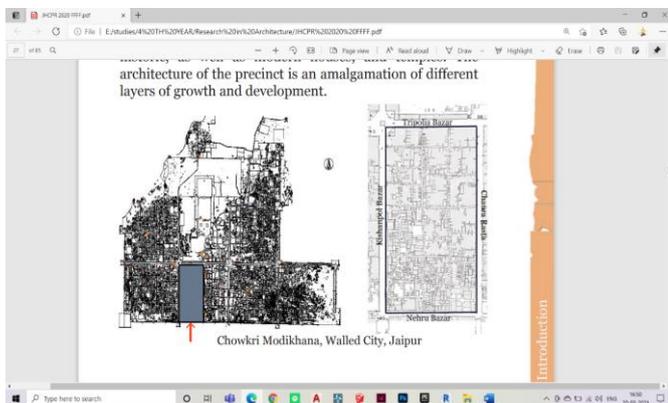
-Built Up area ratio: As achieved within permissible ground coverage and permissible maximum height or no. of floors.

- Parking: as per parking policy of walled city. Parking area to be identified and parking to be allowed in such designated areas with levy or fee prescribed as per JMC.

- No basements allowed in special cases for parking, MRT'S etc. special permission to be taken from the state government

iv] Restrictions no development/redevelopment/repair etc.: - No development or redevelopment or engineering operation or additions/alterations, repairs, renovations including painting of the building, replacement of special features or plastering or demolition of any part thereof the said listed buildings or listed precincts or listed natural feature areas situated within walled city area shall be allowed except with the prior permission of Competent Authority. Before granting such permission, the Competent Authority concerned shall mandatorily consult the Heritage Cell/Technical Heritage Committee and shall act accordingly

v] Façade control guidelines for Chowkri Modikhana, Jaipur walled: They are the extension of the Municipal Council, Jaipur (Building) Bye-Laws (Part V, No. 26).



- Aim: To counteract the loss of architectural style and contribute to the revitalization of the precinct through heritage conservation protection.

- Purpose: To help the users and owners to maintain the historic character. This guideline will be used by JNN Heritage Conservation Committee/ Heritage cell to review any project or proposal in Chowari Modikhana in the walled city of Jaipur.

- Typologies: There where two types - Havelis and Houses. The havelis of Jaipur from a single courtyard house to assemblage of multiple courts. The most prominent features of the historic facades included: grand arched entrances, multi foliated arches, colonial columns, decorative parapet bands, stone carving, brackets, stone jalīs, stained glass windows, bangaldar roofs on jharokhas, chajja ornamentation, frescos and painted motifs.

-Signage: The signage of individual shops needs to coincide with the existing historic facades and not damage the original architectural character of the precinct. The signage should be in harmony with, be sensitive towards and not encroach upon the existing fabric. Any new fabric needs authorization of the heritage cell and should be developed in close consultation with it.

- Materials and colours: No alterations in the colour of the building and its features shall be carried out by the owners. When changes carried out the original colour shall be used.

Buildings, whose facades are in the colour Jaipur pink, shall not be repainted with any pink colour imitation, but use the original colour which shall be the colour exactly matched with the historic tie in the Hawa Mahal that provides this colour. Use of distemper and oil-based finishes for elevations should be discouraged.

- Repairs, Renovation and Restoration: Repairs, Renovation and restoration of the original façade elements or any other architectural features may not be allowed with prior permission of the Heritage cell. Materials used should be same materials as used in the original works. If that is not available, any suitable substitute material can be used with prior approval of Heritage Committee. Removal/replacement of all reversible modifications, e.g., inappropriate signage, loose and fixed wires, coolers etc.

- Rehabilitation of Existing structures: The historic building should be compatible with the structural integrity and architectural significance of that building. The details or elements should be retained when improvements are done. Deteriorated features should be restored with similar material and similar craftsmanship. New additions to be placed on non-primary façade & should follow the traditions of making additions to the building as they occurred throughout the history. Any changes to the building that are needed to improve the services as in suspiciously as possible. Rehabilitation work should always take into account archaeological significance of sites. Non-disturbed soil should not be disturbed. Attempts should be made to use existing foundations and utility trenches whenever possible. Where development makes it necessary to disturb previously undisturbed soil, an archaeological investigation should be undertaken. No addition to be allowed on the exterior façade of a historic structure.

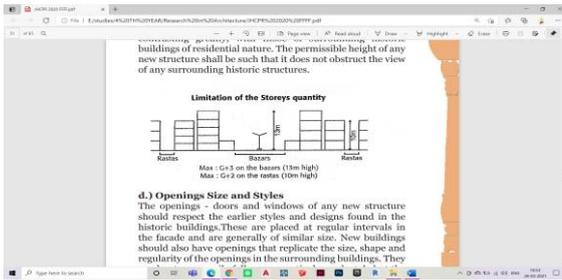
- New Construction: It should not completely replicate the original structure. The new constructions shall take inspiration from the past and not copy.

a) Building setbacks: Any new structure shall conform to the given location and shall adhere to the existing building line of the given plot. The orientation of the front façade should be visually consistent to the historic buildings. The setback should align the historic structures since there were no setbacks while construction of the historic buildings.

b) Size Design & scale: The new buildings shall conform to the volumetric proportions of their neighboring historic structures.

c) Height: The permissible height of any new structure shall be such that it does not obstruct the view of any surrounding historic structures.

d) Openings Size & styles: Any type of opening should respect the earlier styles and designs of the historic buildings. The sizes shall be proportionate to the openings found in the historic structures nearby. They should have wooden panel doors and stoned chajjas.



e) Material, Texture, Details & Colour: It should be visually compatible, by not contrasting the surrounding historic structures. The construction can be done in any material but the finishes to match the surrounding historic structures & all the other aspects mentioned in a), b), & c) above.

f) Roofs: The roof of any new building should conform to the characteristics of the roofs around them. The roof of any new structure shall conform to existing roof of similar historic typology such as any commercial or residential new building shall only conform to roof types found in historic residences. Distinct and unique roof forms such as the ones found in the historic temples should not be replicated in any manner.

g) Utilities: Any services should not be visible from outside of the buildings everything to be installed from the interior of the building.

h) Outhouses or Storage structures: An outhouse or storage building should reflect the character of the period of the house to which the outbuilding will be related.

i) Reconstruction: Reconstruction may be appropriate when it accurately reproduces a no-longer existing building on its original site, if the building would have contributed to the historic and architectural character of the area. It has to be compatible in terms of style, height, scale, massing, and materials with the buildings immediately surrounding it and should be accurately based on documentary, physical, or pictorial evidence.

j) Demolition: It is not allowed if has historic value or the building is in a good condition or is a tourist attraction but if is not in a good condition, has lost its historic value and is not a tourist attraction anymore it is allowed to be demolished.

k) Relocation: Moving a historic building from its original site should be avoided. Moving a non-historic building, or a building which has irretrievably lost its architectural and historical integrity, may be appropriate.

l) Streetscape: Streetscape in the controlled area should conform to the historic character of the streets. Paving materials on the streets should be subtle, water permeable and easily maintained. It should also be retained, restored and replicated wherever necessary. Plant materials introduced into the landscape should be sturdy, drought and pollution resistant and should be indigenous. There should be minimum amount of street furniture.

vi] Façade control guidelines for Main Bazar, Jaipur walled city, JAIPUR, RAJISTHAN: UNESCO, JHCPR (Jaipur Heritage Conservation & Protection Regulations), 2020:

- Architectural Characteristics:

a) Doors: The door openings of any new structure or any addition within the heritage structure of that period should respect the traditional styles and designs of the period of construction. New buildings should also have openings that replicate the size, shape and uniformity in opening spaces in the adjacent buildings. The ratio of width to height of doors in a new building shall be in similar to the surrounding heritage building to maintain the uniformity of the facade.

b) Windows: The window openings of any new structure or any additions within the heritage structure should follow the architectural pattern and rhythm of the openings in the facade. They are generally placed at regular intervals and are of similar sizes. Wherever possible, balconies which have been enclosed should be opened up to create cohesive facade.

- Architectural Elements: Architectural Elements such as Jharokhas and Chattris form an integral part of the eighteenth-century layer of the historic urban fabric of the precinct. These elements should be preserved wherever possible, especially in the surviving temples and havelis. In case the elements have suffered extensive physical damage and are beyond repair, they should be reconstructed only if sufficient documentary or physical evidence is available. The reconstruction of the parapets and railings should be done in conformity to the architectural features of the existing buildings. Any railings which are blocked or filled up shall be restored or replaced if possible, with a new railing similar to the original.

- Signage & Street Furniture: The original system of signage above the arched openings is presently in use by some of the shops. However, the text size and style is variable even in these signs. Street furniture like lamp post, dustbin, benches should be customised to relate with the historic context. Street furniture should be designed specifically to enhance the character of the area.

- Materials & Colours: No alterations in the colour of the building and its features shall be carried out by the owner to the elevation of the building facing the main bazaar against the uniformity to the traditional colours. The colour of the walls including the verandah and the pillars shall be dark pink. Colour of shutters, doors and windows shall be pink or brown wood colour. Colour of railings and window grills shall be in white. All alterations, additions or repairs to existing built fabric is to be carried out in matching stone or lime surkhi mortar. The traditional lime plaster and lime wash finish is to be maintained. The materials and colours of the new buildings shall be visually compatible and not contrasting greatly with the surrounding historic buildings.

- New Construction: New construction should not completely replicate the traditional architectural styles. The new construction shall take an inspiration from the past and not

copy. The new construction should be identifiable as the construction of its own time.

- Reconstruction: Reconstruction may be appropriate when it accurately reproduces a no-longer existing building on its original site, if the building would have contributed to the historic and architectural character of the area. It has to be compatible in terms of style, height, scale, massing, and materials with the buildings immediately surrounding it and should be accurately based on documentary, physical, or pictorial evidence.

- Restoration, Maintenance & Repair: Repairs/ renovation / restoration of the original façade elements or any other architectural features may be allowed with prior permission of the Heritage Cell. The materials used in repairs, restoration, reconstruction shall be in the same materials as used in the original works. However, if such original material is not available easily, suitable substitute material may be allowed to be used in the works with the prior approval of the Heritage Committee. Restoration of facades which have been damaged over time can be started by first removing all later additions which seems to disfigure the façade. JHCPR, UNESCO



- Setbacks: New building's front facade shall be visually consistent and aligned with surrounding historic buildings. The setback restrictions are as follows. All the new constructions/reconstructions will about the main pavement. Corner buildings will have both the sides of the buildings facing the main street directly abutting the main street.

- Height Restrictions: The total height of a new structure, height of each floor and the height of individual elements such as the plinth, chajjas, parapet and main roof of a new building shall be compatible, by not contrasting greatly, with those of surrounding historic buildings of commercial nature.

- Parking: Parking shall be provided in commercial areas is at 1ecu per 75 sq.km area.

The guidelines prepared will apply to all commercial areas and buildings within the precinct. These guidelines will help enforce in maintaining and determining the appropriateness of the proposed work within the heritage area of the Walled City of Jaipur. The regulation will apply to the heritage buildings, structures, areas and precincts and have to be approved by the

JNN. The guidelines will help preserve and protect the historical and architectural value of the buildings. Guidelines will help maintain urban aesthetics that compliment the historic buildings and other structures.

CASE STUDY 2

SIDAPUR, GUJRAT: Heritage Management Plan, 2016

-Bylaws tightened to preserve properties in 'Core heritage area', Times of India, 2019

-Protection and management requirements

The aim of this management plan is to assure protection of the heritage structures of Ahmadabad while promoting sustainable development. It aims at integrating cultural heritage conservation and sustainable urban development of historic areas as a key component of all decision-making processes at the city, agglomeration and larger territorial level.

The Heritage Department, Ahmedabad Municipal Corporation, as the nodal agency for heritage management in Ahmadabad plays a leading role in the preparation of the Heritage Management Plan of the city. It has the support from all relevant administrative wings in the Ahmedabad Municipal Corporation, as well as authorities like the Ahmedabad Urban Development Authority as well as Archaeological Survey of India, Gujarat State Department of Archaeology, and National Monuments Authority.

In January 2019, the state urban development department made several amendments to the comprehensive general development control regulations (CGDR), 2017, and notified them. The notification had an elaborate section on changes to development regulations for the core heritage zone of the city's walled city area. The notification had a "must do" list for heritage property owners, which included conservation of original aspects of their buildings including facades, building footprint, character of open spaces such as courtyards, khadis & other spaces, to preserve the authenticity of the heritage site.

HCA (Heritage Core Area): it is the area consisting of critical mass of buildings with unique architectural features of the original dwelling units & heritage streetscape.

Utility: Heritage structure owners shall be required to conserve facades, building footprint, the character of open spaces such as courtyards, khaki & streets. Tradable Floor Space Rates:

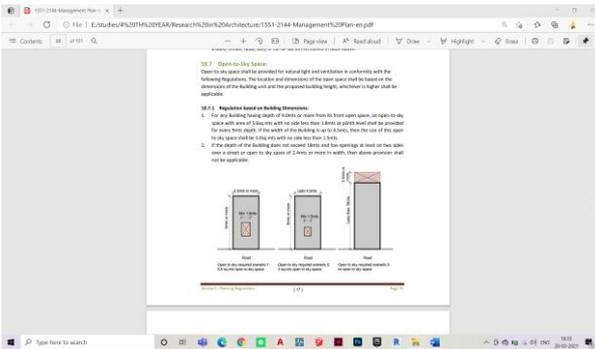
A] 50% of total utilized FSI for highest heritage value.

B] 30% of total utilized FSI for high & moderate heritage value.

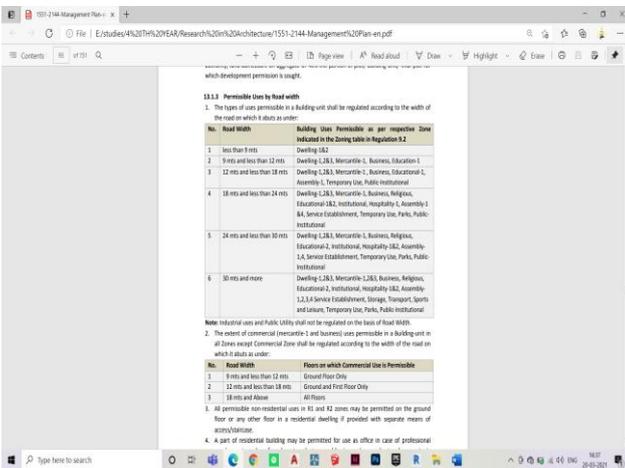
- Maximum 10% of floor space may be used for extensions of or alterations to notified heritage buildings with the limit of maximum permissible FSI.

i) Regulations implemented: Heritage Management Plan, 2016

- All open to sky shapes & sizes required according to the regulations.



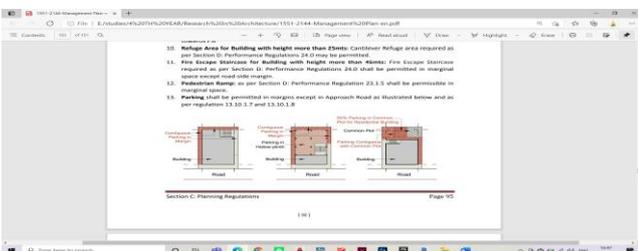
- Basement road margin 2.5m and height 3.8m
- Road width for specified buildings:



- Maximum permissible height for buildings:



- Parking to be permitted in margins except in approach road as illustrated below:



- If repairs begin before permission is granted, charges will be twice the usual.
- Repair & restoration shall be permitted according to regulations of CGDCR. Uses & FSI utilized prior to June 5, 2017, shall be permitted without considering road width.

- Any repair & restoration work shall be carried out under the supervision of a registered structural engineer category-1 with experience of minimum 10 years.

- Hospitality uses shall be permitted on all floors without considering road width.

“The rest may be utilized in other zones through the Transfer of Development Rights (TDR) mechanism, where FSI is chargeable the regulations also warned that in case of repairs of heritage buildings, the AMC’s official nod is necessary before they begin, in such cases inspection charges would be double, which is minimum of Rs 10,000 per unit for properties used for commercial purposes & between Rs 1,000 to Rs 4,500 for residential buildings. It has also been mandated that structural engineer engaged for conservation on repair should have experience of at least a decade, says a senior central zone official.

Sindhpur, Gujrat.



Ahmedabad, Gujrat.

METHODOLOGY:

By doing a case study and comparative analysis of Jaipur & Ahmedabad which comes under UNESCO world heritage sites, and also asking experts opinion, I did a qualitative analysis by asking the architects about the problems which they face on site while working on such projects.

-Primary data: Collecting the rules and regulations data from the UNESCOs website of the two cities which come under UNESCO heritage sites.

-Secondary data: Collection of data from the architects who work on site or who have worked on such projects previously by interviewing them.

Following are the questions asked:

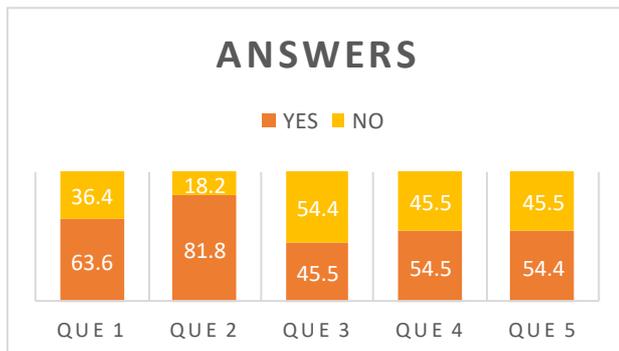
Que1] Are there any regulations governing for maintenance of the facades?

Que2] Whether policies such as architectural elevational characteristics should be maintained in the surrounding area of heritage structure which is enforced in Jaipur will help in maintaining the character in Pune?

Que3] Do you face any difficulties in procuring masons and artisans to build the facades?

Que4] Does the clients agree to keep the facades?

Que5] Is it feasible in terms of cost and implementation?



- RECOMMENDED SOLUTION

As seen from the above case studies (Jaipur & Ahmedabad) both the cities history and its historic structures are maintained by the governing bodies by enrolling policies such that they will help in maintaining the history the same can be done by governing bodies of Pune & Sindhpur to maintain the history and historic structures of these places.

CONCLUSION

From the analysis we can conclude that there are problems faced by the architects on site. Sometimes the masons or craftsman are not available. Many craftsman or masons are forgetting their skills and turning towards machinery as it is more easily available, some have left for their homes since there is no demand. The clients are also not interested sometimes in keeping the facades same since it is not feasible, it is feasible for the population which is more economically strong. People don't feel the need to conserve their houses since there is no revenue that will come from the houses as when it becomes a building, they can earn a revenue from it. Also, many clients turn to fabrication of glass and plastic which in

turn also increases the carbon footprint. The time required to make a traditional construction is more compared to the time required for a modern construction. People need to be educated about why to conserve such structures since many a times the facades were built to be climate responsive. Due to the generation gaps people from our generation not all want to conserve the history. Therefore, if a similar policy can be invoked and also, the awareness is spread about the conservation, such places can be conserved.

ACKNOWLEDGMENT

I would like to sincerely thank my guide Prof. Seema Paulzagade for her valuable guidance and encouragement throughout this paper.

REFERENCES

- i) [http://lsg.urban.rajasthan.gov.in/content/dam/raj/udh/lsgs/lsg-\[pjaipur/Order/order2019/oct/JHCPR%202020%20FFFF.pdf](http://lsg.urban.rajasthan.gov.in/content/dam/raj/udh/lsgs/lsg-[pjaipur/Order/order2019/oct/JHCPR%202020%20FFFF.pdf)
- ii) <http://whc.unesco.org/en/list/1605>
- iii) <https://www.thebetterindia.com/91930/photo-story-pune-old-buildings-wadas/>
- iv) <https://www.re-thinkingthefuture.com/fresh-perspectives/a828-the-architecture-of-wadas-of-maharashtra/>
- v) <https://s3da-design.com/traditional-architecture-versus-modern-architecture/>
- vi) <https://portella.com/blog/can-traditional-and-modern-architecture-coexist/>
- vii) <https://timesofindia.indiatimes.com/city/ahmedabad/bylaws-tightened-to-preserve-properties-in-core-heritage-area/articleshow/69349524.cms>

COMPARATIVE STUDY BETWEEN JAIPUR, AHMEDABAD & PUNE, SINDHPUR

● Parameters	● <u>Cities with regulations for maintaining the facades.</u> (Jaipur & Ahmedabad)	● <u>Cities without regulations for maintaining the facades.</u> (Pune & Sindhpur)
● Rules & Regulations:	● Yes	● No
● Materials availability:	● Materials are not always available but different materials can be used to showcase the elements required.	● Materials are not always available but different materials can be used to showcase the elements required.
● Facades control guides:	● They both have rules and regulations on the façade control.	● They both don't have any rules for maintaining the facades
● Difficulties faced:	● Due to the rules and regulations enforced upon not many difficulties are faced.	● Masons and artisans are not easily available, not all clients want to keep the facades many have turned towards the modern architecture.
● Maintenance:	● The historic structures or the old houses are maintained by abiding the rules.	● The historic structures or the old houses are not maintained as such because there are no such rules here.
● Tourist attraction:	● Since they both have been listed for UNESCO world heritages sites, they already are a tourist attraction.	● These two cities can also become a more famous tourist attraction if maintained regularly.

Learning From Indigenous Architecture: A Case of Gujarat

Navneet Savaliya, Naresh Chhatwani

IDEA, Indus University, Ahmedabad, India

Email: navneetsavaliya.17.barch@idea.indusuni.ac.in
n.chhatwani.idea@indusuni.ac.in

Abstract: *Indigenous practices in different Indian regions are the result of a long process based on the ultimate goal of achieving human comfort. The word indigenous itself describes that dwellings are made by occupants of their own, with limited local materials and time-tested traditional construction methods. Dwellings and spatial planning of villages in Gujarat have many parameters that could become a base for contemporary architecture. The purpose of the research paper is to look at both vernacular and contemporary works of Gujarat, find the relevance of indigenous practices for modern development to develop architectural sensitivity towards these traditions.*

Keywords: Vernacular architecture, indigenous architecture, learning from the past, modern demands

INTRODUCTION

‘Our vernacular traditions are in a terrible situation; we don’t have knowledge about how to appreciate that and how to preserve that. So, in being modern we have lost our ancient wisdom.’
-Ar. Himanshu Patel

Vernacular describes approach of design; considering local materials, climate and geographical condition of the region. Vernacular is not about past, present or future. Dwellings are made by owners in best direct way possible. This approach of design has evolved with time, and as a result it became commonly accepted model by communities of any particular region. Construction methods and skills have been shared from generation to generation, and that became tradition of construction for that region. Tradition acts as a norm for construction which is mutually accepted by the communities.¹

There are many indigenous practices across Gujarat, which have been neglected or completely vanished with this happening, there are many questions that arises about continuation and limitations of these practices. Modern demands have changed, hence we started looking at new ways to fulfill those demands, and ignored that our past has vast knowledge that can become the base for our modern solutions. There are certain limitations that make using these traditions more difficult in modern time. Learning from traditions and develop ways of its continuation while fulfilling modern demands; is the approach that revive these traditional practices.

Integrating vernacular lessons with modern technology could be the different idea of contemporary architecture, with which inherent architectural identity sustains. Many architects have successfully applied knowledge from the vernacular dwellings into their modern works. The process of understanding each parameter of architecture from these villages and trace its relevance in contemporary works, would enlighten in two ways. First, developing ideas for modern needs based on indigenous principles is the sustainable approach for the future. Second, vernacular dwellings of any particular region are manifestation to achieve comfort in local climate and geographical condition.

AIM

The research aims to study vernacular architecture and its significance in contemporary practices.

OBJECTIVES

- To study the details of vernacular architecture of the region.
- To develop architectural sensitivity towards indigenous practices.
- To analyze compatibility of indigenous systems with modern demands.
- To study details and design process of contemporary works, that are evolved from knowledge of architectural traditions.

METHODOLOGY

With several practices vanishing, vernacular buildings and typology still have many examples in current time that can be considered to create base for the study. Materials like earth, grass, bamboo, timber and *bella* stone are the primitive material that has been in use for walls and structure of vernacular buildings in Gujarat. Similarly, for roof; materials like timber, grass, thatch and clay tile has been in use for decades. Except *Saurashtra*, villages of all other regions of Gujarat demonstrate different earth construction practices. Vernacular buildings of any village can be distinguished by set of building traditions, that gives unique identity to them. To understand vernacular practices of villages, field work was carried out in these

¹Rapoport, Amos. *House form and culture*. NJ,USA:Prentice-Hall Inc., 1969.

villages, which exhibit primitive architectural identity of the region. Initial research consists of review of books, thesis and articles to understand the past, and compare it to current scenario. Focus of the study is on typology of vernacular buildings and spatial layout of the villages. To study contemporary works of the region and understand significance of vernacular practices, the data has been collected from interviews with senior architects of the region. Specific point of view to analyze both vernacular and contemporary practice will be the fact that vernacular practices have been neglected in the region, which can be reinterpreted into contemporary works. The study does not try to trace the evolution of the indigenous construction practices.

1.1 CONCEPT OF VERNACULAR IN GUJARAT

Gujarat has different zones with various climatic and geographical conditions, based on that state can be divided further into regions which shares similar context. Indigenous practice for construction of dwellings is response to these natural contextual conditions of the region. Each region has its unique traditional way to build dwellings, which can be described by vernacular approach of that region.

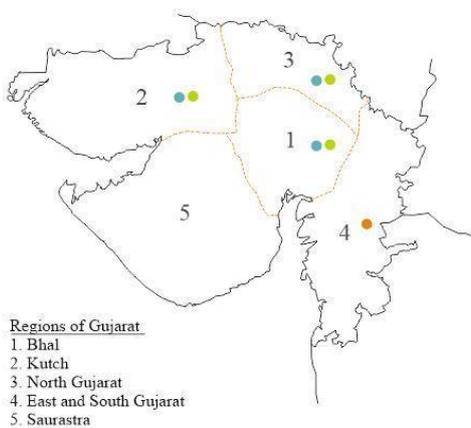
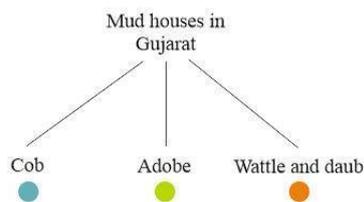


Fig 1.1 Regions of Gujarat

Source: "Housing Practices in Gujarat.redrawn by the author



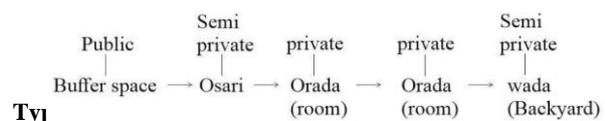
Following the indigenous practices in villages, in south Gujarat wattle and daub is extensively used; in Kutch they are using cob construction technique to make circular *bhonga* and in *Saurashtra-bellastone* is the primary construction material. If we look at these vernacular traditions of different regions, it is extensively responsive to the climate and geographical condition. And if we look at modern buildings of these regions, they are not using the same traditions. So, question arises about why there is a sudden break and what are the drawbacks between these two technologies. There is a gap between two, even the climate and geographical conditions are the same. Modern problems required different solution, but that doesn't point towards neglecting vernacular traditions. So, we have to carry all the knowledge that we got from our ancestors, and apply it to our modern practices. Otherwise, it will definitively vanish.²

2.1 VERNACULAR PRACTICES OF VILLAGES

Many indigenous practices vanished in the region which had lot to offer in terms of knowledge and many are at the verge of end. There are several reasons for that like, people's mindset about primitive buildings and drawbacks of these construction techniques. Even people from rural areas are looking at urban areas and trying to replicate construction ideas, because there is a lack of appreciation for their primitive techniques. Despite of all these, many villages are still using indigenous systems and not much affected by modern construction practices and materials. Identification of these villages had been done by literature review and field survey in these regions. Villages selected for the study are the villages in which traditional values are still intact in modern context. After field visits, few villages had been shortlisted and documented for this ongoing study.

Village 01: Case of Malvan village in east Gujarat

Malvan village is located in Mahisagar district. Planning of the village is in such a way that each community has different zone. But dwellings in each zone are identical, since they used to follow same traditional values of construction. There is a buffer between street and *osari* of the house, which acts as a common public space. The sequence of spaces in house form is as follows:



²Interview with architect Snehal Shah, Ahmedabad

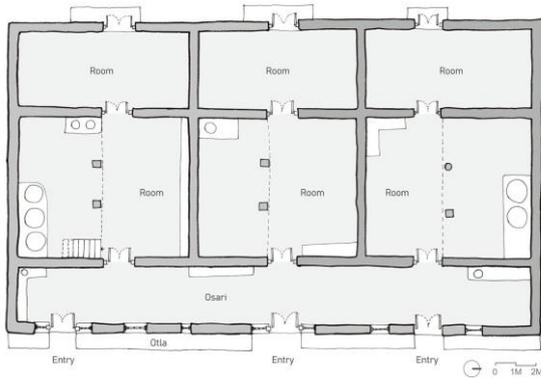


Fig. 2.1a Plan showing sequence of spaces (source: author)

House has large attic for storage in rooms and *osari*. Large attic also provides protection from heat. Adobe walls with less opening; and timber columns support the large timber truss. Large timber logs (*sagwan wood*) are used as a beam to support these large span structure. 2 or 3 houses shares common walls with long combined *osari* (Fig 2.1). This system of planning reduces construction cost and material use, because of shared walls. houses are not found in a cluster, they are located in farm, far from each other. Because of this reason, safety and privacy is main concern. That is why each house has only two opening on facade, one in the front and one in the back side. This makes inside space very dark even during the day. These long houses are oriented towards north-south direction to avoid solar radiation on large facades.

Village 02: Case of Bhirandiara village in Kutch

Kutch being the largest district of the Gujarat with Arabian sea at south side and white desert at north side, demonstrate two different architectural typologies. Southern and western coastal areas have one or two stories high houses with stone masonry walls and clay tile roof; opening up in narrow streets of the village. Villages of northern part in desert area, people used to make circular mud house with conical thatch roof as a tradition, called *bhonga*. This house typologies are result of direct response to the harsh climate of the desert.

Bhirandiara village is located on northern side of the Bhuj. Village occupies large part of the land with many separate settlements. Each settlement is located at distance of few meters. Main reason for this settlement pattern is scarcity of water. Every settlement has 10-15 houses, cattle sheds and storages with large mud plinth at the base of all this structure. Top of the plinth is covered with layer of cow dung and mud mixture, called as *Lipan*. Thick mud walls, thatch roof and mud plinth combined provide protection from harsh summer sun in desert. Outer walls of the houses are plastered with *Lipan* and internal walls are decorated with white clay. Layer of *Lipan* is done by women, twice a year; once after monsoon and second before Diwali festival. Thick conical thatch roof with attic

provides insulation, and steep angle of roof helps for easy water runoff. Extended eaves at the periphery protract mud walls from rain water.



Fig. 2.1b Settlement on large mud plinth (source: author)

There are very few small openings are present on the circular wall, due to desert climate. This creates dark space inside. They have used small mirrors called *aabhala* to decorate interior walls, that make space lit even with very small amount of reflected light coming inside through those openings.

3.1 CONTEMPORARY INTERPRETATION OF VERNACULAR ARCHITECTURE

A few projects in the recent past in Gujarat conceptually evolved from lessons of vernacular. The architects of these projects have understood and learned from the vernacular traditions and incorporated that idea into their recent works. The criteria for selection of the case studies for this part of the study; are projects that exhibit the fundamental principles of vernacular architecture, its methods and strategies in contemporary manner.

Case 01: Aranya Farm Stay at SasanGir

Design of Aranya farm stay by architect Himanshu Patel has an apparent principle of vernacular architecture of the region. Terracotta tiled roof is one of the main elements that describes this project. This roof type in its original form, represents villages of the region, where using tiled roof is common traditional practice.

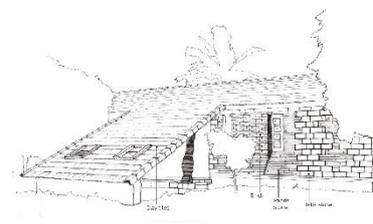


Fig. 3.1a Front sloping roof of the cottage (source: author)

Local sandstone called *Bella* is used for load bearing walls. Using indigenous construction technique of sandstone wall and tiled roof in a contemporary way, is justifiable to the vernacular norms. It also reinforces the idea of developing upon traditional techniques and its sustainability. Many design decisions, like a

low laying form of cottages were made after analyzing local nomadic structures and vernacular traditions. The overall idea of building with the vernacular materials and principle in a very simple and direct way possible for modern needs, creates the new perception about vernacular traditions in local people's mind. People from nearby villages get inspired from this project and started using these materials and technique once again with a new perception about vernacular traditions. In a way this project revived the indigenous practices of that region, which have been neglected.³

Case 02: M.C. Shah house, Ahmedabad

The architect's office is situated in a dense urban area where the office gets only two sides open, south and north. The south side of the site opens up in the main street and the north side on the tertiary street of the existing society. Even with these limitations of orientation, he designed the office in such a way that each space on every floor gets enough light and ventilation. Some rooms are small but it is very big because it's all open space around.



Fig. 3.1b Section showing atrium space
(Source: redrawn by the author)

Central atrium space is tight small and tall, but it serves the purpose very well. This is the design principle that has been in use in many traditional and vernacular buildings across India. The scale of the office building is bigger than those buildings, but the architect applied core principles from the past to overcome modern issues. The architect builds this building on his own, with the help of his team without hiring any contractors. This is very similar to the vernacular practice where people used to build their dwellings by own or with the help of family members. While learning from the vernacular practices and applying principles to the modern building, the economy is the major constrain that should be looked up carefully. The modern building should also be economically viable while working with this approach.

4.1 CONCLUSION

In modern context where indigenous practices started disappearing one after another. Learning from that core and understand its interpretation into contemporary buildings could be reviving factor for indigenous practices. Integration of vernacular architecture with contemporary systems is a step forward towards sustainability of local architectural identity.

5.1 ACKNOWLEDGEMENTS

I would sincerely like to thank my guide and co-author Prof. Naresh Chhatwani for consistently helping me with this research, providing me with his invaluable insights and keeping indulgence with the topic. I would like to thank architects with whom I had conversation related to this topic.

Regional Terms:

- *Bhonga* – House with circular plan in Kutch
- *Bella*- Local lime stone found in Saurashtra
- *Osari*- Front verandah of the house
- *Lipan*- Mud and cow dung-based surface
- *Otla*- Plinth built in front of the house
- *Rann*- Desert
- *Sagwan*- Tropical teak wood

6.1 REFERENCES

- i."Housing Practices in Gujarat." 2004. Buildwell Source . Research Paper. Accessed 6 March 2021. <<https://buildwellsources.org/materials/natural-materials-rural/earth/139-housing-practices-in-gujarat-2004/file>>
- ii.Rapoport, Amos. House Form and Culture. New Delhi: Prentice-Hall of India Private LTD, 1969. Book. Udumale, Sanjay. Architecture for Kutch. Mumbai: English Edition, 2003. Book.
- iii."Aaranya Farmstay Resort / d6thD design studio" 05 May 2020. ArchDaily. Accessed on 7 Mar 2021. <<https://www.archdaily.com/938713/aaranya-farmstay-resort-d6thd-design-studio>> ISSN 0719-8884
- iv.Sen, Snehal. Understanding change and continuity in house form: A case of sirohi, Rajasthan . Ahmedabad, 2020. Published Undergraduate Thesis. "Traditional materials and construction technologies." Context (2015): 5-65. Document. <<https://www.dronah.org/wp-content/uploads/2018/06/Context-19.pdf>>.
- vi.Bhatia, Gautam. Laurie Baker: Life, Works & Writings. Penguin Random House India, 1991. Book.
- vii.Tipnis, Aishwarya. Vernacular Traditions Contemporary Architecture. New Delhi: TERI , 2018. Book.

³Interview with architect Himanshu Patel, Ahmedabad

Eco Resorts In India: Case Study of Resorts In Western India

Neev Rathod, Ar. Ramiya Gopalakrishnan, Dr. Vaidehi Lavand

SMEF'S Brick School of Architecture, Pune

Email: neevrathod99@gmail.com

Abstract: *The travel and tourism industries are one of the largest in India. While there are many positive aspects, Tourism also puts enormous stress on local land use. Thus careful development of these areas is crucial to preserving environmental quality. Eco resorts, a newly emerging concept can be the solution to this. Eco-resorts can help in reducing the carbon footprint by employing the principles of Environmentally Sustainable Design and help in fighting climate change. This research paper intends to show the emerging concept of eco-resorts through case studies of Nature Resort, located on the Goa-Karnataka border, and Khem Villas, located near Ranthambore, Rajasthan. This research will further help form guidelines for architects to design and plan sustainable eco-resorts in the future.*

Keywords: Eco resort, Design principles, Environment, Sustainability, Ecotourism, Conservation

INTRODUCTION

Ecotourism is responsible travel to natural areas that conserves the environment, sustains the wellbeing of the local people, and involves educating the staff as well as the guests (TIES, 2015). Eco-tourism activities are community-based and rural-based and provide an opportunity for the tourist to know about the environmental assets of the rural communities, local traditions, art forms, and ethnic cuisine. Conscious efforts have to be made to preserve the natural beauty and environment while creating infrastructure and facilities for tourists that fit in with the natural surroundings. Eco resorts, a newly emerging concept can be the solution to this. Eco Resort is a destination with accommodation, dining, and entertainment facilities where the central focus is the preservation of Earth's environment. They are designed to have minimal impact on the environment and to be as sustainable as possible in their usage of resources without compromising on guest's comfort and safety and provide them with a nature-based experience (Bromberek, 2009). They also aim to improve the welfare of the local population by supporting local suppliers and workers. Eco Resorts help to minimize the harmful impact that resorts have on the environment. There is a general trend towards a focus on the environment and the amount of customers craving an

eco-friendly option is expected to increase in the near future as everyone wants to take a break from their fast-paced life and spend some time with nature. Although implementing the best practices saves money, the goal of an Eco-resort is to eliminate as much as possible the negative impacts on the environment both by reducing the consumption of resources and by changing the practices so that the waste produced can be used (Pyo, 2008). By following the environmentally sustainable design principles a resort can be called an Eco Resort. The design principles stated by (TIES, 2015) are as follows:

- Minimizing physical, social, behavioral, and psychological impacts.
- Building environmental and cultural awareness.
- Providing positive and nature-based experiences for both visitors and hosts.
- Producing direct financial benefits for conservation.
- Generating financial benefits for both local people and private industry.
- Designing, constructing, and operating low-impact facilities.
- Recognizing the rights and spiritual beliefs of the Indigenous People in your community and work in partnership with them to create empowerment.
- Optimizing the site potential.
- Minimizing the use of non-renewable energy.
- Using environmentally preferable products.
- Protecting and conserving water.
- Enhancing the indoor environmental quality.

Although these principles are partially implemented in few Indian cities, a thorough implementation of the same is still lacking in an overall context. The purpose of the study is to define the basic principles that can be adopted while developing an Eco-Resort, to analyze the benefits of Eco Resorts, and to understand the eco-friendly practices used by Eco Resorts through the help of case studies. This also helps create awareness among people about the concept of eco-resorts.

METHOD & METHODOLOGY

The research methodology used is based on two case studies which include documentary research such as books, journals, articles, and thesis related to the topic. The two case studies taken are:

- I. Nature Resort
- II. Khem Villas

I. Nature Resort

Location:

Located on the Goa-Karnataka border, amidst the thick expanse of forest. It offers pristine views of waterfalls, birds, and nature's bounty as it overlooks the Vazra valley. Nature Resort sits at a height of 800 meters above sea level.

Concept:

To develop & practice wildlife and eco-tourism in the Sahyadris, through sustainable and commercial eco-friendly initiatives, to create an appreciation of nature and provide a platform for experiencing the exquisite natural & cultural riches that abound the Sahyadris (Nitin, 2005)

About the resort:

18 specially designed eco-cottages have been placed on the site and are positioned in such a way that they don't hamper the forest and put you near nature and offer comfort and hospitality of the highest standards. All built structures including eco-cottages resemble village huts that are designed to provide an authentic feel of a forested habitat without compromising on the levels of comfort (Ethico, 2020). A restaurant serving local cuisine, an infinity pool that uses minimal chlorine, and an Ayurvedic rejuvenation center are there apart from an array of outdoor experiences such as treks, nature walks, village visits, etc.

Materials and sustainable practices:

- Fine use of sustainable materials such as Australian Acacia, recycled railway sleepers, Khanapur stones, bamboo, and other natural materials.
- Every cottage interior includes the use of alternative energy, natural lighting, etc.
- has its bio-waste plants that create manure and has a strict implementation of plastic reduction as well as a recycle and reuse policy.



Figure 1: Cottage showing the use of Acacia wood and other sustainable materials in nature resort

II. Khem Villas

Location:

Khem Villas is a small wilderness camp located along the edge of Ranthambhore National Park in Rajasthan.

Concept:

To provide peace and tranquillity within its luxurious and very personal atmosphere offering an unparalleled wilderness experience that is tranquil with nature trails and sit-outs from where visitors can view a wide variety of birds and animals. The running theme of the property is 'self-sustainable' (Usha, 2006).

About the resort:

Khem Villas is a jungle camp, which provides a wildlife experience like no other. It is a 'luxury jungle camp' which comprises of 7 luxury tents, 8 cottages, 2 villas and 4 rooms on the site which blends with the surroundings. The food served over there is vegetarian which is grown in their greenhouse even the dairy products come from the cows that they rear. The property also includes an age veda spa, small water bodies apart from that they even provide river safari, jungle safari, nature walks, folk dance, etc.

Materials and sustainable practices:

- The cottages have been constructed using in-grown thatch, bamboo, wood, and locally sourced materials.
- Rainwater harvesting measures used in Khem villas have made it almost self-sufficient for its water needs and have raised the water table by almost 25 feet.
- Organic waste is composted.



Figure 1: Cottage showing the use of thatch and other sustainable materials in Khem Villas

RESULTS AND TABLES

After going through both case studies some basic principles that were followed by both the resorts are as follows:

Table 1.0: Comparison between the two case studies

Parameters	Nature Resort	Khem Villas
Location	Goa, India	Rajasthan, India
Owner	Captain Nitin Dhond	Dr. Goverdhan Rathore
Previous land use	Used for mining	Barren land
Accommodation	18 cottages	7 luxury tents, 8 cottages, 2 villas, and 4 rooms
Area	700 acres	30 acres
Built-up area	3 acres	3 acres
Concept	Minimal interference	Self-sustainable
Materials	Australian acacia recycled railway sleepers, khanapur stones, bamboo, and other natural materials.	In-grown thatch, bamboo, wood, and locally sourced materials.
Sustainable interventions	Rainwater harvesting system, bio waste plant, renewable source of energy, social forestry sector, plastic-free zone, natural shampoo and soaps, no outside food, planting indigenous trees, employing locals.	Rainwater harvesting system, bio waste plant, renewable source of energy, greenhouse, dairy farm, pure vegetarian, planting indigenous trees and creating artificial ponds, employing locals, working with NGO's.

Activities	Treks and hikes, machans and hides, bird trail, night trail, visit to organic farms, village tour, folk dance, sacred groves, ayurshala, etc	Jungle trips, nature walks, blackbuck gazing, river safari, camel rides, local craft, fort trips, folk dance, etc
Fauna	Sloth bear, Indian gaur, barking deer, sambhar, palm civet, small Indian civet jungle cat, mouse deer, wild dog, black-faced langur, leopard, etc, and a variety of birds.	Jackals, jungle cats, hyenas, desert fox, black-faced langur, crocodiles, tigers, and a variety of birds.

- Use of renewable sources of energy as much as possible.
- Conserving water by harvesting or recycling as much as possible.
- Setting up biowaste plants and composting their waste.
- Minimizing the use of plastic as far as possible.
- Creating employment for the locals.
- Planting of indigenous trees.
- Raising awareness about the local biodiversity.
- Working towards the ecological restoration of the land.
- Building on less than 5% of the total land holding and planting the remaining area with indigenous trees.
- Encouraging nature walks and other wilderness experiences.
- Use of locally sourced and natural materials.
- The principles that were missing from either of the case studies were as follows:
 - Designing, constructing, and operating low-impact facilities.
 - Both the resorts are luxurious.
 - Khem villas still use plastic while the nature resort has demarcated the property as a plastic-free zone.

Benefits of building an Eco Resort are:

- Cost savings: Financial savings are one of the most important factors that influence the implementation of environmental initiatives in a resort and by using natural and

renewable materials in the resort there are going to be financial gains in the longer run.

- **Competitive advantage:** Over a period of time, green practices in the hospitality sector will become a minimum requirement, particularly as the cost of non-renewable energy continues to rise, regulatory pressure increases, and consumers become more demanding. So going eco-friendly is going to benefit in the long term.
- **Creating employment:** Employees are identified as one of the greatest benefits of going green and by giving employment to the locals, job opportunities increase in the area and the locals tend to work with the resort as the indigenous communities are being empowered and promoted.
- **Social cause:** Beyond regulation and compliance, many environmental and social initiatives are voluntary. Whether driven by cost savings or a principled strategy, the hospitality industry is recognizing the environment, and the community to be a valuable resource that needs to be protected so the concept of green hotels, eco-resort, ecotourism, etc has started to gain movement.
- **Fighting climate change:** Eco resorts help in fighting climate change by reducing its carbon footprint through the use of locally sourced materials, conserving water, use of renewable energy, conserving its surroundings, planting indigenous trees, etc.

CONCLUSION

The tourism industry has both positive as well as negative impacts on the physical environment. Eco Resorts are environmentally friendly properties that institute programs that save water, save energy, and reduce solid waste while saving money to help protect the earth. Being green goes directly to a higher long-term value of their property.

ACKNOWLEDGEMENT

I take this opportunity to acknowledge all those who have helped me in getting this study to a successful present status. I would like to express my deep sense of gratitude and indebtedness to my humble Guides, Dr. Vaidehi Lavand and Ar. Ramiya Gopalakrishnan whose help, encouragement, and constant critics kept my morale high during the work

REFERENCES

- i. TIES. (2015). *What is Ecotourism. The International Ecotourism Society*: <https://www.ecotourism.org>
- ii. TIES. (2015). *Ecotourism Principles. The International Ecotourism Society*: <https://www.ecotourism.org>

- iii. Bromberek, Z. (2009). *Eco-Resorts- Planning and Design for the Tro-pics. Burlington, USA: Elsevier Ltd* <https://issuu.com/sulmankhalid/docs/eco-resorts.planning.and.design.for>
- iv. Pyo, S. (2008). *Benchmarks Marks In Hospitality And Tourism. New Delhi: Jaiso Publishing House.*
- v. Ethico. (2020). *a sustainable getaway*: <https://www.ethicoindia.com>
- vi. Nitin, D. (2005). *The concept behind nature resort*: <https://www.goa.com>
- vii. Goverdhan, R. (2020). *Goverdhan Rathore interview*: <https://sustainability-leaders.com>
- viii. Priyam, B.(2018). *Khem villas escape responsibility in the lap of nature*: <https://www.outlookindia.com/outlooktraveller>
- ix. Surendra, S. (2015). *Environmental conservation and sustainable development. New Delhi: Lenin media Pvt ltd* https://www.academia.edu/23506418/ENVIRONMENTAL_CONSERVATION_AND_SUSTAINABLE_DEVELOPMENT
- x. Bramwell, B., & Lane, B. (1993). *Sustainable Tourism: an evolving global approach. Journal of Sustainable Tourism*: <https://www.tandfonline.com/doi/abs/10.1080/09669589309450696>

Feasibility of Concrete Roads In India

Author - Neha Dandawate

Author affiliation– Dr. B.N. College of Architecture, Pune.

Corresponding Email: (a17102.nehad@bnca.ac.in)

Co-Author – Ar. Vaishali Anagal

Co-Author affiliation - Associate Professor, Dr. B. N. College of Architecture, Pune

Corresponding Email: (vaishali.anagal@bnca.ac.in)

Abstract: *This research studies the urban heat island effect created by concrete roads and compares it with asphalt roads. It also studies the advantages and disadvantages of concrete roads along with the construction methods used. A case study regarding Urban Heat Island effect is conducted. The research also intends to understand the views of road contractors on concrete roads by conducting open ended surveys.*

Key words: Concrete roads, Climatic impact, Construction techniques, Urban Heat Island Effect, Road services.

I. INTRODUCTION

In the development of any country roads are one of the essential elements of infrastructure. There is a lot development in the road construction technology from just loose soil roads to asphalt roads; these asphalt roads are majorly getting replaced by concrete roads. On the preface of this situation, taking Pune as an example, the research intends to understand durability of concrete roads and its' contribution in creating urban heat island effect. Climatic changes global warming is one of the biggest fears of humanity. It also partly happens due to trapping of heat in earth surface especially in cities which is briefly called as "Urban Heat Island Effect". So, to know how concrete roads contribute towards this effect, case studies are conducted to compare concrete and asphalt roads in terms of –thermal studies and to understand which roads will trap and release less heat. This study will help in selection of appropriate road construction technology and materials to address the issue of urban heat island effect to a certain extent.

The construction process for concrete roads is complex than asphalt roads. It requires a lot of machineries to cast concrete roads and also requires more time for curing to gain strength. To understand the construction process of concrete roads and the perception regarding issues related with concrete roads, open-ended interviews with road contractors were conducted as a part of methodology of this research. The observations in those interviews are also listed below. Also, as our Ministry of Road Transport and Highways (MoRTH) has decided to construct the National Highways in Cement Concrete as a 'default option',

this research will certainly be an eye opener onto this decision as well.

II. CONSTRUCTION PROCESS

Construction process of is very much similar to concrete shear wall or RCC raft. Currently the concrete roads in India are casted by the following process:

1. Surface preparation – removing debris and levelling (very minimal as compared to asphalt roads)
2. Fixing Formwork – According to construction joints the formwork is fixed
3. Laying Reinforcement – Usually one layer of reinforcement (varies according to site conditions such as loading, sub soil conditions.
4. Laying stiffeners for construction joints
5. Casting the road in parts
6. Filling the construction joints with bitumen.
7. Curing for usually 1 week.

Road Contractors Opinions:

1. There is very minimal surface preparation needed which is a good thing.
2. There are less expense for repairing of roads in DLP (Defects Liability Periods). As these roads don't get eroded.
3. For small road contractors, procurement of all the machinery is sometimes difficult.
4. Casting process is tedious but the end product is good.
5. Some part of road structural design had come up in concrete roads compared to asphalt roads, so many of them had to look into this new construction process
6. A lot of water is needed for curing of concrete roads (at some places there are difficulties in procuring water)
7. Comparing to asphalt roads making process, the toxic gases released in making process which was very harmful for the labours also is omitted.
8. Initial investment for concrete roads is more compared to asphalt road.

III. URBAN HEAT ISLAND EFFECT DUE TO CONCRETE AND ASPHALT ROADS:

Urban heat island effect occurs when cities replace land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat.

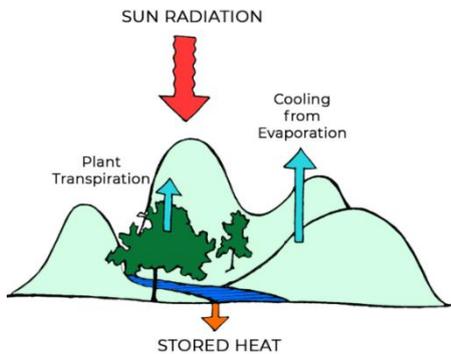
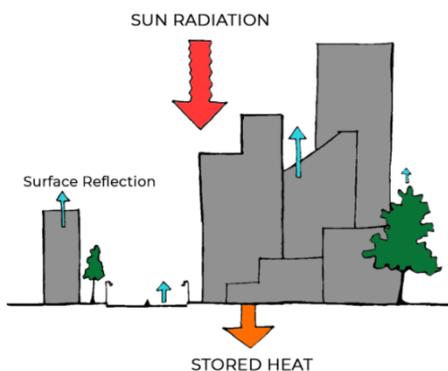


Figure I: RURAL SCENARIO (Author)

Figure II: URBAN SCENARIO (Author)



Two case studies were conducted in which Urban Heat Island effect due to concrete and asphalt roads were studied. Two roads with similar conditions were selected that are Sinhgad Road (Concrete Road) and Bajirao Road (Asphalt Road). Three temperature readings were taken during three-time frames on three different locations on the selected roads. The temperatures readings recorded are presented in tables below as per given time frames.

6:00 – 7:00 a.m.			
To understand how much heat is retained overnight.			
Sinhgad Road Concrete Road		Bajirao Road Asphalt Road	
Location	Temperature °C	Location	Temperature °C
1	25	1	22
2	26	2	21
3	24	3	23
Result: Concrete retains a little bit more i.e. 2-3 degrees heat than asphalt roads.			

2:00 – 3:00 p.m.			
To know the peak heat captured (temperature) by both roads.			
Sinhgad Road Concrete Road		Bajirao Road Asphalt Road	
Location	Temperature °C	Location	Temperature °C
1	56	1	57
2	54	2	56
3	53	3	58
Result: Both the roads show not much difference in peak temperature but asphalt roads get slightly hotter than concrete roads.			
8:00 – 9:00 p.m.			
To understand how fast the road gives off heat after heating up			
Sinhgad Road Concrete Road		Bajirao Road Asphalt Road	
Location	Temperature °C	Location	Temperature °C
1	31	1	34
2	30	2	32
3	32	3	33
Result: Concrete roads seem to give off heat a bit faster than asphalt roads.			

Conclusion: Following observations are made and conclusions are drawn based on the on-site observations.

1. Concrete roads absorb a little lesser heat during peak time as compared with asphalt roads. However, concrete roads release the heat faster in the atmosphere during night. Thus, area in which concrete roads are constructed gets more hotter during night time.
2. Asphalt roads absorb more heat in peak time as compared with concrete roads. However, they release it gradually in the atmosphere during night. According to the observations, it can be concluded that, "Urban Heat Island effect due to concrete roads is more than that due to asphalt roads."

IV. GENERAL ANALYSIS

	Concrete Road	Asphalt Roads
Durability	As concrete roads do not get eroded by water like asphalt roads, they are more durable options.	These roads get eroded by water so these roads need constant repairs hence are less Durable
Oil Leaks	Resistant to any	Not resistant to oil

	types of oil leaks	leaks
Speed of Construction	Is slow as it requires machinery for construction and concrete takes time for curing.	Is fast as it doesn't require any different type of machinery for construction.
Skid Resistance	Vehicles tend to slip or slide on concrete roads in rainy season as well as in snow conditions.	Increased road safety so fewer chances of accidents.
Deflection During Monsoon	If the concrete road is casted properly, the whole road behaves as a rigid plate hence there is no uneven deflection.	Due to granular structure of asphalt roads, the road transfers grain by grain. That's why these roads are more damaged during monsoon and need more maintenance.
Noise	Noisier than asphalt roads due to its texture	Less noisy.
Fuel Consumption	Large vehicles may save up to 10-15 % fuel on concrete roads.	No such saving on fuel.
Pollution	Air pollution during and after construction is lesser as compared with Asphalt roads	Highly polluting gases are released in preparation of asphalt roads, so not an environmental friendly option.
Maintenance	Very minimum maintenance if laid properly.	Requires frequent repairs especially in monsoon.
Life	Approx. 40 Years	Approx. 10 Years
Cost	20% more initials cost than asphalt roads	Lesser building cost than concrete roads

Advisable for	Adverse weather conditions In cities where there is high traffic	Rural roadways For low traffic conditions
----------------------	---	--

Result: Concrete Roads are more economical and viable option for roads than asphalt roads.

V. PUBLIC REACTIONS

1. An open-ended survey regarding opinions of people was conducted into which following observations were listed from the public response
2. Many of the people were quite happy that in maintenance aspect concrete roads are much better than asphalt roads as they save them so much of hassle of road repair works.
3. A lot of them also complained about the road texture as it doesn't provide a smooth ride and still prefer asphalt roads in that aspect.
4. Also, if the construction joints are not sealed properly in concrete roads, two wheelers can slip due to that as the tyres get stuck into the grooves so that can be dangerous.
5. In general, many said that concrete roads look very neat and tidy as compared to asphalt roads
6. Many didn't have an idea in terms of environmental aspects when asked about that.

IV. CONCLUSION

According to durability, cost, maintenance, fuel consumption, etc. definitely concrete road is a good option for the roads as in every aspect concrete roads are better than asphalt roads, but from "Urban Heat Island" point of view, concrete roads can attribute to releasing more heat in the atmosphere and contribute to global warming.

ACKNOWLEDGEMENT

We would really like to sincerely thank to the road contractors who participated in the interviews and gave valuable insight regarding road construction and other aspects of concrete roads. We would also like to thank all the respondents who participated in the interviews.

REFERENCES

- i. Paweł Szymański, Michał Pikos, Piotr Nowotarski, 2017, *Concrete road surface with the use of cement concrete*, *Science Direct / Procedia Engineering*, Volume 208, Pages 166-173, <https://www.sciencedirect.com/science/article/pii/S1877705817360289>
- ii. Olukayode Olawale Alao, 2013, *Current trends in Design and construction of Concrete Roads*, *Research Gate*, Pages 1 -4, https://www.researchgate.net/publication/257894842_Current_Trends_in_Design_and_Construction_of_Concrete_Roads
- iii. Valerii Vyrozhemskiy, 2017, *Durable high strength cement concrete topping for asphalt roads*, *IOP Conference series Series: Materials Science and Engineering*, volume 236, pages 1-6, 012031, <https://iopscience.iop.org/article/10.1088/1757-899X/236/1/012031/pdf>
- iv. Ioannis Tegos, Alexandros Bantias, 2013, *A proposal for the avoidance of joints at concrete pavements*, *Vienna Congress on Recent Advances in Earthquake Engineering and Structural Dynamics*, Pages 1-10, 312, https://www.academia.edu/44403458/A_proposal_for_the_avoidance_of_joints_at_concrete_pavements
- v. Nagham Tariq, Shakir Al-busaltan, Ali Adnan Abdulwahid, 2018, *Experimental study on properties of pervious concrete pavement comprising sustainable materials*, *Journal of Engineering and Sustainable Development*, Vol. 22, No. 2 (Part 5), Pages 2-13, https://www.researchgate.net/publication/332492715_EXPERIMENTAL_STUDY_ON_PROPERTIES_OF_PERVIOUS_CONCRETE_PAVEMENT_COMPRISING_SUSTAINABLE_MATERIALS
- vi. <https://climatekids.nasa.gov/heat-islands/>
- vii. https://en.wikipedia.org/wiki/Urban_heat_island
- viii. <https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect>
- ix. Li Yang, Feng Qian, De-Xuan Song, Ke-Jia Zheng, 2016, *Research on Urban Heat-Island Effect*, *Science Direct, Procedia Engineering*, Volume 169, Pages 11-16,
- x. P L Bongirwar, *Cement a Good Additive for Durable Economical Road Construction*, https://www.concreteshowindia.com/Portals/23/PDF_File/Presentation%20Pack%202018%201/sustaiplbicj2nagfinalr1r2r3.pdf?ver=2018-06-16-113748-563

Vegetal Concrete Walls: Hempcrete A Carbon Sequesters

Nikita. Vinchurkar

D. Y. Patil School of Architecture, Lohegaon.

Nikitavinchurkar333@gmail.com

Abstract: Over half of the global raw materials are consumed in construction of buildings and roads, their associated greenhouse gas emissions from excavation to final disposal are pivotal to the change in global climate. Pollution is a major issue growing vigorously it needs an acute acknowledgement since it straight affects the human health. Air quality can be affected by many different pollutants, in most situations, particles are the major consideration. As per Air quality index, WHO guidelines states PM 10 should be 20ug/m³ (micrograms/ cubic meter). PM 10 standard is generally used to measure air quality; which stands for particulate matter. Major concerns for human health from exposure of PM 10 include effects on breathing and respiratory system; damage to lung tissue, cancer, asthma or influenza and premature death. Hempcrete is a revolutionary material which is incognito a natural resource that has been used as a low environmental material in a number of composite products in countries like Australia, France, U.K, U.S, Germany, etc. in order to improve soil conditions and reduce pollution. The aim

of this research is to execute a comparative analysis for performance of hempcrete walls; in most polluted city Delhi which is followed by identifying the construction techniques and materials involved in the construction of hempcrete walls and to establish their impact in macroclimate. A unit block of 1 metre square in area, 300mm thick and supported with timber frame from inside. The content of carbon in air of Delhi's air is considered in initial stages of primary study. The urban air database released by World Health Organization in Sept, 2011 reported that Delhi has exceeded the maximum PM10 limit by almost 10 times at 198 ug/m³. With reference to earlier papers, the values for carbon sequestering with hempcrete wall, the conclusions for amount of carbon absorbed from the air will be formulated to improve the air quality.

Keywords: Hempcrete, Carbon-sequestering, Hemp lime, pollution, Air Quality

INTRODUCTION:

Pollution is a major issue growing vigorously in our country contaminating the earth's environment leading to increase in the Global warming issue needs an acute acknowledgement since it straight affects the human health. In India, Delhi has worst air quality as compared to other cities in our country. In 2011, it was estimated that about 3000 metric tons of air pollutants were emitted every day in Delhi, with a major contribution from Vehicular pollution (67%). Air quality can be affected by many different pollutants, in most situations, particles are the major consideration. In which Vehicular pollutants are shown in fig 1. The most common measurements are PM 2.5 and PM 10, measured in micrograms per cubic meter; whereas PM stands for particulate matter. PM describes the inhalable particles with diameter that are generally 10 micrometres and smaller.

Most common measurements are PM 2.5 and PM 10. PM 10 refers to the concentration of particles less than 10 microns in diameter. While these can also come from some of the same sources as smaller particles, including dust, pollen, mold, including all gases like CO₂, Carbon Monoxide, Hydrocarbons, etc. comprising carbon molecules in it. According to Air Quality Guideline, by World Health Organization, the annual mean concentration recommended for PM 10 was 20ug/m³, beyond which the risk for cardiopulmonary health effects are seen to increase. Major concerns for human health from exposure of PM 10 include effects on breathing and respiratory system; damage to lung tissue, cancer, asthma or influenza and premature death. The urban air database released by World Health Organization in Sept, 2011 reported that Delhi has exceeded the maximum PM10 limit by almost 10 times at 198 ug/m³.

HEMPCRETE:

Today in construction sector, most common man-made, building material is undoubtedly concrete. Every year, world production is about 1 m³ of concrete per head of population but each ton of cement produces about 900 kg CO₂. (Nigal Issacs,2014). One possible material with suitable solution to all problems based on renewable resources, pollution, global warming, long lasting life of structure is hemp fibre concrete – hempcrete. Cellulose aggregate concrete (CAC) or bio-aggregate concrete has not only the multi-benefits of low density, better thermal insulation and low embodied energy, it can also make use of industrial wastes such as fly ash, slag, etc. One such CAC is hemp concrete, which is a composite,

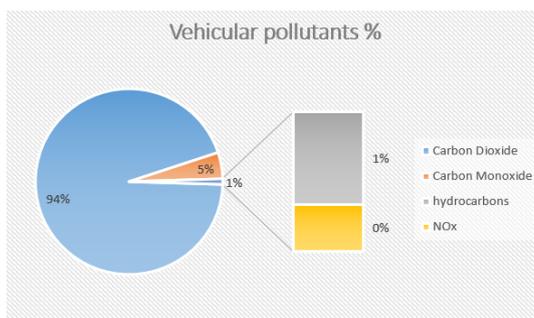


Fig 1. Pie chart showing distribution of vehicular pollutants (6)

made of hemp shiv and lime based binder. The hemp requires no pesticides and very little fertilizer, which goes perfectly with our culture of low environmental impact. On top of each hectare of this plant stores upto 3 tons of CO₂. This composite breathes, as well as having good thermal and acoustic-insulation properties. Moreover, hemp has the potential to meet environmental requirements as it can be produced and supplied in an environmental responsive manner. (24)

HISTORY:

Hemp is not a new construction material. The study indicates that many valuable properties of hemp were known to Indians in the 6th century. Archaeology experts have claimed to have found the agent- a proper mix of hemp with clay and lime plaster- that has prevented the famous Ellora caves from degrading over the 1500 years they have been in existence and also at Ajanta where Rampant insect activity has damaged at least 25% of the painting. This was confirmed by technologies such as scanning of electron microscope, Fourier transform, infra-red spectroscopy and stereo-microscopic studies. These specimens have been found in cave number 12 of Ellora during Yadavas period who also built the Deogiri (Daulatabad) fort in Aurangabad. Hemp samples also collected from areas in Jalna district near Aurangabad and also from outskirts of Delhi. Archaeologists have confirmed the use of hemp fibre (also called 'shive') in the construction of a bridge, dated to the 6th century AD, in southern France. The first modern use of hemp fibre composite construction was in France in 1990 for the renovation of historic timber-framed buildings, casting the hemp lime mixture around the timber frame. (27)

APPLICATIONS OF HEMPCRETE:

Applications of Hempcrete are seed food, Hempseed edible oil, Oil, resin and wax for industrial applications such as lubricants, etc., Medicines for various pains and psychological ailments, as well as cancer treatment, Personal care products derived from hempseed oil Textiles products such as apparels and technical textiles, Cordage, Biofuel, Cellulose plastics, Paper, Defence applications such as bullet-proof vests and bunkers, Hemp concrete, Hemp composite boards for construction In construction industry hempcrete has been used for constructing non-weight bearing insulating infill walls, to renovate old buildings made of stone or lime, in frame structures, hempcrete mixtures can be used as filling materials in infill walls, Increasing the density of the mixture allows the production of roof or floor insulation hempcrete materials, Decreasing the density allows the production of indoor and outdoor plasters, its block walls can be laid without any covering or can be covered with finishing plasters. Hempcrete walls are fireproof, transmit humidity, resist mould, and have excellent acoustic performance. (23) The fact that the mixture contains a plant-based compound introduces the caution against water and rising damp levels. Hempcrete walls need to be built with a joint between the wall and the ground in order to avoid capillary rising as well as water runoff at the wall

base. Moreover, hempcrete block can only be installed above the ground level. External walls need to avoid rotting of shives by implementing protection by the rain gale with sand and lime plaster. (21)

HEMPCRETE IN INDIA:

There is very little data available to evaluate the life-cycle environmental impact of hemp-lime (HL) building materials, particularly in India where, Indian government allows cannabis or hemp (non-drug category) products to be sold on general ecommerce sites that too after due diligence, hemp cultivation is banned where it's not within restricted THC form and its cultivation is only practiced in rare parts of India's land, namely Himachal Pradesh, Uttara khand, Uttar Pradesh, Arunachal Pradesh. Currently, the knowledge and awareness of HL is marginal in the local construction industry while no study on HL in India.

INDUSTRIAL HEMP AND ITS CONSTRUCTIVE MEASURES:

Industrial Hemp (*Cannabis sativa L.*) a variety of cannabis, also known as Hemp – is a non-drug cannabis with tetrahydrocannabinol (THC) content generally below 0.3 percent. This Hemp is a fast growing annual crop with 1.5-4m height mainly grown for its tensile strength natural fibre which grows in the stem around the woody core of the plant.



Indication of hemp stem and fibre (31)



Hemp shives (31)

This woody core of plant is chopped up into small sizes (5mm – 25mm) hurd/shiv and mixed with lime, water and a small quantity of cement (to accelerate setting time) to form a bio-composite mix known as Hempcrete. The hemp fibre is chopped upto length of 5cm. It must constitute 62% of shivs,

35% of fibres and dust particles must not be more than 3%. The fibre must be kept in water for 24 hours, in order to absorb water. The lime used can be of class 'C' which is for whitewashing purpose. The lime has to be powdered and lumps must be avoided. Tap water can be used for whitewashing purpose. The lime has to be powdered and lumps must be avoided. Tap water can be used with moderate hardness ranging from 0-100mg/l of the temperature of water being 27degC.

When lime reacts with water heat is evolved which leads in evaporation of water. Therefore, the water required is very high as compared to cement. The ratio used for Hempcrete is- 1:2.9:1.5:1, where 1 is Hemp fibre, 2.9 is water, 1.5 is lime, 1 is cement.

There are two ways to construct a hemp wall: 1) The first technique consists of using forms to cast or spray hempcrete directly in place on the construction site.

2) The second technique consists of stacking prefabricated blocks that are delivered to the project site similar to masonry construction.

A. Placing in mould:

Construction method frame/timber within it hempcrete:

1) Install as much formwork as is practical prior to mixing hempcrete. It is best to take care of trickier areas like window openings before starting to install hempcrete, as custom cutting and fitting of forms in these places takes time that could slow down the installation.

1. Wall, framed as per plans.

2. Exterior form. Can be full height of wall or slip form. One complete round of formwork should be fastened before hempcrete mixing begins.

3. Interior slip form. One complete round of formwork should be fastened before hempcrete mixing begins. Run form boards across openings to minimize cutting.

4. Height for slip forms is typically 24 inches (600mm). This can be achieved by ripping a typical 4-foot-wide sheet material in half, and is a comfortable reach for installers and tampers.

5. Any electrical boxes or other services and penetrations in the wall will need to be cut out of the form boards. This can be a time consuming process.

needs to be developed by documenting the previous papers conducting actual experiments done in various regions.

Hence a hypothetical site which is located in a residential area of Delhi, wherein a functional unit (FU) of timber frame wall of dimensions 1m x 1m x 3m high, 300mm thickness of hempcrete wall and a normal paint finish of

lime plaster of 20 mm, with enough sunlight, wind, is considered for the study. Hemp Lime wall concrete is typically cast around a timber frame as it has low rigidity and accommodates major



Placing hempcrete in mould



Lime-hemp mix



Lime-Hemp timber frame (32)

2) Formwork should be placed around the top and sides of all door and window framing. Leave the sill open to facilitate loading hempcrete from above. Flared, angled or curved openings will take extra time to form. Avoid having this formwork protrude beyond the face of the wall to avoid interfering with slip forms when they are placed in these areas.

3) Interior and exterior corners require secure attachment for forms, especially when centered framing and spacers are being used.

B) Manufactured blocks: These blocks are directly brought from factory. The standard blocks size is 215mm x 100mm x 90mm.

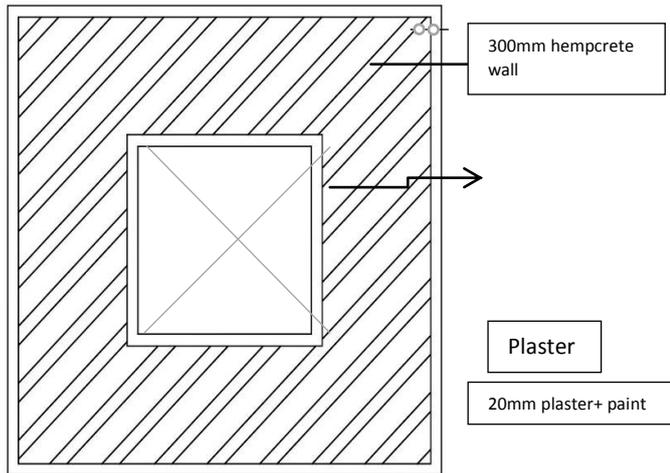
And recommended breathable finishes on these blocks are:

Paint finish: Add lime plaster 20mm thick let it dry, followed by breathable basecoat for paint (eg. Mineral

silicate paint). This process is used for both internal and external plastering.

METHODOLOGY:

The air quality in Delhi, according to a WHO survey of 1,650 world cities, is the worst of any major city in the world, which deformations without rupturing. Relevant similar case studies are documented for obtaining appropriate results.



Plan of Functional unit: 1m x 1m x 3m

COMPARATIVE ANALYSIS: (25, 27, 29, 30)

Hempcrete- An environmentally friendly material.	Hempcrete- An environmentally friendly material.	Lifecycle greenhouse gas emissions of Hemp Lime wall constructions in UK.	Assessment of carbon sequestration of Hemp concrete
Hana Bedliva, Nigel Isaacs.	Hana Bedliva, Nigel Isaacs.	Kenneth IP, Andrew Miller	Tarun Jami, Sumit Kumar.
Year: 2014	Year: 2014	Year: 2012	Year: 2016
Location: Ireland	Location: Ireland	Location: UK	Location: Gujarat Laboratory
1 m3 of Hemp wall	Typical house	Wall of 1m x 0.3m	Test cube of 7x7x7cm
PM10 annual concentration 17.5 (micrograms/m3)	PM10 annual concentration 17.5	PM10 annual concentration 18	PM10 annual concentration 108
Result: hemp shiv 110kg – 220kg CO2 absorbed. 220kg lime	Result: Typical house of wall area 140m2	Result: Not only compensated for 46.43kg of CO2	Result: Functional was able to sequester 307.26kg

binder – 94kg CO2 emitted. Summary: 108kg CO2 absorbed.	embodied carbon dioxide- 50 ton CO2. Carbon dioxide saving- 40%	emitted during growing manufacturing & constructing process, but also enabled additional 36kg of carbon storage.	of CO2 per m3. 
CO2 108kg sequestered.	CO2 sequestering upto 40%	CO2 sequester 82.1kg	CO2 sequester 307kg of test cube per m3

The summary of comparative analysis for the Hemp Crete case studies is that Hana- Nigel’s paper is about a model with dimensions 1m x 1m x 3m, 0.3m wall thickness which can sequester 272.16kg CO2, which was studied at site of Ireland where the weather is comparatively colder for maximum months. Secondly the study according to Kenneth, Andrew’s paper states that the model can sequester carbon up to 206.89kg CO2; the site for this model is located in UK, with a cold weather and dry summers. Both this models are similar to the study model considered in this paper however there is difference in context of these two examples above as compared to the surroundings in Delhi, India.

Furthermore, testing a cube of hempcrete was done by Jami, Kumar in Gujarat. According to their findings the block was able to sequester 307.26kg of CO2 per m3. Consequently, it can be assumed the considered model of 1m x 1m x 3m x 0.3m thickness can breathe 1072.51kg CO2. These values may differ on the basis of location of site, quality of the hemp, properties of lime and its surrounding environment. It can be understood that the carbon sequestering properties of Hemp Crete wall may make a difference in Indian context too; further which can be explored with practical experiment at the site by taking the actual sample. The study may further consist of finding its workability with various building construction techniques like load bearing structures, RCC structures, steel structures, etc.

CONCLUSION:

The study of paper states that Hemp Crete has a clear advantage over cement in terms of these global warming and pollution issues, mainly due to its carbon sequestering properties. As such, the results of this documentation and case studies demonstrate that this building material could lead to reduction in CO2 emissions and increase of oxygen content in air, which is related to the building sector and can help overall to reduce the pollution, hence improve the air quality in most polluted cities like Delhi and make their lives safe enough to

breathe and have longer ages without any diseases with good health.

REFERENCES:

- i. 1. Lime and hemp concrete LCA: A dynamic approach of GHG emissions and capture- Clermont Ferrand, France.
- ii. 2. United States Environmental Protection Agency, Article, <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics> (online)
- iii. 3. A. Shea, M. Lawrence, P. Walker, Hygrothermal performance of an experimental hemp-lime building, *Constr. Build. Mater.* 36 (2012) 270–275
- iv. 4. R. Bevan, T. Woolley, Constructing a low energy house from hempcrete and other natural materials, in: *11th Int. Conf. Non-conventional Mater. Technol. (NOCMAT2009)* 6-9 Sept, Barh. UK, no. September, 2009, pp. 6–9.
- v. 5. K. Ip, A. Miller, Life cycle greenhouse gas emissions of hemp-lime wall constructions in the UK, *Resour. Conserv. Recycl.* 69 (2012) 1–9.
- vi. 6. "Average Annual Emissions and Fuel Consumption for Passenger Cars and Light Trucks" (PDF). *Transportation and Air Quality*.
- vii. 7. L. Zampori, G. Dotelli, V. Vernelli, Life cycle assessment of hemp cultivation and use of hemp-based thermal insulator materials in buildings, *Environ. Sci. Technol.* 47 (13) (2013) 7413–7420.
- viii. 8. R. Rhydwen, A model for UK hemp cultivation and processing to supply the building industry with hurds for hemp and lime concrete and fibres for insulation bats, with the ethos of environmental protection as a priority, *Thesis* 44 (2006).
- ix. 9. S. Wilkinson, A Study of the Moisture Buffering Potential of Hemp in Combination with Lime and Clay-Based Binders, pp. 1–140, 2009.
- x. 10. R. Busbridge, R. Rhydwen, An investigation of the thermal properties of hemp and clay monolithic walls, *Proc. Adv. Comput. Technol.* (2010) 163–170
- xi. 11. Hempbizjournal.com
- xii. 12. Benthamopen.com
- xiii. 13. *Air pollution in Delhi: Magnitude and effects on health*.
- xiv. 14. Manufacturing of building blocks using Hempcrete - Nayana Manohari T K1 , Sunil H G2 , Devika Rani3 , Akshay Kumar.
- xv. 15. Extremetech.com
- xvi. 16. www.studiogreen.com
- xvii. 17. blog.sadguru.com
- xviii. 18. - Abdulla Mahmoud Guma, 2 Vikas Kumar Pandey, 3 Bipin Kumar Singh, Prospect of hempcrete in Multi-Storey & sustainable environment
- xix. 19. Hemp Concrete – A Traditional and Novel Green Building Material 1.Tarun Jami 2.S R Karade and 3.L P Singh.
- xx. 20. Newindiaexpress.com
- xxi. 21. "6 Advantages of Building With Hempcrete". *Green Building Canada*. 2017-06-29. Retrieved 2019-08-10.
- xxii. 22. Jay H. Arehart, William S. Nelson, Will V. Srubar, On the theoretical carbon storage and carbon sequestration potential of hempcrete, *Journal of Cleaner Production*, Volume 266, 1 September 2020, 121846
- xxiii. 23. Arrigoni, Alessandro (April 2017). "Life Cycle Assessment of Natural Building Materials: The Role of Carbonation, Mixture Components and Transport in the Environmental Impacts of Hempcrete Blocks". *Journal of Cleaner Production*.
- xxiv. 24. Rhydwen R. A model for UK hemp cultivation and processing to supply the building industry with hurds for hemp and lime concrete and fibres for insulation bats, with the ethos of environmental protection as a priority. M.S. thesis, University of East London, London, 2006.
- xxv. 25. Jami T., (2016), "A Study on Carbon Sequestration of Lime Hemp Concrete", MS Thesis, Inst. of R&D, Gujarat Forensic Sciences University, Gandhinagar, Gujarat, India
- xxvi. 26. "Ambient (outdoor) air pollution in cities database 2014". *who.int*. WHO. 2014. Retrieved 31 May 2015
- xxvii. 27. Nigel Issacs, "Hempcrete- An environment friendly environmental?" Article: *Advanced Materials Research* · October 2014
- xxviii. 28. Syed Rizwanullah, "Hemp shielding Ellora caves from decay for 1500 years: Study", Article, Mar 10, 2016
- xxix. 29. [Timesofindia](http://Timesofindia.com), article <https://timesofindia.indiatimes.com/> (online)
- xxx. 30. Air quality statics, Article, <https://www.gov.uk/> (online)
- xxxi. 31. K Van Balen, A. Versele, J. Langmans Hempcrete as a sustainable material for heritage storage; applicability and transition, *Academic* 2015-2016
- xxxii. 32. Chris Magwood, "Hempcrete Construction", e-book, complete step-by-step guide, 17 June 2016
- xxxiii. 33. K. Ip, A. Miller, Life cycle greenhouse gas emissions of hemp-lime wall constructions in the UK, *Resour. Conserv. Recycle.* 69 (2012) 1–9.

Study of effect of open spaces on the people living in housing societies and their sense of well being

Nupur Bohara*, Vaishali Anagal**

*Student, Fourth year, B. Arch, Dr. B. N. College of Architecture, Pune, **Associate Professor,
B. Arch, Dr. B. N. College of Architecture, Pune

Email: *a17029.nupurb@bnca.ac.in, ** vaishali.anagal@bnca.ac.in

Abstract: *The open spaces act as transit areas between the built masses and also provide emotionally nourishing physical environment. They allow physical movement and stimulate sensory stimulation with their aesthetic qualities to the users of these open spaces. This paper aims to study the emotional impact that open spaces have on a community and how people-environmental transactions play an important role in mental wellbeing. The area of study is residential societies with designed landscape spaces and the method used in this study will be interpretive. The study will help the planners to understand the elements in the open spaces that enhance the sense of well-being while designing the open spaces in urban areas.*

Keywords: Community housing, designed landscape space, living environment, human health, physical activity

I. INTRODUCTION

The industrialization of contemporary societies in today's world has had an enormous effect on reducing the old ways of communication among individuals. The cities of the globe are in earnest need of more augmented spaces that meets the Socio-cultural relationships of the individuals. As a result, creating more spaces for the people who constantly try to overcome the lack of human communication and interaction is important.

In the current situations across cities and housing societies around the world, one may say that housing societies are in demand of a lot of specific spaces that fulfill Socio-cultural relations with proper performance. One of these spaces is the public recreational space in which people spend their leisure times. Findings of a study that was done in 2006 on 1000 public spaces around the world indicate that four factors are highly effective on the utility of the urban spaces (Nasser, Azadeh, Seyed, 2015). The first factor is continuity of spaces and easy access to them, second factor points to the activity of the people in these spaces. The third factor refers to comfort and attraction of such spaces with the last which is social places that allow social interaction for the public (Moeini, 2012).

Literature reveals some factors of open space failures such as lack of space for gathering, poor entrance, inaccessible spaces from a visible view and direction. With the progress of technology and abundant tendencies to virtual spaces (such as cyberspace) and unilateral formation of social interactions, there is a need for open spaces in order to reduce social stresses by increasing face to face interactions and setting up verbal communication .

Making nature part of life in current busy and confined life is the best way to live life contently. Although people in the current live together, but they perpetually live in isolation. In a research by Agustina and Beilin (2012), the multicultural interactions within the community garden have been studied and the degree of which gardening practices changed the people's behavior, as a result of society interactions with nature, has been revealed. For the activities like to get together, to interact and to feel belonged - landscaped spaces in housing societies play an important role in people's life. The neighborhood is made easy by introducing nature in such spaces as there is constant availability of more interaction. Trees and other vegetation have positive impact on people's mind. When they interact with the nature they establish better relation with neighbors.

As the city is guided to urban development with specific conditions of modern life, social interactions have been reduced and human beings made continuous effort to create and use virtual spaces (Omar, N., 2014). Therefore, the aim of this study was to explore how the formation and establishment of such open spaces in Housing societies especially for the people who work during day would increase the quality of environment using interaction design approach.

Hunt et al (2000) state that the impact of the environment on health is complex and difficult to disentangle; health within an environmental context must be considered as a multifaceted and holistic phenomenon. They recognize that the identification of a link between environment and public health is not new and that environmental legislation targeted at protecting health through improved housing and sanitation go back centuries (ibid.; see also Morris, 2003; Gesler, 1998).

II. MATERIAL AND METHODOLOGY

A total of 300 of survey questionnaires were distributed within the study areas in Aurangabad. It was distributed randomly regardless of the users' age, race and ethnicity. However, only 160 completed responses received. The unanswered survey form considered as undecided and unheeded. In this survey, the respondents also were asked their main purposes of coming to the open spaces that are divided into two subsections that are the human-nature interaction (relaxation) or human-human interaction (socialization). The target users were the residents of the Bluebell society, 50 Greens society and a city – level park Sidharth garden users from the city of Aurangabad, Maharashtra.

Four approaches were mainly used in the paper:

Through the literature study useful information related to the role of open spaces with regards to interactions and sense of well-being was revealed and some case studies were summarized as well.

Research and investigation: The first-hand information on the site in case study was collected by visiting and photographing as field research was an effective and intuitive manner to collect examples. The analysis and discussion in the research were mainly based on the first-hand information.

Maximum number of user associate open spaces with park or an open field and 40% of users use the open space daily while 32% users use the open space twice in a week. 60% of the users also said that they prefer an open space within the society

Comparative analysis: Logic analysis tools were used in the study to analyze the case. The similarity and dissimilarity of landscape design, as well as their advantages and disadvantages were considered.

Even though the placement and accessibility of the open spaces differed in both the societies and the city level park, it didn't impact on the number of users using the open space.

Summary: The research work was summarized by analysis of relevant case studies and firsthand information received followed by some well-established methods.



2.1 Spaces used in the morning and evening (Bluebell Society)



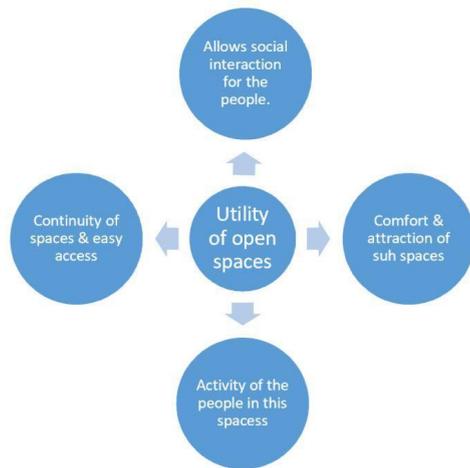
2.2 Activity Mapping (Bluebell society)

III. RESULTS AND TABLES

The survey conducted suggests that human-nature interaction in open spaces can be divided into three parts which are in contact with nature, aesthetic preference, recreation and play. A strong association was found between people and use of landscape spaces. People from

all age group enjoy the designed landscape spaces in residential societies, both physically and psychologically. Association of landscape spaces with time reveals that huge open spaces are mostly accessed in the morning and evening.

3.1 Four factors effective on utility of the open spaces



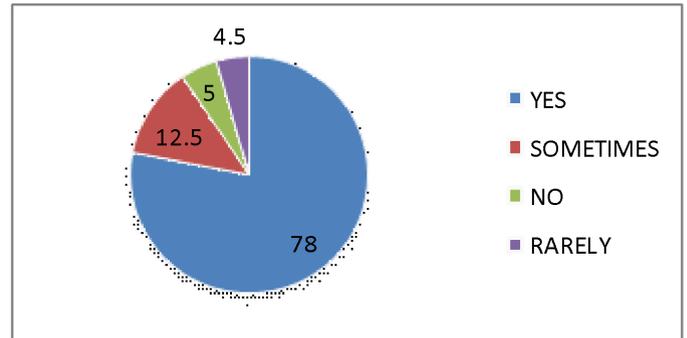
The function of the space changes with the time. It was seen that 78% users feel safe and relaxed and 70 % of the users feel positive when they visit the open space. During the pandemic, having an open space nearby affected 84% of the users in a positive way. When asked to the users in a scenario, where they would not have open spaces nearby; how it would have impacted them, they used words like ‘dull’, ‘stressful’, ‘claustrophobic’, ‘mentally tiring’, ‘caged’, ‘lazy’. Words like ‘peace’, ‘relaxed’, ‘happy’, ‘lively’, ‘soothing’, ‘energized’, ‘positive’ come to the users mind when they think about an open space. As Landscape elements changes people adopt new function with new element. But the urge to use or be in touch with the nature remains constant.

3.2 Overall finding on human interaction with open spaces

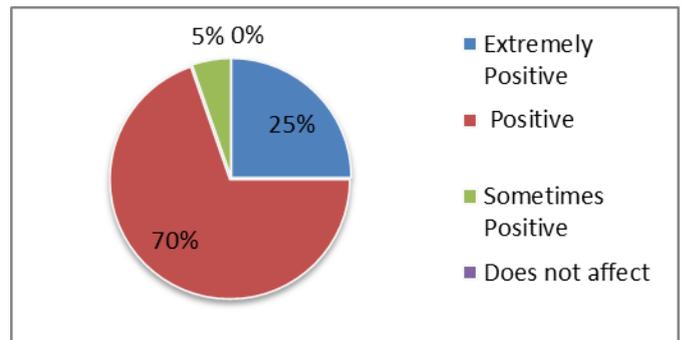
Landscape influenced activities	Daily activities	Occasional Activities
Walking / Running	Yes (28%)	
Visiting temple in the open space	Yes (8%)	
Accompanying family		Yes (4.3%)
Sitting alone for peace	Yes (12%)	
Relaxing	Yes (32.6%)	

Club activities	Yes (7.5%)	
Meditation		Yes (4.3%)
Reading books		Yes (4.3%)

3.3 Do you feel safe and relaxed when you use the open space?



3.4 How much is the difference between your days when you visit open space?



Open spaces are generally used for exercising and relaxation. Association of landscape elements with age factors reveals that children find landscape spaces always accessible in any form. They explore the rawness of nature than the manicured landscape, while old age people prefer the functional landscape space with more visual and emotional adherence to the spaces, plantation.

Change in placement of landscape elements provides very less change in the perceptions about the landscape but it does change the function of the space. Lawn and parking spaces are most visited places by people in the morning and evening time. People visit places for the rigorous activities in morning while in the evening relaxing activities are takes place in the same place. That shows the time influence the function of the place.

The benefits of nature exposure are available to people in a wide variety and at various points across the human life-span. From the study done, the evidence of the health benefits of physical contact with nature for people was observed. These benefits extend to children, adults, older people, and mothers with young children, pregnant

women, and individuals suffering from various diseases, depression, anxiety, stress, asthma, and mobility impairments. It is becoming increasingly clear that regular exposure to nearby nature offers hope and health to individuals and communities with high levels of stress, mental fatigue, social isolation, and idle behavior.

IV. CONCLUSION

Landscape space and plantation provides strong visual and psychological benefits to the society. People associate positive feelings with the open spaces and sense of fitness and wellbeing with the vegetation and activities in the open area and assign values to the surrounding greenery. Touch, Vision and senses are highly satisfied by presence of landscape spaces and it eventually helps is betterment of Human Health.

ACKNOWLEDGEMENT

Authors of this paper would like to express their deep and sincere gratitude to D.Y. Patil School of Architecture, Lohegaon, Pune and Maharashtra Association School of Architecture for giving us the opportunity to publish this research by providing a platform to showcase it. We would also like to thank the peers and faculty at BNCA for the thought provoking discussions and come up with research paper.

REFERENCES

- i. Johnston R .J. et. al. (2000). *The dictionary of human geography*. Oxford: Blackwell.
- ii. Masoudi, K. (2001). *The urban space, place of social interaction*, *Journal of shahrdariha*, 26, 12-15.
- iii. Hopper, J. R., & Nielsen, J. M. (1991). *Recycling as altruistic behavior: Normative and behavioral strategies to expand participation in community recycling program*. *Journal of Environment and Behavior*, 23, 195.
- iv. Teig, E., Amulya, J., Bardwell, L., Buchenau, M., Marshall, J. A., & Litt, J. S. (2009). *Collective efficacy in Denver, Colorado strengthening neighborhoods and health through community gardens*. *Health & Place*, 15(4), 1115-1122.
- v. Lennie.P,1998 *Single units and visual cortical organization*, *Perception*,

- vi. Van Dillen, S.M., de Vries,S., Groenewegen,P.P., and Spreeuwenberg,P,2011 *Green space in Urban neighbpurhoods and residents' health: adding quality to quantity*, *J.Epidemiol.Com He*. 66(6).
- vii. Plunz.R,2007 *Apropos "patch dynamics"*, New York.
- viii. Hagan,s.,2004 , *Taking Shape: A New Contract Between Architecture and Nature*, Oxford: Architectural Press.
- ix. Omar, N., (2014). *Communication competence during the preparation phase of the direct selling communication activities*. *Procedia - Social and Behavioral Sciences*, 155, 228 – 235.
- x. McDermott,1996 , *'Bridging the gap between teaching and learning': The role of research*, *American Institute of Physics*, Woodbury.

Changing Faces of River And New Development Along River And Its Relationship And Effects on The Historic Built Fabric On Its Bank.

Miss. Nupur Phadnis , Ar.Shekhar Garud

VITS Padmabhushan Dr.Vasantdada Patil College of Architecture,Pune

Email: phadnis.nupur.pvpcoa1621@gmail.com, shekhar.pvpcoa.13@gmail.com

Abstract: Pune is a city of river and has evolved on the banks of the river – Mula Mutha at the core of the city, other major rivers include the Pawana river, Ram river and Dev river. Various heritage and historic structures in Pune are in the vicinity of this river, the main structure being Shaniwar wada which was the abode of the Peshwas during the 18th century. Hence, there are few temples, ghats and sepulchral of the Peshwa family on the banks of the river.

Various river banks in towns and cities are a vital area in terms of Heritage and historic structures being situated on them and as an element in the town or city. But while the heritage structures were planned to be situated on the river bank, was the natural behavior of the river at different times of the year considered, this relationship of the structures on the river banks and behavioral pattern of the river over the years has to be analyzed and studied.

Along with the historic structures, what are the other parameters along the river banks which are affected by the behavioral pattern of the river over the years and what role does the heritage structures play to determine the relationship of the river and heritage structures and also newly developed fabric.

The aim of the research is to find and analyze the relationship of the built fabric in immediate vicinity of the river with the river and how does the changing behavior of the river affect its built fabric around. The built fabric majorly involves ghats which are currently developed and also which were built in the in the 18th and 19th century. Various temples and residences built in 18th and 19th century area also situated on the river banks.

As per the study conducted it can be clearly concluded that the floods which we see on Mula-Mutha river are due channelization of the river which was a result of construction of dam on the river. The newly built fabric gets affected by the river as they are constructed within the original span of the river before channelization. The historic structures which is dominantly the temples, ghats and sepulchral along the river have been constructed considering the behavior of the river in various seasons and its relationship. But due to channelization and newly built fabric, these structures lost their connect which was very dominant and vibrant.

Key words – Activities, Behavior, built fabric, river, Relationship, Heritage

INTRODUCTION

The river becomes the identity of the various cities through which the rivers pass. Various cities in the world have

been known because of the rivers in the cities. As the majority of the activities of the settlements in the vicinity of the river take place on the river banks and are associated with the river. Various activities include prayers, celebration of festivals, interaction, spending leisure time, after death rituals, washing and cleaning of utensils and cloths, etc. These activities take place over the whole year at different times of the day. For these activities which take place there is a built fabric which is being developed in the vicinity of the river, which eventually becomes the part of the river. On the other way, various structures are constructed taking into consideration the presence of the river and to develop an association with the river and the relationship of the activities which take place.

This scenario is observed in all the river cities. But the behavior of the river changes in different seasons. It gets flooded in the monsoons and gets dry in the summers. Now the question arises, is the built fabric on the river banks designed taking into consideration the behavior of the river in different seasons as most of the temples, Ghats, etc. get flooded during the monsoons. Is the rising water level considered during the design of these structures?

Narrowing down to the context of Pune which homes the Mula-Mutha rivers, and its behavior can be seen in a wide spectrum range in various periods of the year. This behavior may or may not affect the activities which take place along the river.

LITERATURE REVIEW

The cases of Ganga river in Varanasi, Indrayani river in Dehu and Neera river in Bhore will be used as a base for analysis of the Mula-Mutha river in Pune. These rivers in their respective cities define the culture, history and identity of their respective cities, hence the cities and rivers are known by each other. Hence, these rivers have been chosen as a base of the study as Pune has evolved its identity from the Mula-Mutha river.

METHODOLOGY

Activity mapping will include-

1. Religious practices

2. After death rituals
3. Visarjan
4. A play area for children
5. Boating / swimming
6. Animal bathing
7. Washing cloths and utensils
8. Drainage from various sources
9. Flood lines

A study will be conducted based on the following parameters on Mula-Mutha river-

- Number and typology of structures on river bank
- Frequency of submergence of the structures in monsoons
- Various reasons for the floods and their frequency
- How does this affect the daily chores happening on the river banks?
- The situation in the past and the present on the river banks and river

These conditions of the river will help in analyzing the behavioral pattern of the river in the past and in the present.

Certain river sections will be selected of the river depending upon the various activities which take place on the ghats. The ghats resemble the character of the river and its changing behavior will be taken into consideration.

These ghats will be studied according to the above-mentioned parameters. The outcome of the study will clearly show and suggest the changing behavior pattern of the river over the year, relationship of the built fabric – old and new with the river, and how does the activities change or respond to the activities during changed circumstances and conditions.

The stretch of the river in Pune studied runs from SM Joshi bridge up to Amruteshwar Temple bridge and ghat which is a home for various activities which include also dominantly include religious practices.



Figure – 1: River stretch form SM Joshi bridge upto Amruteshwar Temple bridge

The major landmarks or the structures which are within the span of the river which contribute majorly in giving river the identity and vice a versa. These structures have become dormant today, but these were of major importance and were a vital feature when river was taken into account for any purpose.

These historic structures today are intact but they have lost their relationship with the river in the recent years after channelization of the river which has eventually resulted in dragging the river away from these structures.

Various structures, typology, era of construction, various activities taking place in the past and present will be studied. The studied areas will be a vital base for the research which will eventually become the hotspots for the research and also are the areas of importance when taking into consideration the river banks and the built fabric majorly associated.(Refer fig : 2)

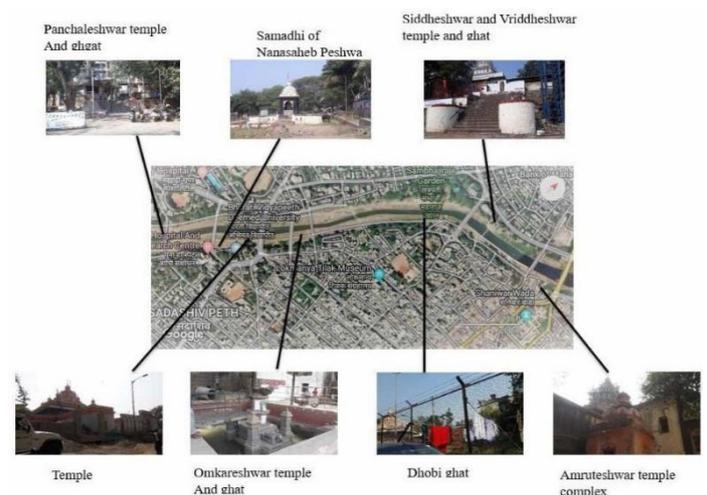


Figure – 2: Hot spots on the banks of Mula-Mutha river which were a vital part of the study and reference.

RESULTS AND OBSERVATION

The city of Pune gradually developed along the river. There were fourteen ghats on the river. As the population of the city increased, attempts were made to explore other sources of water. Lakes like Katraj and dams were constructed to suffice the water needs of the city, which led to city expansion away from the river.

The diagram shows the current channelized river along with the original span, which is the most probable span of the river considering the historic fabric around.

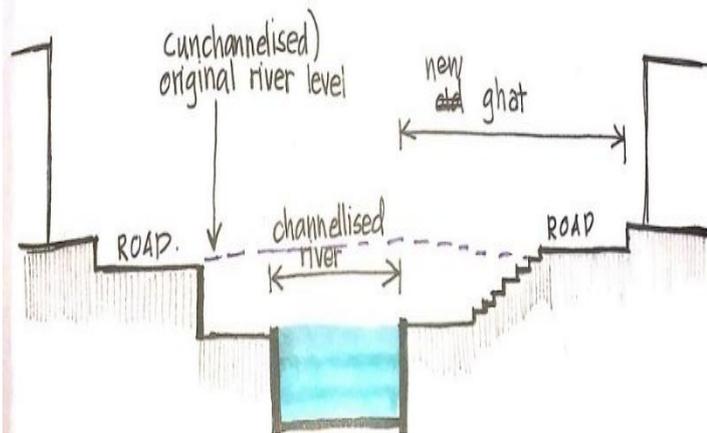


Figure 3: Current condition of the river.



Figure 5: The old river.

The existing historic structures are approximately 5 meters above the current level of river water. Due to channelization the depth and also span of the river had eventually decreased leading to formation of various Urban elements like a road in the old river span, some parks, small spanned ghats, Dhobi ghats, drainage outlets and drainage humps. These have deteriorated the original character of the river.

A few ghats within the complex of Onkareshwar, Amruteshwar, Siddheshwar, Vriddheshwar are currently not in use as they are situated at a height from the river and have lost the association due to road in the river span.

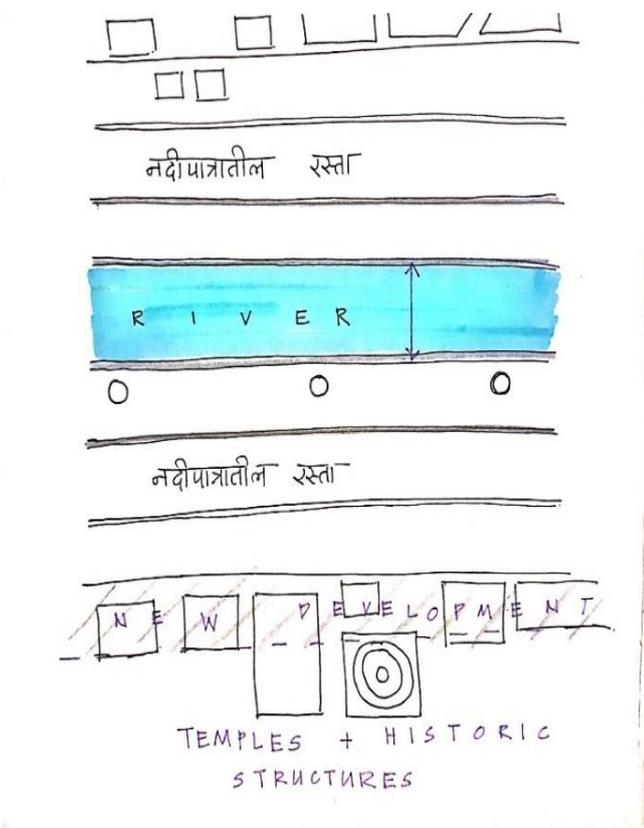


Figure 4: Current condition of the river.

The diagram shows the road within its span and newly developed and old built fabric.

The Panshet dam burst in 1961 washed away many of the ghats. No attempt was made later to restore them and the river gradually lost its connection with the people. Only seven remain now, and those too poorly maintained.

The river dammed at two places the river appears nothing less than a drainage as a number of pipes are seen opening into the river waters carrying all the sewage from the city, most of which is untreated as the city has the capacity to treat only 50% of the sewage it generates.

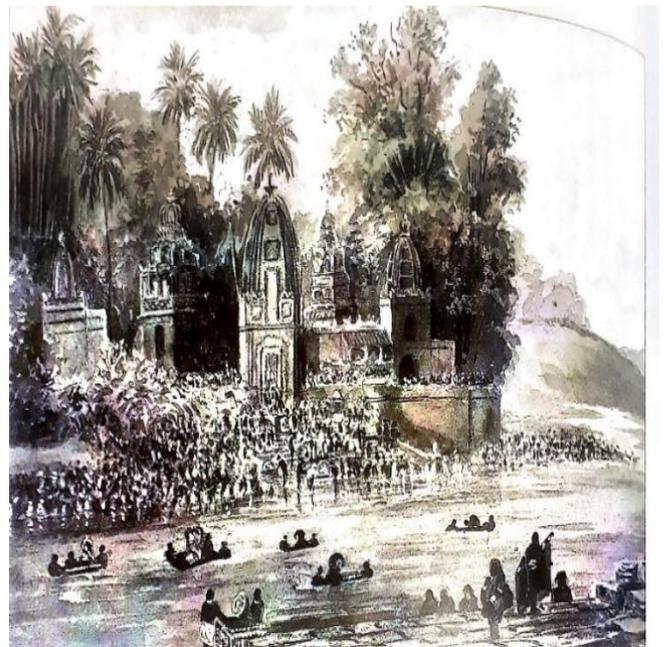


Figure 6 : The image shows the Mula-Mutha river along side a temple and ghats during the Peshwai era ie. 18th century, it was an important aspect for various occasions in the city



Figure 7: Condition of new built ghats

Newly constructed ghats of concrete and bricks stand unattended, filled with garbage over the year. These ghats are only dominantly used during the immersion of Lord Ganesh idols during Ganesh Festival.



Figure 8: Ghat along the Siddheshwar Vriddheshwar Temple



Figure 9: View of the Vriddheshwar-Siddheshwar temple complex along with the new and old ghats

The newly constructed ghat remains dormant over the year. It is only utilized during festivals and immersion of Lord

Ganesh Idols during Ganesh Festival. But these ghats have lost its culture.



Figure 10: Samadhi of Nanasaheb Peshwa on the river bank of Mula-Mutha.

There are various Samadhis of Peshwa family on the river banks. But these Samadhis are dumped under the garbage along the river except of Nanasaheb Peshwa Samadhi as it was conserved. Various attempts are being made in order search the other samadhis of renowned personalities, but no positive outcomes have emerged.

CONCLUSION

After studying the selected stretch of the Mula-Mutha river, the main reason for the floods is due channelization of river, which has reduced the span of the river and hence has lost its original nature. Another major reason for the floods is the release of of water from the Dams on the river. Construction of dams on the river has reduced the original flow and span of the river, hence during heavy rainfall when water is released the river reaches its own nature and hence the roads on the banks of river go under water. These roads previously were a part of flood lines when the Pune city started to develop in the 16th and 17th century. Hence all the temples are constructed beyond this road and at a higher level that is Minimum 3-5 meters above the river level. Hence, it can be clearly stated that the basic reason for the floods which Pune sees is due to channelization of the river and not taking into consideration the original nature of the river. The structures which dominantly get affected due to changing behavior of the river are the lately built and not the historical structures. The historic structures were latest affected due to Panshet dam burst which engulfed almost the whole of the city and various ghats along the river and also a few small temples which were situated on the nearest to the river.

The flooded river and the Urban fabric around. This can be the original span of the river before the dams were constructed as the historic structures are away, and recently developed Urban Fabric is near the river. Refer figure: 18. This can be a dominant reason, because of which the Urban fabric and the

activities which are carried are getting affected due to the changing behavior of the river.



Figure 11: The view of the channelized river along with recently developed urban fabric.



Figure 12: River during the floods

ACKNOWLEDGEMENT

I would like to express my gratitude to Ar. Shekhar Garud sir who guided me with the Research paper and encouraged me to work towards my topic and come out with interesting area of research to be conducted.

I would like to express my gratitude to Ar. Prof. Prasanna Desai sir, director of PVP College of Architecture.

REFERENCES

i. *Pune river map*. (2019, February 21). Retrieved from www.mapsofindia.com:

www.mapsofindia.com

ii. *Pune Rivers - Jeevitnadi*. (2017, February 15). Retrieved from

www.jeevitnadi.org: www.jeevitnadi.org

iii. *Rivers*. (2016, May 03). Retrieved from knowindia.gov.in: knowindia.gov.in enal,

iv. V. K. (2016, February 01). *Researchgate*. Retrieved from www.researchgate.com.

v. Banerjee, S. (2018, November 28). *Resuscitating the dying Mula-Mutha river in Pune*. Retrieved from thehindu.com

vi. Basudkar, N. (2020, February 18). *Mula-Mutha awaiting transformation*

from nala to river. Retrieved from sakaltimes.com

vii. Gupta, J. D. (n.d.). *Pune : Queen of the Deccan*.

viii. Khambete, A. K. (2018, January 30). *Slow Death of a river*.

Retrieved from *India Water Portal*: www.indiawaterportal.org

ix. *Pune rains : Revelers flock to catch a glimpse of swelling rivers*.

(2019, July 28). Retrieved from *Times of India*: m.timesofindia.com

x. Umbrajkar, S. G. (2017, October 2). *Water front development of*

Indrayani and Pawana rivers planned. Retrieved from *Times of*

India: [https://timesofindia.indiatimes.com/city/pune/waterfront-](https://timesofindia.indiatimes.com/city/pune/waterfront-devpt-of-pavana-indrayani-rivers-planned/articleshow/60904840.cms)

[devpt-of-pavana-indrayani-rivers-](https://timesofindia.indiatimes.com/city/pune/waterfront-devpt-of-pavana-indrayani-rivers-planned/articleshow/60904840.cms)

[planned/articleshow/60904840.cms](https://timesofindia.indiatimes.com/city/pune/waterfront-devpt-of-pavana-indrayani-rivers-planned/articleshow/60904840.cms)

xi. Hegewald, J 2005. 'Ghats and Riverside Palaces', in G Michell and RPB Singh(eds.) *Banaras; The City Revealed*, Marg Publications, vol. 57, no.2, pp. 66-77.

Rebirth of Architecture After Covid 19 And The New Perspective For Public Spaces

Omkar Dandwate¹ | Ar. Pranoti Lad² | Ar. Shreyas Paranjape³

1 -Architecture Student | E-mail - omkardandwate23@gmail.com

2 - Faculty- Sinhgad College of Architecture, Pune | E-mail - pranotilad@sinhgad.edu

3 - Faculty- Sinhgad College of Architecture, Pune | E-mail - shreyasparanjape.scoa@sinhgad.edu

Sinhgad College of Architecture, Pune | 2021

Abstract: In the light of recent global shutdown due to the corona virus pandemic , researches in every field are underway to reduce the effects of the disease and make the world a safer place. Architecture being the shaping tool for human accommodation, movement and interaction is a field where it is of utmost importance to find new ways to rejuvenate public spaces and related economies. These alterations in Architecture include application of safety norms , social distancing and anti transmission techniques which are studied in detail and their creative incorporation in architectural designs is the focal point of the research.

Keywords - Pandemic, architecture, social-distancing, safety protocols, transmission, renovation, COVID-19, Corona Virus

INTRODUCTION –

The Corona virus disease or COVID-19 pandemic which began in March 2020 left a mark on the global economy and completely shut down the outdoors for the whole world. It changed the way of interaction between humans and created a hostile environment in the public spaces. After several months of global lockdown the it has become nonviable for global economies to keep commercial and public places shut since small businesses depend on the these very places but due to the fear of infection among the masses, restoring the normalcy and flow of people in these public spaces is a challenge. According to the World Bank statistics the COVID-19 pandemic will result in and overall 5.2% fall in Global GDP which is the biggest global economic setback since 1870. Creative solutions are emerging around the globe to tackle this problem and have proven to be useful in many scenarios. Permanent changes are being made in architectural standards and interior designing to make our living spaces well prepared for such pandemics and any possible future virus outbreaks since the Corona virus is proven to have several mutations which could prove even dangerous in future.

The research studies shows historical events of similar pandemics on global magnitude .The strategy is to take inspiration from buildings and urban renovations from the past and implement them in today's pandemic scenario. The primary focus of the research is to study the modes of transmission of the virus and behaviour of users and to implement safety features as creatively as possible in open and commercial public spaces. Commercial public spaces are the most vulnerable areas for transmission since businesses will be opening simultaneously and places like malls and essential items' stores will experience significantly more crowd in less time which means greater risk of infection. On the other hand, open public spaces like parks and gardens will experience gradual rise in crowd which will also slow down small businesses which are dependent on this crowd like food stalls , hawkers, etc. The research can prove useful in speeding up the normalcy in these open public spaces by ensuring safety for the users through social distancing and other protective measures. Even if normalcy is established after successful vaccination , the research can prove useful until the vaccine is widespread and accessible to all or in times of pandemics or disease outbreaks in future.

AIM –

To explore the Architectural solutions to safeguard users from virus transmission, minimize the psychological effect of the

Corona virus among the masses in various public spaces like open parks and commercial hubs and to study the behavioral traits of users to make permanent changes in architectural standards of designing public spaces.

METHODOLOGY –

With the help of case studies of projects of successful implementation in present times of pandemic, observational analysis along with creative solutions can be obtained. Information from the case studies will be used to re imagine a

local public space to analyse the practicality of the solutions. Data collection through interaction with the locals and site visits of the public spaces where the research can be applicable. Observation of public and their habits of use of public spaces to be done to better understand the needs and requirements of the public spaces. The research can potentially be adopted as the new normal for architecture in public spaces as a measure of precaution against any disease outbreaks.

HISTORICAL BACKGROUND -

CHOLERA OUTBREAK OF 18TH CENTURY-

I. Haussmann Renovation of Paris -

During the 18th century Cholera outbreak, Paris was one of the most affected European cities. The reason for the fast transmission of Cholera Disease was the open drainage and narrow streets between tall buildings which were too crowded and unhygienic. In 1850 a renovation of Paris was planned to unclutter and widen the streets so that they were exposed to sunlight which was a natural solution to kill bacteria through UV radiation of the sun.

II. Street Reconfiguration of London -

During the same 18th century Cholera outbreak, London was also greatly affected due to the absence of a planned street drainage system. A reconfiguration of the affected areas was planned and the roads were laid out in a straighter and wider to incorporate the drainage lines.

TUBERCULOSIS OUTBREAK OF 19TH CENTURY-

I. The Paimio Sanatorium was designed by Alvar Aalto in Finland in 1932 to house Tuberculosis victims. The structure was strategically designed without sun shades to let in maximum daylight which was proven to kill tuberculosis bacteria through UV radiation. It also provided warmth to the patients who experienced cold during sickness.

CASE STUDIES -

I. Street reconfiguration of Milan -

During March 2020 Corona virus pandemic, the Milan government decided to shut down 35 KM of urban streets for vehicles and use them as bicycle tracks and footpaths. This meant people got more space to walk and maintain social distancing when the lockdown was lifted and people were allowed to go out. The added benefit of reducing the streets for vehicles is a significant decrease in air pollution and

greater pedestrian safety while maintaining social distancing on pathways and footpaths.



Milan Street Reconfiguration, 2020. (Source - The Guardian)

II. Street Dining in New York -

New York City is one of the most affected cities due to the pandemic and restaurant business is one of the biggest part of New York Economy. Due to the social distancing restrictions, indoor dining capacity has been reduced. To tackle this problem, streets in New York have been shut down for traffic and utilized for outdoor dining so that tables can be arranged at appropriate distances. This idea has helped the restaurant business in New York to get back on track and has helped with the overall economy of the city.



Mulberry street, Manhattan 2020 (Source - The New York Times)

III. Mount Sinai hospital, New York.

During the surge of the pandemic, hospitals experienced extreme conditions as the health-care workers came in direct contact with the infected. To minimize the risk of infection

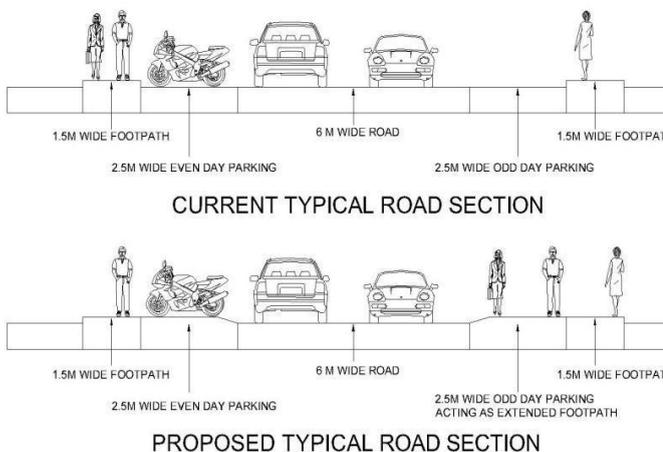
Mount Sinai Hospital in New York implemented some useful measures. The patient wards were made into negative air pressure isolation rooms which ensured no infected air escaped the room and were fitted with HEPA filters. The patient monitoring systems were moved out of the rooms and in the hallways so that the doctors could monitor patients without entering the isolation wards. The hallways were visually marked to inform people about social distancing and infected wards. These small changes helped the hospital staff work with safety and the risk of infection was minimized.

Areas of Focus -

Primary focus of the research is study and execution in open and commercial public spaces which effectively covers the most affected spaces. To better implement safety strategies in these public spaces, they are divided in following points of focus for this research-

i. Footpaths-

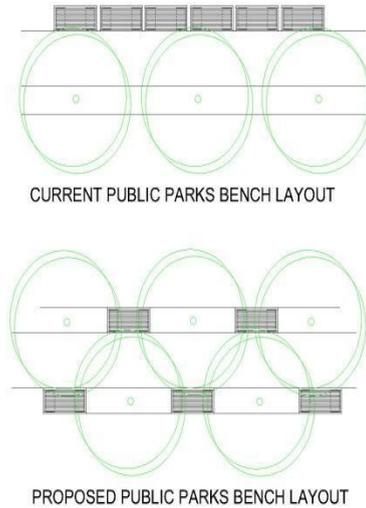
Current footpath layouts in urban areas are not designed to incorporate social distancing, there is a close proximity of people while walking which is not safe after COVID, hence primarily the footpaths should be laid out wider and with less obstructions than usual which will allow the users to maintain safe distance from each other even in the prime hours of use. As for the current footpaths, many cities follow the odd even parking rule and the same can be used as an advantage to maximize the footpath space on the side without parking on alternate days. This implementation will require fixing of visual markings to demarcate footpath extension in the parking lane so as to inform vehicle drivers of the footpath expansion.



(Source - author)

ii. Street furniture -

Street furniture, primarily benches and seating can be re-modelled and re-designed without armrests to discourage users to touch the seats while being seated. Additionally the positioning of the benches has to be changed from adjacent to alternatively stacked to increase the distance between 2 seats. The length of the benches needs to be reduced to incorporate only 1 individual at a time. Bus stands can be redesigned to accommodate more seating space with appropriate distance.



(Source - author)

Street shading can be strategically done so as to discourage people from standing in close proximity. People tend to gather in groups under shade and this habit can be used to disperse them as well by shading an area in patches. This will reduce the risk of transmission in places like street queues, bus stands, outdoor restaurant waiting areas, college campuses, etc.

The seating can be arranged at specific distances and be re-modelled without arm rests. Installation of sanitizer stands at the entrance and at the reception. The width of the lobby to be maximized to avoided crowding in a small area. Entrance and exits to be separate to avoid cross circulation, this will also help is hassle free temperature checks at the entry

Based on a limited interaction with the staff and locals of the area, following chart shows the usual crowd saturation vs the same during the pandemic:

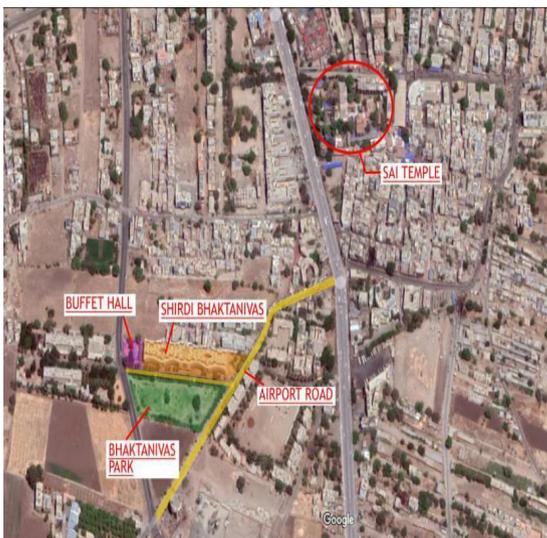


Conventional street queues, Proposed shading devices
(Source - author)

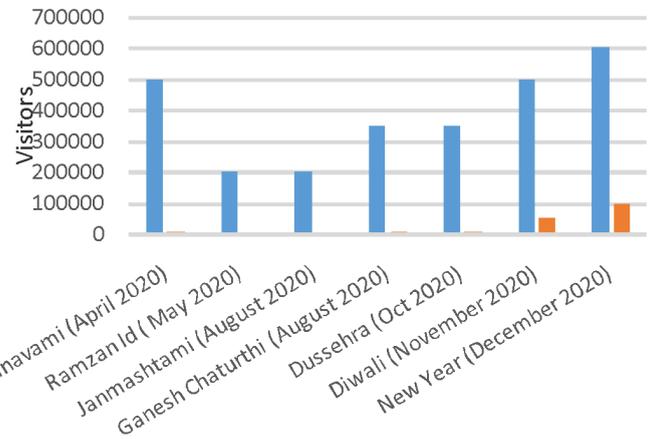
iii. Waiting Lobby -

Covid safety compatible redesign proposal at Sai Ashram, Shirdi, Maharashtra.

In order to further demonstrate the purpose of the research, a redesign of a crowded public space like Sai Ashram Shirdi is proposed. The Sai Ashram at Shirdi experiences a heavy crowd throughout the year, especially during festivals and days of religious significance which makes it a highly vulnerable public place for virus transmission during the pandemic. After a lockdown of almost a year, the gates of the Ashram have been reopened but the park and halls remain closed. If proper safety protocols are followed and safety alterations are made, it can be fully reopened to the public.



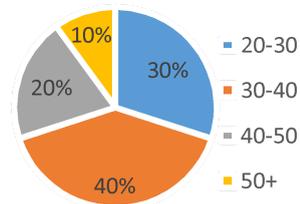
(Source - Google maps)



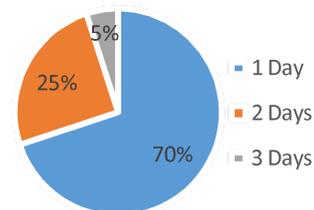
Significant periods of visiting Shirdi in 2020

■ Usual visitors ■ Visitors during PANDemic

Age of Visitors



Period of Stay



As there is a gradual rise in the number of visitors over time during pandemic, it is an urgency of accommodation facilities in Shirdi to implement safety measures in their premises.

After interacting with 20 visitors and locals in the Ashram premises, the following data is obtained.

due to the frequency and quantity of crowd entering the premises at the same time. This problem is magnified due to

only one entry and exit gate which also not safe from social distancing perspective.

- Solution - Making Entrance gates wider and increasing entry points if possible and setting up several entrance rows with

Solution - Making visual markings and creating physical intermediate obstructions to break the queues to implement social distancing. The adjacent airport road has relatively less traffic so a lane can be used for pedestrian movement and for making a queue in case there are too many people entering the temperature check at the same time.

- people walk very close to each other which defeats the purpose of social distancing.
- vi. Staff and workers need proper training on how to direct crowds to follow safety procedures.
- vii. Existing safety protocols in the premises.
 - Workers wearing masks.
 - Hand Sanitizers in ticketing areas.

Identified Issues-

1. Temperature check -

It is difficult to temperature check each and every individual temperature check points for smooth and continuous flow of people.

2. Social Distancing in Queues -

People often cut in and don't follow social distancing when in ticketing queues. Lack of visual markings adds to the disorder in the queue.

•

3. Social distancing in common waiting lobbies -

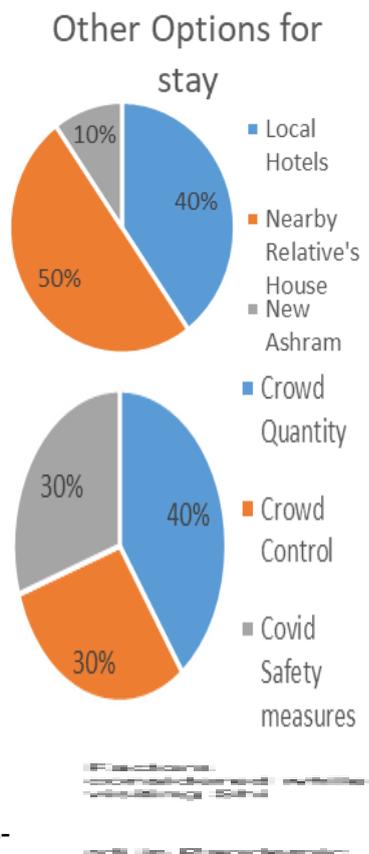
The traditional seating has not been changed which means people are seated close to each other and often the seat arm rests are touched by possibly germ carrying hands.

- Solution - Installation of chairs with no arm rests to discourage the people from touching the seats/chairs and arranging them in an alternate way leaving recommended distance between.

4. Footpath safety -

Footpaths on the adjacent Airport Road are very narrow which discourages the social distancing among it's users. The pedestrians prefer walking on the road instead of the footpath due to the trees that are planted in the middle of the footpath.

- Solution - An additional 2.5m of width can be added to the footpath by either temporarily encroaching in the adjacent 6m wide single way road or expanding it the adjacent vacant plot.



Observations-

- Majority of visitors put crowd saturation at the top priority when considering visiting Shirdi during the pandemic.
- Social distancing is neglected knowingly or unknowingly because of the habitual public place behavior.
- Parks and kids play areas are the most vulnerable as they are touched the most without precautions and kids do not seriously follow the safety measure in the play area so completely shutting down the play area remains the only option for the authorities in the time of the pandemic.
- Sanitizer stands are scarce in a public place of such crowd saturation.
- Footpaths are not correctly planned as most of the space on the footpath is taken by the trees and people often prefer walking out on the road which is risky and makes



Adjacent Airport Road and footpath. (Source - Author)

4. Parks -

Reopening of parks and children's play area is challenging. Visitors as well as locals use the parks on regular basis. Since the children are do not fully understand the concept of social distancing it is not safe to reopen parks in current conditions.

- Solution - Children's play equipment like swings to be redesigned and installed at safe distances from each other. Sandpit play areas to be kept closed since many kids are expected to use them at once.

Sanitizer stations must be installed near each play equipments with cartoon murals which will attract kids and hence encourage them to sanitise their hands more often.

5. Banquet Halls -

Due to the heavy concentration of visitors and no safe buffet systems, banquet halls in the premises have been shut down since the pandemic.

- Solution - The traditional row wise table layout has to be changed into staggered layout so as to maintain safe distance between 2 tables. Staff has to be appointed at the buffet to serve the visitors so that they don't have to touch the food containers. Buffet queues have to be marked on the floor with clear indication of standing positions for the visitors.

CONCLUSION-

With the world slowly getting back to normal after the pandemic, there is a strong need of concrete measures to make sure that public safety is maintained in the process. Even if the normalcy is established after successful vaccination, chances of another pandemic cannot be neglected and to avoid another global lockdown situation, permanent safety measures are a must.

ACKNOWLEDGEMENT-

My sincere appreciation to the faculty guides of Sinhgad College of Architecture, Ar. Pranoti Lad and Ar. Shreyas Paranjape for their valuable guidance and insights on the

topic. It is my immense please to have studied and researched the topic under their guidance.

REFERENCES-

- i. *World Bank article on economic effect of the pandemic.*
<https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world>
- ii. *The Guardian article on Street Reconfiguration of Milan*
<https://www.theguardian.com/world/2020/apr/21/milan-seeks-to-prevent-post-crisis-return-of-traffic-pollution>
- iii. *The New York Times Article on street dining in New York.*
<https://www.nytimes.com/2020/11/02/dining/outdoor-dining-nyc.html>
- iv. *A MASS design group report on Mount Sinai Hospital.*
https://massdesigngroup.org/sites/default/files/multiple-file/2020-04/Redesigning%20Hospital%20Spaces%20on%20the%20Fly%20to%20Protect%20Healthcare%20Workers_4.pdf
- v. *A Newyorker article on Coronavirus and architecture*
<https://www.newyorker.com/culture/dept-of-design/how-the-coronavirus-will-reshape-architecture>
- vi. *An article on Haussmann renovation of Paris.*
https://www.mansionglobal.com/articles/pariss-haussmann-style-homes-offer-a-refined-lifestyle-222910?mod=sponsored_main&tesla=y
- vii. *Haussmann Renovation Wikipedia*
https://en.wikipedia.org/wiki/Haussmann%27s_renovation_of_Paris
- viii. *Cornell University Press' article on London street reconfiguration.*
<https://www.ph.ucla.edu/epi/snow/broadstreetpump.html>
- ix. *An article on Paimio Sanatorium*
<https://www.inexhibit.com/case-studies/aaltos-paimio-sanatorium-and-the-birth-of-the-modern-hospital/>
- x. *A MASS Design group report on spatial strategies for restaurant.*
https://massdesigngroup.org/sites/default/files/multiple-file/2020-05/Spatial%20Strategies%20for%20Restaurants%20in%20Response%20to%20COVID-19_.pdf
- xi. *A MASS Design group article on spaces for infection control.*
https://massdesigngroup.org/sites/default/files/multiple-file/2020-03/Designing%20Spaces%20for%20Infection%20Control_MASS%20Design%20Group_200327.pdf

Relativity of colour in class room design

Pooja Agrawal, Ar. Sujata Patil

Bharati Vidyapeeth College of Architecture (Deemed to be University)Pune, India

Email: poojaagrawal0181@gmail.com, ms.sujatapatil@gmail.com

Abstract: School plays a foremost role in learning stage. Colour is an important visual element of design which is recognised to have direct impact on child's cognitive attitude and interfere with the perception of space [vi]. Diversity in the hue of colour varies with child interpretation relationship between space and environment. The present study aims at providing right choice of colour to lift the student teacher experience, defining of space and response of day light to the diversity of colour in educational setting and its interference with space. The methodology includes case study of urban school located in Jabalpur and surveying about the effect of colour in educational environment for children. Depending on the outcomes of the result collected from two case studies and survey, the relevance of the colour on the educational environment has been analysed. Accordingly, the potential of colour and its preferences in educational setting has been discussed. Colour scheme for different spaces that suits the purpose is revealed. This paper is an attempt to study the application of colour to supplement daylight and its role in the description of the building and space regularity.

Key words – Class room, Colour in architecture, educational environment, day light, space, nuance.

1.INTRODUCTION

The learning process of the child after being guided by parents for nearly five years since their birth is initiated by primary school and the first step of this stage begins with classroom.[iii] Winston Churchill once said --

“People build buildings, then building build people”

In the present educational setting where everyone is running after modernization, we are losing sight for the effects and benefits of the natural environment. Exposing and making child adaptable to natural environment than man made environment is not only beneficial for child development but also acts as a cherry for the classroom architecture. Hence, there is need to create spaces which can boost child development without obstacles. To add that perk, study will be discussing two such factors-

- Colour

- Day light.

Colour, whose impact is often overlooked and is an inseparable part of our everyday life. In choosing colour in field of education one must realize the importance of colour in architecture of the classroom. Colour accomplishes a small but essential constructive feat contrary to what gloomy environment can never do [x]. It not only adds pleasing quality to design but reinforces day light and to some extent thermal quality of space. Stimulus caused from the physical elements of the space not only affects people behaviour and attention but also to the day lighting and thermal comfort of the room. In making the choice of best suited colour for the classroom it is difficult to predict result. Hence intention of the study is to forecast on how colour can contribute to enhance space day lighting and factors related to feel of the space.

The summarized outcomes showed that depending on lighting condition there was a need in the hue shift. The analysis presented that the colour was not only affected by day light but also the compass orientation of the light. The concept of warm and cool colour is more complex than what was expected. The level of advancing and receding of colour in presence of day light was a stunning experience and contradictory to the basic knowledge of capacity of colour to advance or recede. The outcomes quoted in the study shows that colour is one of them which hits the arrow on two goals that is enhancing light and at same time adds colour to the learning space of child.

2.MATERIAL AND METHODOLOGY

The research aims at understanding system of colour of classroom and its effect on the rhythm of daylight. The chosen route to this is two live case study of kindergarten located in Jabalpur (Madhya Pradesh) and preliminary questionnaire survey was also conducted with teachers of kindergarten for better understanding of the process in whole year. A total of seven teachers samples was selected. Three from live case study 1 and four from live case study 2 were chosen and their responses to the questionnaire were analyzed. The question

involved for study have two perspective, what does the colour look like in the classroom and how does the room look like in the colour? Using above methods observation were made. In the investigation two perspective was selected, first colour perspective and second its effect on daylight. Shift in the hue and nuance differing from the inherent colour are in focus together with the colour gestalt. As classroom is matter for children's and teachers so the chosen duration of time was in school hours mainly 11:00am to 1:30pm. The steps of the research involved consist of four studies mainly.

- Hue shift in relation to the amount of glare produced.
- Illumination caused due to reflection from different hue.
- Thermal comfort in relation with colour.
- Advancing and receding level of colour on the level of day light reflection.

For the study colour of wall surface and classroom furniture was considered. The wall surface of classroom was covered with oil paint of different colour and observation were made using the above-mentioned environment.

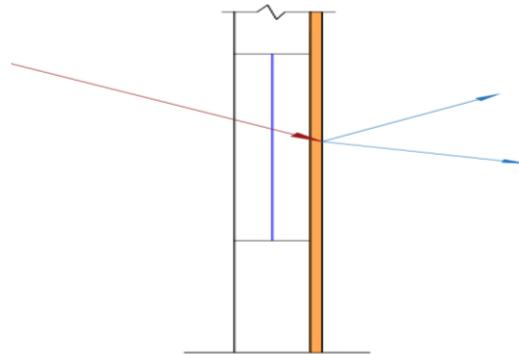
The studies quoted from questionnaire with samples (teachers) were further verified by conducting small experiments at individual level. For studying the illumination caused due to reflection of day light from different hue were taken with the help of lux meter. Munsell colour system provides base for understanding the spectrum of colour on the bases oh hue, chromatic level, and nuance. This comprehensive study will help in blooming the classroom environment on basis of colour and daylight by creating impressions of emotional tone (light - glare), dynamic (advancing - receding), spatial quality (open or closed) and character (warm - cool).

3.RESULTS AND TABLES

For carrying out the study two kindergarten located in Jabalpur (Madhya Pradesh) were appointed. The architectural data collection consisted of two complementary surveys of two kindergarten carried out on a same day. The correlation between day light and colour of the classroom were studied. In addition to this a questionnaire-based interview was also carried investigating each teacher's experience of their classroom. These questions sought the teacher's opinion of the colour and illumination levels the whole year. The illumination produced in the interior of the classroom and the effect on colour was studied. It was found that illumination level of classroom was affected by the following factors: - compass orientation of the classroom, interior surface treatment, colour of furniture and walls, and also the area of the window. The outcomes are discussed as follows-

3.1 STUDY-I

Two classrooms selected from two different cases but located in same direction in south were painted with same hue but with little shift in nuance of colour created varied effects of the illumination level of the classroom and glare produced.



The classroom painted with defined hue orange (fig.1) in case one produces glare and white patches on wall which created visual difficulty (fig.2) on the other hand the one painted with lower chromatic value of the same hue (fig.3) in case two minimises the above affects (fig.4). Shift in the hue and nuance caused immense difference in colour appearance and classroom environment.



Fig 1 Case 1

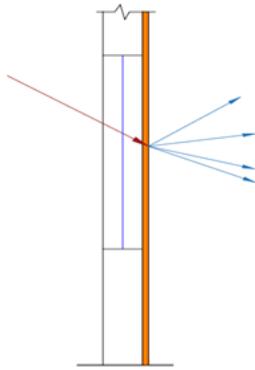


Fig 2 (Case 1)



Fig 3(case 2)

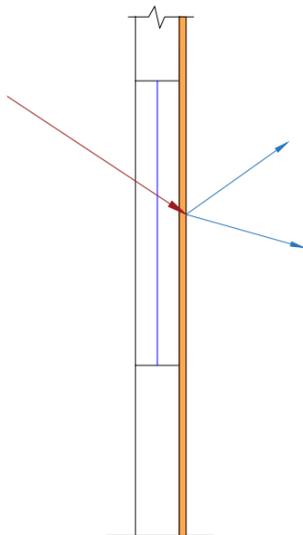


Fig 4(case 2)

of 88 lux irrespective of their location (fig.5, fig.6). The time so chosen was in accordance with the school hours. One of the feasible reasons which can be outlined from the study was same amount of reflection caused by analogous colour on Munsell colour system.

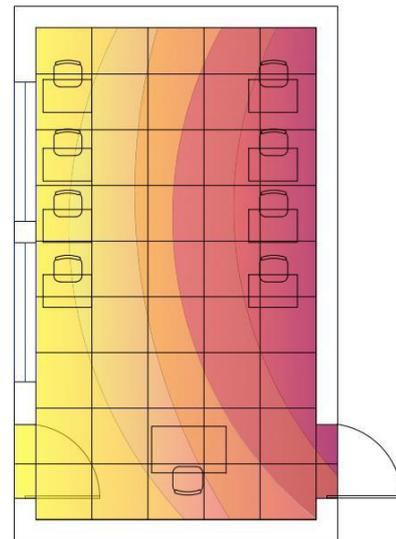


Fig 5 (case 1)

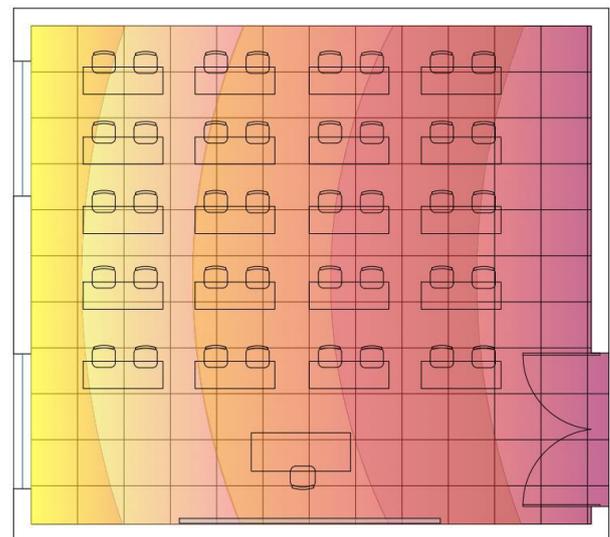
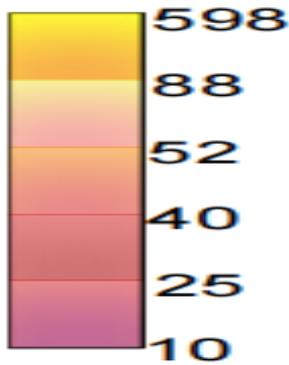


Fig 5 (case 2)

2 STUDY -II

For this study classrooms from two cases with different locations one in south and other in west with different hue, orange and red in the same time interval of 11:00 am to 1:30 pm when sun is in south direction showed similar lux reading



Lux level scale

3.3 STUDY -III

The interviews were conducted with selected teachers sample to know relation between the colour and temperature. From data analysis, dark colour class room presents increased in temperature than light colour surfaces. For concrete verification of the saying a test was conducted a small experiment with different coloured liquid water filled in glass bottles were exposed to sunlight for five hours which is the duration hours for primary school. The base temperature at starting of the experiment was noted to be 22°C and the end resulting temperature are noted in table 1. The reason for this phenomenon which can be figured is dark surface absorbs more of the incidental radiation than light surface hence causes increase in temperature.

Table 1

Colour	Red	Green	Yellow	Blue	Clear
Temperature	23°C	27°C	25°C	27°C	25°C

3.4 STUDY -IV

Another factor that affects our perception of colour in classroom was its saturation level. When the pure colour was placed on the background with colour of low chromaticness. In sunlight the pure colour was advancing and the colour with low chromaticness was receding (fig.7). Outcome experience for

the study noted from the questionnaire session was openness and congestion of the space in dark room the experience of congested space overruled. The increasing chromaticness together with the hue shift seemed to cause this effect.



Fig.7 (Case 1)

Snug Embracing Pushy Overriding	Soft Pushy Importun
Soft Fluffy Energetic Alive	Snug Embracing Pushy Overriding

Table -2 (Differences in verbal descriptions.)

Colourful Fun	Embracing Enclosing Demanding
Warm Welcoming Peaceful	Pale blue Cool Soothing

Table -3 (Differences in verbal descriptions.)

4.CONCLUSION

The research carried clearly helped in building a bridge between colour and day lighting which further helps in building a cognitive space. The study for the relation between colour and day light would achieve an extra tick in the construction of

utopian space for children. The results did indicate the pros and cons which can help one in making right choice for the colour scheme of classroom.

Even a small shift in the nuance of the colour was noticeable. Two breaking points in the hue shift were identified from the amount of illumination level achieved through the reflection. In terms of observed nuance shift the room colour became more chromatic striking with day light. The thermal properties of colour were far more different than what our basic knowledge said. The advancing and receding properties of colour help in creating optical illusion for the space. The observation made are highly beneficial in selecting colour scheme and create most conducive primary educational environment for future interventions, building a cognitive space and receding properties of colour help in creating optical illusion for the space.

5.ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude to my guide, Associate Prof. Sujata Patil for all the relentless and selfless assistance. I would like to express my special thanks of gratitude to the teachers and school management of little kingdom school and St. Aloysius school Polipathar, that took part in the studies.

6.REFERENCES

- i. Peter Barrett, Fay Davies, Yufan Zhang, Lucinda Barrett
The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis: (2015)
www.elsevier.com/locate/buildenv
- ii. Stine Louring Nielsen, Kathrine Marie Schlederemann
The Impact of Dynamic Lighting in Classrooms. A Review on Methods
Ellen Kathrine Hansen: (2018)
<https://www.researchgate.net/publication/323576711>
- iii. Anishkaamilanihettiarachchi, nayanathara. A.s
The effect of class room colour on learning with reference to primary education; a case study in srilanka: (2017)
(pdf) [the effect of class room colour on learning with reference to primary education; a case study in srilanka \(researchgate.net\)](https://www.researchgate.net/publication/323576711)
- iv. Ellen Mannel Grangaard University of Nevada, Las Vegas
Effects of color and light on selected elementary students
Effects of color and light on selected elementary students : (1990)
[Home | UNLV University Libraries](http://unlv.edu/libraries)
- v. Fazila DUYANI
A research on the effect of classroom wall colours on student's attention:(2016)
https://jag.journalagent.com/itujfa/pdfs/ITUJFA-57441-DOSSIER_ARTICLES-DUYAN.pdf

- vi. M Billger,
Colour in Enclosed Space. Gothenburg, Chalmers University of Technology, Form och Teknik. ISBN 91-7197-820-8. (1999)
<https://scholar.google.com/scholar?cluster=1654393119335495331&hl=en&oi=scholar>
- vii. Nienke M. Moolenaar, Mirjam Galetzka, Ad Pruyn
Lighting affects students' concentration positively: Findings from three Dutch studies : (2013)
<https://www.researchgate.net/publication/258169434>
- viii. Beata Stahre Wästberg
Physical Measurements vs Visual Perception: Comparing colour appearance to Virtual Reality.
(2006) https://www.academia.edu/8328247/Physical_Measurement_vs_Visual_Perception_Comparing_colour_appearance_in_reality_to_Virtual_Reality
- ix. Alana S. Pulay
Awareness of Daylighting on Student Learning in an Educational Facility: (2010)
https://digitalcommons.unl.edu/archthesis/91/?utm_source=digitalcommons.unl.edu%2Farchthesis%2F91&utm_medium=PDF&utm_campaign=PDFCoverPages
- x. Marilyn Read
Designing with Color in the Early Childhood Education Classroom: A Theoretical Perspective: (2019)
<http://www.scirp.org/journal/ce>
ISSN Online: 2151-4771

Sustainability In High Rise Architecture.

Authors 1. Pooja Gaikwad. Email – poojagaikwad8600@Gmail.Com

2. Aprajita Kaushik. Email – aprajita@dypatilarch.Com

Institute Name: D.Y. Patil School Of Architecture, Charholi(BK),Lohegaon, Pune.

Year Of Study :Fourth Year B. Arch

ABSTRACT:

In developing countries, places where builders are countingly facing with challenges related to poor infrastructure, obstacles effecting constructability, and a lack of political will and state resources, the sustainable tall building provides a unique opportunity for economic analysis and social reflection. In India, especially, the social structure is defined by the economic structure. As cities cope with rapid population growth—adding 2.5 billion dwellers by 2050—and grapple with expansive sprawl, politicians, planners, and architects have become increasingly interested in the vertical city pattern.

It is concluded that since tall buildings consume massive energy, designers of the next generation of tall buildings will incrementally aim for “zero energy” design. In this approach climate is used to advantage and the building becomes a source of power. It is possible that tall buildings will someday even produce excess energy and transfer the excess to the city’s power grid for use in other ways.

Sustainable architecture is environmentally conscious,energy-saving, and utilizes responsive and renewable materials and systems (Newman, 2001). Ecological and environmental concerns have expanded beyond the issue of the consumption of non-renewable energy sources. Sustainability essentially aims for ecological balance.

This paper will review and examine shortfalls of tall buildings found in the literature to inform future developments. The paper will gather a vast amount of fragmented criticism and concerns, and organizes them around the three pillars of sustainability: social, economic, and environmental. Mapping out the “unsustainable” aspects forms the foundation for addressing them in future research and tall building developments. the authors will argue that a truly sustainable approach to design acknowledges interdependence and embraces diversity in economics, necessitating that a successful “green” tall building be an integrated part of a society’s financial, technological and cultural advancements.

Keywords: Sustainability; High-Rise Developments; Economic Shortfalls; Environmental Problems, steel structure.

INTRODUCTION:

The rapid growth of the economy of the leading countries is contributing to the development of big cities. In connection with intensive internal and external migration of people to big cities, the population density is increasing. As a result, the number of modern multi-storey buildings and high-rise buildings is increasing. [9]

One of the important components of the living environment of a city is the residential environment. The unified system “man - apartment - building - neighbourhood – residential area of the city” defined in the scientific literature as “residential environment” has complex features and mechanisms. A human being, interacting with the residential environment, performs non-productive activities on the territory of populated areas. In big cities, the development of the living environment, mainly consisting of multi-storey buildings, high-rise buildings and modern public spaces, causes variation in temperature and wind conditions of the terrain and aggravates the environmental situation. [8], [9].

The comprehensiveness of the sustainability concept is apparent in one of the earliest and most frequently used definitions created by the United Nations’ Brunt Land Commission in 1987. The commission defined sustainability as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. Concisely, this definition resonates the root meaning of the word “sustain”, which is to “provide with nourishment” or to “keep going”, as defined by Merriam-Webster Dictionary. Therefore, in line with the urban planning profession, sustainability emphasizes the long-term implications of all human activities. It also presumes that resources are finite and that we should use them conservatively and wisely

according to long-term priorities and consequences of the ways we use them. [1], [2], [3].

SUSTAINABILITY:

Over the past three decades, sustainability has evolved and become even more comprehensive and complex. Planners, architects, and politicians have been applying expanded and diversified definitions of sustainability to almost all human activities, such as: [3], [4].

- A sustainable future is one in which a healthy environment, economic prosperity, and social justice are pursued simultaneously to ensure the well-being and quality of life of present and Future generations. Education is crucial to attaining that future.
- In essence, sustainable development is about five key principles: quality of life; fairness and equity; participation and partnership; care for our environment and respect for ecological constraints—recognizing there are ‘environmental limits’; and thought for the future and the precautionary principle. It also assists in planning for “balanced community where urban centers prosper, natural landscapes flourish, and farming is strengthened as an integral component of our diverse economy and cultural heritage”, as Rick Pruetz explains. Notably, in his book *The Architecture of Community*, Léon Krier presents sustainable urbanism as “an ethical and civilizing vision of universal stature”. [3], [5], [6]

Sustainability offers an inclusive framework represented in its three conceptual pillars (the social, the economic, and the environmental) or the “3Ps” of people, profit, and the planet, where:

- “people” represents community well-being and equity;
- “profit” represents economic vitality; and
- “planet” represents conservation of the environment

It is projected that by 2030, 5 billion people will live in urban areas throughout the world (United Nations, 2001). Whereas 30 per cent of the world population lived in urban areas in 1950, the proportion of urban dwellers climbed to 47 per cent in 2000 and is projected to rise to 60 per cent by 2030. [7] Energy shortage, global warming, urban sprawl, air pollution, overflowing landfills, water shortage, disease, and global conflict will be the legacy of the twenty-first century unless we move quickly towards the notion and implementation of sustainability. Survival of the human race

depends upon the survival of the cities--their built environment and the urban infrastructure. This will warrant vision, commitment, and action through partnership and commitment of governments, policy makers, experts, and the involvement of citizens. It will require collaboration of urban planners, architects, engineers, politicians, academics, and community groups.

SUSTAINABILITY IN TERMS OF STEEL:

Construction projects require many decisions. A key decision is to find the most effective option, as well as determining which process could produce ideal results. [10]

The main advantages of steel are:

- stiffness, ductility and resistance
- prefabrication and speed of construction
- flexibility
- sustainability (reusability & indefinitely recyclable)
- reliability

STIFFNESS & RESISTANCE

Steel is the most efficient material for columns thanks to its stiffness and resistance. Steel solutions are 5 to 8 times stiffer and about 10 times more resistant than concrete. Steel has a very high strength to weight ratio, leading to:

- minimum construction dimensions
- increased usable “carpet” area (the footprint of a column is approximately 10 times smaller in steel than in concrete)
- lighter columns (about 3 to 6 times lighter than concrete columns)
- lower loads transferred to foundations (total building weight is more than 2 times lighter in steel than in concrete)
- long span

Example: Comparison between concrete and steel columns
Load = 15000kN (| 25 floors), Buckling length = 4m

Class / Grade	Concrete C60	HISTAR® 460
Dimensions / Section	650 x 650mm	HD 400 x 314
Weight	314kg/m	1060kg/m
Column area	0,42m ²	0,04m ²

It is widely acknowledged that steel structures inherently offer superior performance in earthquakes compared to masonry or reinforced concrete.[10]

FLEXIBILITY

Structural steel can be combined with other materials to achieve the desired look, properties or functionalities. Steel is the material “par excellence” when it comes to inventing new structures and forms. All solutions are possible, from the very simplest to the most challenging ones. No other material is used to make structures which are so slender, light and transparent. Forms can be created using different structural effects and envelopes with pure or finely sculpted curves. Steel provides the flexibility needed to enable a building to evolve throughout its working life. The building can be initially designed in order to facilitate future evolutions:

- modification of applied loads due to change of the building’s usage
- floor plan layout
- possibility to create new openings in façade or slab. [10]



Broad J57 Tower, 19 days for 57 storeys, Changsha, China [10]



Scrap yard, Belval, Luxembourg [10]

FABRICATION AND SPEED

Fabrication of steel elements is carried out in a workshop, leading to:

- less material and waste on-site
- minimum disruptions to the surroundings (e.g. less noise)
- ease of construction
- reduced workforce on-site
- higher level of safety for the workers
- reduced management costs on-site
- optimised construction time
- earlier pay-back of investments [10]

SUSTAINABILITY

It is an approach to produce safe and sustainable steel reflecting our commitment to protect and improve the environment in which we live and work. Constantly work to develop clean practices in steel production. More than 1 500 research engineers are constantly trying to develop cleaner and greener processes to produce steel. One example is the development of the modern high strength steel HISTAR®. Increasing the strength of the steel, less material is needed. For example, HISTAR® which has been used in buildings such as One World Trade Center in New York and Emirates Tower One in Dubai, can reduce CO2 emissions during construction phase by as much as 30%.

Steel is an especially sustainable material as it can be definitively recycled, without quality loss. Thanks to this property, it surpasses other materials and saves millions of tonnes of resources worldwide. [10]

RELIABILITY

All structural steel products are manufactured using automated and computerised industrial processes. Finished products are subjected to high levels of quality controls to ensure the best finished quality. [10]

*Steel is the most efficient material for slender columns thanks to its stiffness and resistance. Compared to concrete, steel is 5 to 8 times stiffer and 10 times more resistant in compression. This makes steel sections the ideal material for columns in tall buildings.



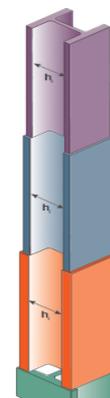
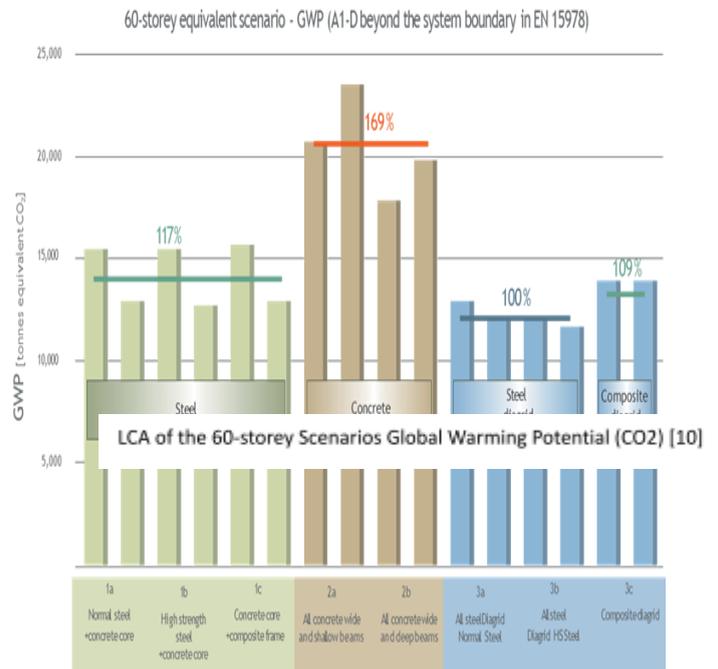
Steel can be indefinitely recycled without any loss in quality. This means that the amount of scrap material from job sites or manufacturing plants, in addition to steel elements recovered from demolished building and structures, contribute to most of the steel material used in new high-rise structures. Steel is the most recycled material in the world. About 65-70% of all steel needed for reinforcement bars has

Come from recycled material and 99% of steel beams are developed from recycled steel (approximately 88% recycled and 11% can be reused). Recycled steel represents currently about 40% of the steel industry's ferrous resource in the world. With 33 million tonnes of CO₂ saved each year, Waste generation, water use, and air emissions are continually decreasing, as are energy consumption and greenhouse gas emissions. The European steel industry is one of the most efficient steel industries in the world. European steelmakers have reduced energy consumption and CO₂ emissions per tonne of steel by 50% since 1960 and are now close to the technically feasible minimum. production sites of beams have all reached ISO 14001 certification, the international standard for environmental management systems.

STEEL STRUCTURE PERFORMANCES

To verify the sustainability of steel as a structural product, 60-storey tower scenarios were developed for different structural arrangements. In this analysis, all-concrete solutions performed worse (on average) than the other scenarios that used steel, in terms of GWP.

Consequently, each tall building scenario can benefit from the recyclability of the steel at the end of the building life cycle along varying magnitudes: concrete scenarios benefit from the recyclability of rebar, while steel buildings benefit from the recycling potential of the majority of the structural material, including steel sections, rebar, steel decks, etc.



Stacking up HD 400 columns [10]

Fabricator: Yuanda Keijian

J57 Mini Sky City (Changsha, China)

Height: 207,8m (682ft) Number of Floors: 57Gross floor area: 179 600m² Building function: Residential; OfficeCompletion: 2015Structural material:

SteelArchitect: Broad Sustainable Building Co., Ltd Structural Engineer: Sky City Investment Co., LTD General Contractor: Sky City Investment Co., LTDArcelorMittal Steel: 10 345 tonnes of prefabricated sections. Fabricator: Yuanda Keijian

Project Overview: J57 Mini Sky City was built in a combined construction time of only 19 days,which is almost at a pace of 3 completed floors per day. The tower was developed by Broad Sustainable Building (BSB), which is a construction company specialising in prefabricated buildings. The tower was built with energy-efficient, factory produced elements, using the BSB prefabricated construction method, which won the 2013 Council on Tall Buildings and Urban Habitat (CTBUH) Innovation Award. Using this construction method reduced the use of up to 15000 concrete trucks and avoided the release of dust associated with conventional Chinese construction processes. J57 includes 19 ten-meter tall atriums, 800 apartments and office space for 4000 people, which highlights the flexibility of the building use, even if it uses this construction method. [10]

STEEL STRUCTURE:

90% of the tower is made of manufactured block that are developed offsite. The block can simply be locked together and secured with high strength ribs and bolts. This provides adequate structure, increases the rate of construction, and simplifies the construction process. The flexibility of the spaces, strength of the structure, rate of construction ,and the accuracy and precision of each module can only be achieved by using steel elements.

SUSTAINABILITY :

According to the Architect of J57, Xian Min, in addition to significantly reducing the amount of concrete required and eliminating the dust on the construction site, this construction method is so energy efficient that it will save 12 000 metric tonnes of CO₂ emissions compared to conventional buildings with a similar function. Furthermore, another reason for which specifically selected was the fact that the majority of the steel from Differdange was derived from recycled scrap steel elements.

SPEED OF CONSTRUCTION

The structure of J57 is entirely made of steel and has no concrete core. As it was 90% prefabricated in the factory it was possible to erect 3 floors per day. In total, less than 19 days were necessary to erect the building, hosting 4 000 offices and 800 apartments. [10]

Building systems	Steel Solution	ArcelorMittal Solutions			Fire resistance
		Heavies	High strength steel	Finished beams	
Bracing	pre-fabricated steel frames	HISTAR®460		sprayed	
Columns				sprayed	
Floor solutions			modular construction	sprayed	



CONCLUSION:

The paper shows that high performance tall buildings are achievable by adopting the appropriate strategies. The future of the built environment depends on the methods and techniques used by engineers and architects to design sustainable, intelligent buildings. Although application of new technologies to tall buildings will improve our living conditions incrementally, humanism will define our future. The initial cost of integrated green tall buildings may be 5 to 10 percent higher than that of a conventional building, but the long-term lower operational cost makes it justifiable.

Steel proves to be relevant and beneficial to several construction verticals offering longevity of structure

lifespan. It is eco-friendly and recyclable. So for such obvious benefits, it has made its position stronger in the industry and has gained the mind share as well.

pre-engineered buildings are earthquake-resistant, offer more stability and safety during earthquakes as steel is ductile, and can take 18 times more deformation than concrete.

ACKNOWLEDGEMENT:

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Prof. Aprajita Kaushik for her valuable guidance, inspiration and encouragement. Her keen and indefatigable indulgence in this work helped me to reach an irreproachable destination.

REFERENCES:

- i. World Commission on Environment and Development (WCED). Our Common Future; Oxford University Press: Oxford, UK, 1987.
- ii. Merriam-Webster
<https://www.merriam-webster.com/dictionary/sustainable>
(accessed on 15 July 2017).
- iii. Kheir Al-Kodmany buildings-08-00007%20 5
January 2018
- iv. HEC Global Learning, What Is Sustainability?
<http://www.globalfootprints.org/sustainability>
(accessed on 15 July 2017).
- v. Pruetz, R Lasting Value'the Magazine of the American Planning Association, August/September 2012; pp. 32–38.
- vi. Krier, L The Architecture of Community; Island Press: Washington, DC, USA, 2009.
- vii. Mir Ali
overview-of-sustainable-design-factors-in-high-rise-buildings
University of Illinois at Urbana-Champaign, Paul Armstrong, University of Illinois at Urbana-Champaign, 2008.
- viii. Botir Giyasov , Irina Giyasova The Impact of High-Rise Buildings on the Living Environment , 2017.
- ix. Russian Standard SP 131.13330.2012
- x. ArcelorMittal Europe Long Product Sections and Merchant Bars High-rise buildings 2019
- xi.
<https://gosmartbricks.com/7-renowned-green-sustainable-buildings-india>

Understanding The Factors That Affect Human Satisfaction In Office Buildings

Authors:1. Poorva Joshi. Email – poorvapvj@gmail.com
2. Prof. Mahesh Bangad. Email – mahesh.bangad@bnca.ac.in
BNCA College Of Architecture, Pune

Abstract:

Since historical times, human beings have had a distinct trait to develop a hospitable and cosy indoor environment for appeasing peer humans. This research aims at understanding the user satisfaction in artificially and naturally ventilated office buildings by comparing them; thus, trying to provide practical information by reviewing various academic literatures and conducting questionnaire surveys. These surveys were conducted for office employees as well as doctors to understand the practical difference between the artificial and natural indoor environment and its physical and psychological impact, by understanding its thermal, physical and environmental comfort thus achieve a comprehensive related to occupants' health, satisfaction and well-being in office buildings.

Key words: user satisfaction, naturally ventilated, artificially ventilated, thermal comfort, physical comfort, environmental comfort

Introduction :

This research examines and compares the factors that affect user satisfaction in artificially ventilated office spaces and naturally ventilated offices spaces in and around Pune, India. Now-a-days artificially ventilated offices are extensively being used everywhere. Even when the natural weather and temperature conditions are moderate throughout the year in certain places/cities, it is seen that artificially ventilated office buildings/spaces are preferred. Even during the winter season some offices have the air conditioning system working throughout the day as they have fixed glass windows, thus consuming a lot of energy. The concept of working in a natural environment has various benefits but somehow this idea seems to be fading away.

If we date back to the Stone Age era, we see that man used to stay and work in the natural environment but with the enhancement in technology, comfort level and its criteria has changed and raised its bar. For being comfortable, human beings have found out various means and methods. The most important among all is thermal comfort. A person's mood, productivity and health are all dependent on the atmosphere around him/her. The atmosphere mainly depends on the temperature, wind speed, and light. Thus, as we can

artificially produce all the three factors in a definite space, human beings tend to make use of them.

But is an artificially ventilated office space really good for health and various other factors like productivity, comfort, etc will be further studied in this research. Similarly, a naturally ventilated office space will be studied by stating its pros and cons. Ultimately a conclusion will be drawn out from the inferences.

Material and Methodology:

Research Method:

Two offices were identified which are located at two different cities with the same climatic conditions. An artificially ventilated office was taken as the case study which is located in Pune, Maharashtra and a naturally ventilated office which is located in Sangli, Maharashtra. Both the offices are architecture firms. The survey form was filled from the staff members.

Total of three Survey forms were made and circulated. One was for the artificially ventilated office, the second was for the naturally ventilated office and the third was a generalized form for a mixed set of people to fill up and thus understand the opinion and views over a larger scale along with reason based responses.

Doctors' perspective over the topic was given due importance. Dr. Anjaneya P. Agashe – M.S.(Ophthal), D.O.M.S. Dip. N.B. is an ophthalmic surgeon practicing in Mumbai. Dr. Agashe consulted over the topic and the overall impact of artificial ventilation, natural ventilation and the lighting was compared by listing the pros and cons and taking into consideration very minute details. Thus, understanding the effect of work environment over physical and mental condition of a human being. As most of the offices have all the work over the digital screen, the first impact is to our eyes, hence consulted an Ophthalmic doctor.

Artificially ventilated office: Sprout Green, Pune

Total number of staff members working in the office everyday is 10-20. A Survey form was filled up from 10 staff members.

Main Questions asked for the survey were directed to the users interest in using a naturally ventilated office space, the need of artificial lights and the duration for which they are required and the user preference. Questions were also based on the temperature and humidity conditions inside the office and its impact on the user. Users were also asked about the flexibility in opening the windows and changing the temperature settings. The frequency at which

users feel like breathing fresh air, noise as an issue in the office and other things that they like or expect from their office space.

Naturally Ventilated Office: Studio 888, Sangli

Total number of staff members working in the office everyday is around 10-20. A Survey form was filled up from the staff members.

Main Questions asked for the survey focused the reason why they like or dislike working in an artificially ventilated office space, the requirement of artificial lights during the day and comfort level for the same, temperature and humidity fluctuation and its frequency followed by its comfort level and other generalized questions.

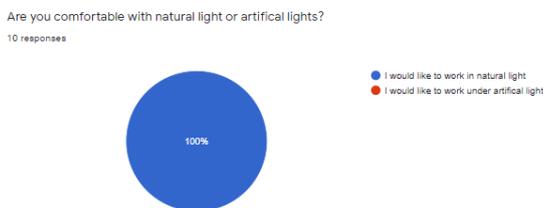
Generalized Form:

It contained similar questions with reasoning as stated above, thus, understanding people’s perspective towards the idea of an ideal work environment.

Results and Pie charts:

The mean ambient temperature at which a person feels most comfortable is considered as 21 degrees Celsius with indoor air velocities ranging from 0.3 to 0.9m/s under experimental conditions- Data from various research papers.

The inferences that were taken out after a long discussion with Dr,Agashe:



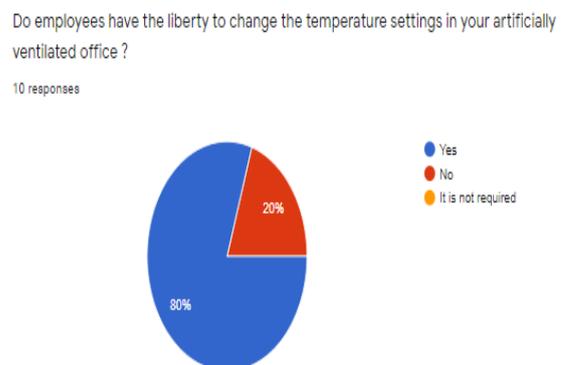
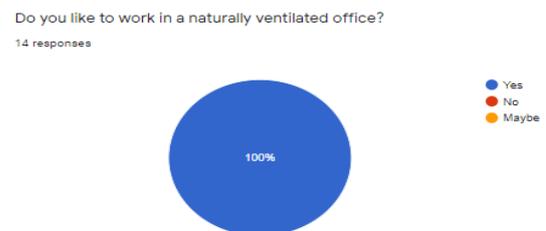
1. Natural ventilation should be implemented as and when required, but it also depends on the climate of the region. For a climate like Pune or Sangli, offices should try to convert themselves into naturally ventilated spaces, as a person works in the same space for long continuous hours, making the productivity low in the case of artificially ventilated offices.
2. Medically a person should change the focal length/ focus of the eyes at a farther distance after every one hour to twenty minutes of continuous work over the laptop/computer screen. In order to get an opportunity to look at a farther distance, the office should be as open as possible and a person sitting at any corner should be able to see outside. Use of indoor plants should be increased even in office spaces as plants have visual depth and each leaf has a different angle and reflects light over the retina

through multiple angles, thus soothing our eyes and brain. The monochromatic, subtle and solid office interiors can be enhanced by using indoor plants.

3. The factors such as dust and dirt coming into the office space should be controlled.
4. Airconditioned space makes constant air changes by filtering the same air again and again thus providing unhealthy conditions as compared to the naturally ventilated space wherein the same air is never repeated.
5. Natural ventilation may sometimes not suffice the needs of human beings as the comfortable temperature may vary from person to person. Just as a specific degree of temperature may be too cold or hot for two different individuals working in an artificially ventilated space as well.
6. Advantage of artificially ventilated spaces is that it keeps dust and dirt from coming into the office space, thus providing cleaner environment.
7. The sudden temperature change a person experiences after coming out from an artificially ventilated space to a natural/relatively warmer space may create a psychological impact if repeated over a long period of time with a high frequency.
8. Dryness of skin can also be a negative effect of artificially ventilated office spaces.
9. The height of the cubicles partition, the height of the ceiling, the colour scheme and the overall transparent interiors an office provides has a psychological impact on the user.

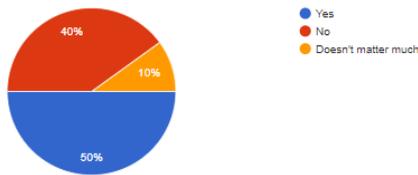
Inference from the survey – Artificially Ventilated Office

Age group – 50% were from 18 to 30, 40% from 31-40 and 10% from 51- 60. And the genders were 40% male and 60% female, with the total capacity being between 10-12 members.



Do you feel that noise is a problem in your office?

10 responses



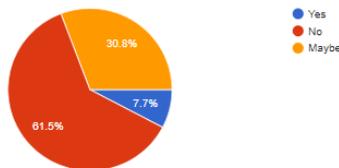
Is there a temperature and humidity fluctuation throughout the day?

13 responses



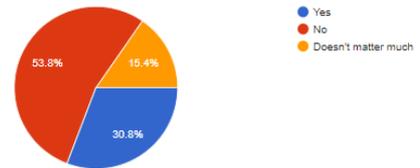
Would you like to work in an artificially ventilated office?

13 responses



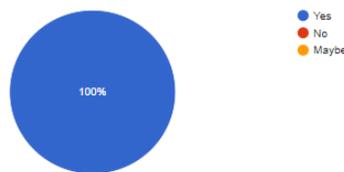
Are you comfortable with the constant change in temperature throughout the year?

13 responses



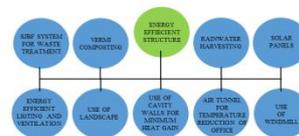
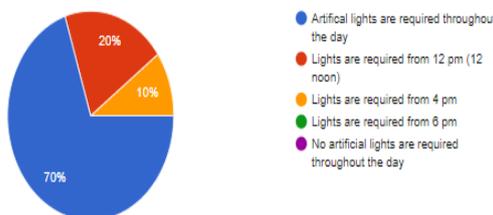
Would you like to work in a naturally ventilated office?

10 responses



Does your office need artificial lights to be used throughout the day?

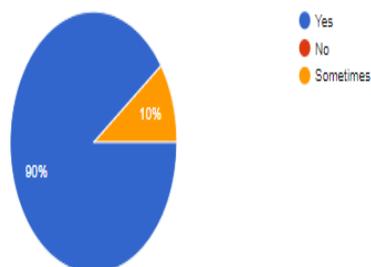
10 responses



The reasons given for being interested in working in a naturally ventilated office are, fresh air feels better whereas airconditioned offices are sometimes suffocating, for health reasons, for better productivity people prefer to stay in natural environment according to this survey. It is also said that air-conditioned space feels comfortable only for a specific period of time. However, comfort level provided by artificial ventilation may vary for different climate zones.

Do you feel like getting fresh air and come out of the air conditioned space, at least once in a day?

10 responses



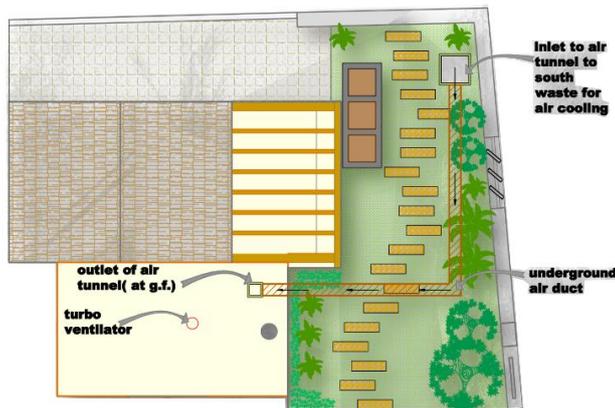
Inferences from the Survey - Naturally ventilated Office:

Age group was 85.7% from 18-30, 7.1% from 31- 40 and 51-60 each. The gender distribution was 64.3% male and 35.7% female. The number of people working in this office is 10-20. Total office area is 3200 sq.ft.



The reasons stated for the question of lights is that natural light is comfortable as compared to artificial light, as natural light is not strenuous to the eyes. Working in a naturally ventilated environment keeps us energetic for a longer period of time and work outcome increases as a person's body is not forced upon any external factors, are the inferences from the reasons given by the users.

PLAN SHOWING THE AIR TUNNEL AND SUPPORTING SYSTEM



Inferences from the Survey - Generalized survey form:

The inferences from this survey are similar to the above inferences. There were a total of 43 responses from people of varied age groups out of which 74.4% say that naturally ventilated offices are better than artificially ventilated offices with 9.3% denying this fact and 16.3% not being sure. People also experienced allergy problems, stuffiness, suffocation in artificially ventilated offices. Need for fresh air once or twice a day is very much essential is what was understood. There was no negative comment for naturally ventilated office spaces.

Conclusion:

A person spends at least eight working hours in the office. Thus, if an office needs artificial ventilation and artificial lighting throughout the day then the total amount of energy consumed by that specific space will be very high as compared to a perfectly designed, naturally ventilated office. The interiors with some natural/real plants will be beneficial for the users. From the inferences we can say that naturally lit and ventilated space throughout the day if designed properly by taking into consideration the various necessary factors is preferred by users. Thus, the conclusion drawn out is that the naturally ventilated offices in areas with moderate climatic conditions are better in terms of a person's physical as well as mental health, ultimately leading to higher amount of energy levels throughout the day.

Acknowledgement:

The authors would like to thank Ar. Namrata Dhamankar (Director of Sprout Green Architects, Pune) and Ar. Promod Chougule (Principal architect of Studio888, Sangli) for allowing to complete the case study in their own office. Special thanks to Dr. Anjaneya Agashe for a very insightful discussion over the topic through the medical perspective. Professor Mahesh Bangad for guiding me through the entire process. All the users who filled the Survey form and helped this research.

References:

Link for survey form for artificially ventilated office:

<https://forms.gle/oAG4cBMhw7ttTLs28>

Link for survey form for naturally ventilated office:

<https://forms.gle/THDupkpuYc4kFTGs9>

Link for generalized survey :

<https://forms.gle/q7VjcTg7p1CDmgzZ7>

i) *An International Comparison of User Satisfaction in Buildings from the Perspective of Facility Management*
https://in.search.yahoo.com/search?fr=mcafee&type=E211IN826G0&p=2007_international+comparison+of+user+satisfaction+case+study&_guc_consent_skip=1615197528

ii) *Evaluation of thermal comfort and occupant satisfaction in office buildings in hot and humid climate regions by means of field surveys*
<https://www.sciencedirect.com/science/article/pii/S1876610217322166>

iii) *Differences in Occupants' Satisfaction and Perceived Productivity in High- and Low-Performance Offices*
https://www.researchgate.net/publication/335509079_Differences_in_Occupants'_Satisfaction_and_Perceived_Productivity_in_High-_and_Low-Performance_Offices

iv) *Investigating the Indoor Environment Quality Parameters and Their Relationship with Occupants' Satisfaction in Office Buildings: A Review*
https://www.researchgate.net/publication/322243086_Investigating_the_In-door_Environment_Quality_Parameters_and_Their_Relationship_with_Occupants'_Satisfaction_in_Office_Buildings_A_Review

v) *Workplace Satisfaction and Thermal Comfort in Air Conditioned Office Buildings: Findings from a Summer Survey and Field Experiments in Iran (PDF) Workplace Satisfaction and Thermal Comfort in Air Conditioned Office Buildings: Findings from a Summer Survey and Field Experiments in Iran (researchgate.net)*

vi) *User-focused design factors of workspace for nearly zero energy office renovation: findings from literature review*
https://in.search.yahoo.com/search?fr=mcafee&type=E211IN826G0&p=User-focused+design+factors+of+workspace+for+nearly+zero+energy+office+renovation%3A+findings+from+literature+review&_guc_consent_skip=1615198539

vii) *Assessment of Air Velocity Preferences and Satisfaction for Naturally Ventilated Office Buildings in India*

https://www.researchgate.net/publication/270276440_Assessment_of_Air_Velocity_Preferences_and_Satisfaction_for_Naturally_Ventilated_Office_Buildings_in_India

viii) *Understanding User Satisfaction Evaluation in Low Occupancy Sustainable Workplaces*
<https://www.mdpi.com/2071-1050/9/10/1720>

ix) *The relationship between user satisfaction and sustainable building performance*
https://in.search.yahoo.com/search?fr=mcafee&type=E211IN826G0&p=The+relationship+between+user+satisfaction+and+sustainable+building+performance&_guc_consent_skip=1615198805

x) *User Satisfaction in Sustainable Office Buildings: A Preliminary Study*
https://www.researchgate.net/publication/228481786_User_satisfaction_in_sustainable_office_buildings_a_preliminary_study

xi) *Daylighting offices: A first step toward an analysis of photobiological effects for design practice purposes*

<https://www.sciencedirect.com/science/article/abs/pii/S036013231400002X>

xii) *Impact of building design and occupancy on office comfort and energy performance in different climates*

<https://www.sciencedirect.com/science/article/abs/pii/S0360132313002862>

xiii) *All the images are obtained with the due permission of the Principal Architect Promod Chougule of Studio888.*

Re-Thinking Urban Markets

An Amalgamation of Public Markets And Open Spaces

Prachi Mehta
Aditya College of Architecture
Email: m21prachi@gmail.com

Abstract: Public spaces are a reflection of what the city offers its citizens. Since ancient times market places have been functioning as the public gathering spaces as bazaar, neighbourhood chowks, or streets. However, over a period of time these markets (mandis) have become restrictive and monopolistic in character. The public spaces in India underwent a similar transition. Today urban cities like Mumbai are highly congested with extremely less open space available. It is necessary to create institutions for public to contribute and thus enrich the life of the citizens. This will eventually lead to the growth of public interactions and engagement.

Keyword: Public markets, public spaces, urban area, accessible, inclusive, public utility, integrated

Introduction:

The form and nature of the market places have been evolving since ancient times and continue to do so till today. Apart from selling and buying goods, markets became an important site for enacting social interactions. Throughout the years, the bazaars, with their own architectural and visual character played a critical role in integrating physical, social, and cultural layers.

However, over a period of time these markets (mandis) have become restrictive and monopolistic in character. The mandis which are now built are nothing but blocks or cubes of shops placed in an uninteresting manner, creating long and ceaseless corridors. There is an absence of spatial character, where a person could pause, take a break, or have a short chat with a friend or an acquaintance. It is monotonous and lacks visual and architectural character. The vibrant and lively environment of the bazaar is missing in these mandis.

Today urban cities like Mumbai are highly congested with extremely less open space available. The few open spaces which are available to the public are either not efficiently utilized or are open to the public only for specific time duration and are left unused or isolated for the rest of the day. In cities people do not have a quality amount of time for socializing as most of their day is either spent at their workplaces and travelling to and from their workplaces. Today the idea to go to a public space for the sake of social interaction seems dubious as some of our most vibrant public spaces are privately owned malls and corporate plazas. As the cities have grown exponentially due to rapid urbanization,

the number of open spaces available in the city has reduced substantially. Mumbai has only 1.24m² of open space available per person. This is too low as per the standards set by the URDPFI-Guidelines, which says 10-12% of open space per person is desirable.

Dynamic public spaces can encourage innovation, as people use space in creative and unintended ways. Public spaces are spaces of visibility with invisible boundaries and thus making citizens feel connected as members of the community. To adapt to the constantly changing and evolving nature of the cities, there is a need to overlap, merge, and combine multiple programs; hence integrating the character of the bazaar, the purpose of the mandi, and the necessity of the open spaces.

The amalgamation of public markets (mandis) and public open spaces will play a crucial role in the creation of improved, accessible, and inclusive spaces for trade and social gatherings and interactions among the varied socio-cultural population and thus enhance the quality of life. This will not only revive the socio-cultural aspects but will also lead to an increase in per capita open space available.

The research aims at an accessible inclusive built form, integrating public markets (mandis) and open spaces which will cater to the population of the urban areas and thus enhance the quality of life.

Materials and methodology

The market places evolved from small bazaars during the ancient time to port towns in the Medieval era. The infrastructural development during the British era led to the development of market towns which further regulated post-independence.

Of the 292 APMCs in Maharashtra for which data is available, only 286 APMCs have their own land, 273 have their administrative building. It is observed that 86 APMCs require godowns of varying capacities, 84 APMCs require covered auction platforms, 70 require internal roads/drainage, 250, 27 require drinking water facility and 201 require other facilities including electronic weighing, automatic grading and sorting machines, office building, canteen etc. as per division-wise details given in the following tables.

The public spaces transformed from Great Baths during ancient civilization to market squares and garden during

aristocracy. The Mughal rule brought in spatial planning and pavilions and the British introduced public gardens based on ratios. Urbanization changed the nature of public spaces in India.

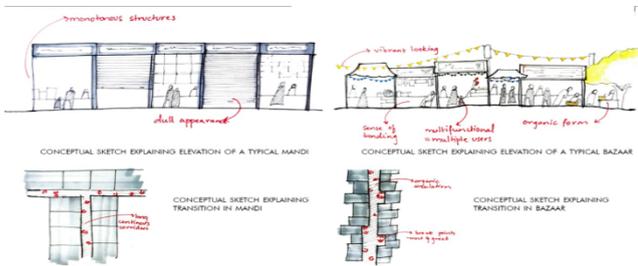


Figure 1: Sketches showing differences between a typical mandi and bazaar.

Source: Author

The World Health Organization (WHO) has set a minimum limit of nine m² of open space per capita in urban areas, the UN has pegged this figure at 30m², and the EU considers 26 m² of open space per capita as acceptable. In India, planning agencies follow the URDPFI guidelines, which suggests that 10-12 m² per person are desirable. Mumbai has 15.37 km² of accessible open space, providing free and fair entry to all citizens. However, many gardens, playgrounds and recreation grounds that are part of this open space are ill-maintained and have broken infrastructure. The inaccessible spaces, such as those occupied by private gymkhanas and closed playgrounds owned by private entities, add about 128.41 km² of open space for the city.

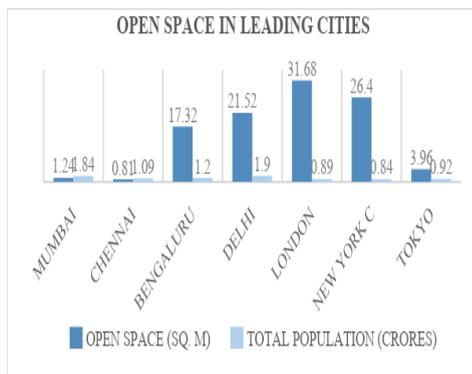


Figure 2: Open space per capita
Source: ORF



Figure 3: Salt Lake City Centre

Source: Charles Correa Foundation

After a thorough study on City Centre, Kolkata it can be observed that permeability and porosity play a vital role in the success of any public space. Incorporating the context and local elements also becomes important in creating a bond between the space and its users. The idea of the shops being more accessible to the buyers with lesser boundaries becomes an advantage for the owners or sellers.



Figure 4: Crawford Market

Source: Whatshot Mumbai

Studying the Crawford market, one of the oldest markets of Mumbai helps in understanding how a market becomes an important landmark of the city because it has a history attached to it. It also highlights how over the years the social aspect of it diminished and its physical condition deteriorated.



Figure 5: Mercat dels Enchants
Source: b720-Fermin Vázquez Arquitects

Nou Mercat del Enchats located in Barcelona is a modern take on traditional markets. It created a new market without compromising on the traditional aspects. The elements and features of the old street market were re-fabricated. The market blurs the distinct difference in levels and a continuous movement is created which thus creates an experience of street shopping within an interior environment.

Results and Tables:

Though the markets are accessible, they lack the basic amenities. Markets are considered to be important social spaces; however, the current market spaces lack quality spaces. As observed, the markets now, are devoid of the social characteristics that existed during ancient times. In addition to this, the current marketing institutions also lack the required infrastructure and amenities. They lack the architectural characteristics and are monotonous visually. The current markets are also not enough in numbers. Their infrastructure and condition minimize the inflow of people.

Further in urban areas, there is an acute shortage of open spaces. The open spaces in a majority of Indian cities have narrowed down to 'residual' spaces. The few spaces that exist as open spaces are restrictive and stagnant in nature. These 'public' spaces are accessible to the public only for a limited period of time during the day. People do wish for quality open spaces which are open and accessible to them for a longer duration of time. There is also a need for these spaces to permeable and the users can have the freedom to use the space with fewer restrictions. The kind of spaces created should be user friendly and create a comfortable and safe environment. In the absence of quality of open spaces, people sought unplanned spaces for social interaction. The problem of shortage of open spaces cannot be solved merely by creating parks. However, in addition to these issues, it is difficult to create new spaces as these cities have saturated the land to its full capacity. This emphasizes the idea of creating multi-functional spaces. The amalgamation of markets and public open spaces integrated with public utility spaces will open up the markets more to the citizens and also help in keeping the open spaces active and accessible throughout the day. Integration of multiple programmes will lead to social inclusion and optimum utilization of available spaces. Making the spaces multi-functional will not only help in solving the issue of space crunch but will also lead to more active, safer, vibrant and interactive spaces within the cities, thus adding to the quality of life of the citizens.

Conclusion:

Markets today lack social characteristics and there is an acute shortage of open spaces in urban areas, the amalgamation of markets and open spaces integrated with public utility spaces will open up markets to the citizens and will lead to social inclusion and optimum utilization of available spaces.

Acknowledgement

I would firstly like to thank my thesis guide and principal Ar. Prof. Rita Nayak for providing guidance for shaping the research. I am also grateful to my classmates, for their support and critique. Lastly, I am thankful to my family and friends for their encouragement and support.

References

- Maiti, C., 2000. Historical Evolution of a market place, Kolkata: s.n.*
- i. Research, D. o. E. A. a., 2018. STATUS OF MARKETING INFRASTRUCTURE UNDER ELECTRONIC NATIONAL AGRICULTURE MARKETS, Mumbai: National Bank for Agriculture and Rural Development.*
- ii. SHARMA, V., 2015. PERCEPTION OF URBAN PUBLIC SQUARES IN INDIA, Manipal: s.n.*
- iii. UDAS-MANKIKAR, S., 2020. Formulating Open-Space Policies for India's Cities: The case of Mumbai, Mumbai: ORF*
- iv. <http://saltlake.citycentremalls.in/the-mall.aspx>*
- v. <https://www.whatshot.in/mumbai/mumbais-crawford-market-is-getting-a-swanky-facelift-and-will-be-ready-by-2022-c-19214>*
- vi. <https://iescoaomnibus.wordpress.com/2017/06/30/a-study-of-crawford-market/>*
- <https://www.archdaily.com/453829/mercant-encants-b720-fermin-vazquez-arquitectos/529d442be8e44e0120000054-mercant-encants-b720-fermin-vazquez-arquitectos-photo>*
- <https://www.publicspace.org/works/-/project/h078-mercant-dels-encants>*
- i. <http://urbanresearchorganization.blogspot.com/2013/05/crawford-market.html>*

Studio Apartment As A Multifunctional Space

Author 1: Prachita Patil

Affiliation: Fo. Y. B. Arch. S.S.M.S.CoA

E- mail: prachitapatil16@gmail.com

Author 2: Prof. Shubhashree Upasani Affiliation: Assistant Prof. S.S.M.S.CoA

E-mail: sdupasani10@gmail.com

Abstract: A studio apartment is that type of housing typology which can accommodate 1 to 2 users, maximum of 3 and is well equipped with all the modern contemporary amenities. With the help of interior décor, transitional spaces, furniture units, etc a studio apartment can be transformed into a space that is not only comforting but also aesthetically pleasing as well as multifunctional. These apartments are pocket friendly where bachelors, couples can enjoy an open floor plate. The author studied a few case studies, analyzed the interior zoning, and made a list describing the observations for the same.

Keywords: multi functional space, functions, internal arrangement, zoning, transitional space, open floor plate

I. Introduction:

Shelter is one of the basic amenities a human being needs. A space that can accommodate up to a maximum of 1 to 2 users with all the modern contemporary facilities is called a Studio Apartment. Studio apartment is considered as one of the smallest housing typologies with an approximate ranging area of 40 to 50 sq. m. It consists of a single room which can further be divided into several zones depending on the activities and functions of the users. It is similar to the one room kitchen concept very commonly seen in slums or over crowded areas of our country. The only difference between the two is Studio Apartments are more luxurious and are made multifunctional with no permanent division between the spaces whereas One Room Kitchens have walls, partitions separating the spaces from one another. The transformation of a Studio Apartment into a multifunctional, compact, comfortable space can be made in several ways. Modular furniture is considered one of the best options in achieving that multifunctionality. Similarly, partitions, sliding, folding doors, collapsible décor items, etc can also be used. Interior layouts should be given at most priority in transforming the spaces of the apartment. The crucial or the critical part of designing studio apartments is the interior layouts, trying various permutation combinations for the same. The orientation, arrangement, zoning, etc becomes the deciding factor. The

concept of Studio Apartment has started enhancing and developing in our country with the recent changes that are happening around us. People have now started living small that is in small houses like condos with minimal requirements.

II. Methodology and materials:

A secondary survey was undertaken to study the features and characteristics of a studio apartment and their multifunctionality. Market surveys were carried out to study about modular furniture, hardware used for fixing, materials needed to build these interior items, etc. Case study method has been employed to find out various aspects of studio apartments and also studying the compact multifunctional quality. Analysis has been done on the basis of plans, forms, types of furniture, partitions, transitional spaces, lighting, etc. as well as various elements embodied as a part of contemporary architecture.

Four cases studies were studied online to get a hint of the space requirement, zoning done according to the functions or activities that would be carried out throughout the day. The study also focuses on the interior layout, various ways in which the furniture is used, how it divides the spaces, circulation, etc. The image given below are the case studies studied from various websites available on the internet (mentioned in figure 1). The study shows how such a small area is divided into several zones depending on the activities. Some zones are kept separate (Bedroom or the sleeping area and also the wet and dry area) to maintain privacy while the rest of them are merged (Living area and the Pantry) since these zones form the public zones of the house.

1. Spring apartments- United States of America: A small partition wall that acts as a barrier between the study/ office space and the living area. The study/ office area separates the two zones that is the public and the private zone creating a buffer kind of space between the two. Area= 24 sq. m.

2. Balaji Symphony- Mumbai: Activities are allotted spaces according to the zones. Living area, pantry, sleeping area and wet and dry area are provided separate zones depending on their functions. Area= 18.34 sq. m.
3. Multi Housing News- Boston: A small open balcony is attached to the living area gives an extra open space. Here the wet and dry area separates the living, pantry area from the sleeping area. Similarly the private zone is kept away from the public area/ zone. The interior planning is kept linear. A small sized pantry is provided. Area= 15.67 sq. m.
4. Yantram- United Kingdom: This studio apartment is slightly bigger than the previous studied apartment. It has a more spacious floor plate with a big balcony. The floor plate is kept open without providing any walls or interior partitions between the living and sleeping area. A television set creates a transition between the two zones. Area= 45 sq. m.



Figure 1



Figure 2

This piece of modular furniture (figure 2) is part of Spring Apartment. The furniture not only acts as a desk but also a bed, seating for 3 to 4 people and also can be transformed into a coffee table. With the help of telescopic tubes the bed can be pulled outside. Other hardware like nuts, bolts, hinges, etc are also used.

III. Results and Discussions:

Studio apartments can be made comfortable, multifunctional; transformative, etc if planned properly. Modular furniture not only helps in saving space, but also makes one think of creative ideas in planning interiors of such small spaces. When planning for a studio apartment the important point to be remembered is the interior designing, wisely usage of space, knowing which zones to be merged and which to be kept separate. Given below is distinguish between Studio Apartment and a Normal 1BHK Apartment: (figure 3).

POINT OF DIFFERENCE	STUDIO APARTMENT	1 BEDROOM HALL KITCHEN APARTMENT
AREA	40 to 50 sq.m.	60 to 65 sq.m
NUMBER OF USERS	1 to 2 (maximum 3 only if it's a child).	3 to 4.
INTERIOR LAYOUT	Mostly does not have any walls or partitions to separate spaces from one another.	Has proper rooms (kitchen, living, bedroom and wet and dry areas).
COSTING (India)	Range- 14 to 20 lakh.	Range- 35 to 50 lakh.

Studio apartments are spaces that have an open floor area which can be further divided into several spaces or zones

depending upon the function required to be followed. It can also be called as an example for compact spaces that fit together like a jigsaw puzzle and provide comfort at the same time. They help save space so that is multi functions can be carried out using a single piece of furniture. Studio apartments are much cheaper compared to a fully fledged apartment with multiple rooms. They are pocket friendly for students, people with low income group as well as people who want a minimalist lifestyle.



Figure 3

IV.Conclusion:

Studio apartments can be used as multi- functionally making the space feel comfortable. This typology is one of the best options for bachelors. These apartments let one socialize since every piece of furniture can be used in multiple ways. These apartments are pocket friendly.

V.Acknowledgement:

I cannot express my enough thanks to my very supportive faculty Prof. Shubhashree Upasani and Prof. Anuradha Joshi for their constant support and encouragement. I offer my sincere appreciation for the learning opportunities bestowed on me by my faculty.

Reference:

- i.(N.d.). Retrieved from https://www.hettich.com/fileadmin/content/mediathek/ffa08_g01_en.pdf
- ii.Google images. (n.d.). Retrieved from <https://www.google.co.in/search?q=studio+apartment&tbm=isch>

[ved=2ahukewiptnb8vpzvahv3n0sfhsduotyq2-cccgqiaabaa&og=studio+apartment&gs_lcp=cgnpbwcqazieccmqj](https://www.home-designing.com/2014/06/studio-apartment-floor-plans)

- iii.Home designing. (n.d.). Retrieved from <http://www.home-designing.com/2014/06/studio-apartment-floor-plans>.
- iv.Mansuri, I. E. (2020). *Studio apartments: a modern trend in building planning. Trends and challenges of civil engineering in today's transforming world*, (p. 9).
- v.Onay, b. G. (2019). *Flexible and modular furniture design for changing living environments.*, (p. 15). Istanbul.
- vi.Özkaynak, m. U. (n.d.). *The emergence of studio apartment*.
- vii.Spring apartments. (n.d.). Retrieved from <https://www.apartments.com/202-spring-st-new-york-ny-unit-2fl/8k0vpn3/>
- viii.Wikipedia. (n.d.). Retrieved from https://en.wikipedia.org/wiki/studio_apartment.
- ix.Xie, y. (2016, may). Retrieved from chinese bench : a research on multi-function furniture design : <https://ir.uiowa.edu/cgi/viewcontent.cgi?article=6571&context=etd>
- x.Yu, g. (2019). *Research on innovative application of modular design in university student apartment furniture. : materials science and engineering*, (p. 8). Changshu.

Reduction of Carbon Footprint By Planning A New Settlement With Sustainable Materials

Author 1: Pradnya J. Bhokare. Email id: pradnyabhokare17@gmail.com

Author 2: Professor Amit Shirke.

Dr. D.Y Patil School of Architecture,Lohegaon.2020-2022

Abstract:

The extraction of huge extents of materials is been very common, in building projects. Construction of new buildings by extraction of materials leads to consuming embodied energy (EE) and it releases carbon dioxide (CO₂) in large amount which is hazardous for the environment. Materials like cement and steel have been proven to emit high percentage of CO₂, so what if by replacing such materials and bringing sustainable materials like mud blocks , fly ash or slag, etc which can reduce CO₂ emissions to some extent. Looking at this situation, we should ask to ourselves is there really a need to always locate in the core of the city, what if we plan a settlement away from the main city area? Can't we develop a new town where residential structures up to two storeys can be built with such materials which emit low carbon emissions? This will help in reducing the carbon emissions at a mega level. Thus, we can create a module which is sustainable and can be repeated in different areas according to the need. Decentralisation is appropriate vision for planning and is also the tool to control carbon emissions, so by using these sustainable materials we can plan a new settlement which will benefit us in reducing the carbon emissions at higher percentage.

Keywords: Embodied energy, carbon dioxide, local materials, Decentralisation.

Introduction

Sustainability is “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

This guide provides information that will not only increase the community's sustainability, but also help to mitigate the adverse impacts of climate change. The world's main construction materials are cement and bricks which, are produced in all countries because of their geographic profusion. The manufacturing of cement emits CO₂ from the combustion of fossil fuel(coal) and also due to the use of electricity which involves the burning of coal.

Buildings are responsible for a large amount of energy consumptions and environmental emissions throughout its life

cycle. However, majority of the research focus has been on material selection and constructing a small settlement with low carbon emitting materials to minimise emissions from buildings. Promoting the development and use of the low embodied carbon building material and services, the energy efficiency of construction machines, as well as the renewable energy use are identified as three main pivotal opportunities to reduce the carbon emissions of the construction sector. (Huang, L.; Krigsvoll, G.; Johansen, F.; Liu, Y.; Zhang January 2018).

Cities are the major contributors to carbon emissions and therefore are at the forefront of achieving tangible reductions. Tools that quantify emissions in cities are required to provide the baseline knowledge to allow coherent future planning targeted towards low carbon footprint.

Methodology

It is noted that most of the energy rating tools have given importance towards selection of greener/sustainable materials and utilisation of energy efficiency methods to enhance the building occupancy conditions with less emphasis on construction stage emissions and impacts. Understanding the complete building process is very important in justifying CO₂ emissions. These processes include extraction, manufacturing, transportation, construction, maintenance, and disposal. Wide ranges of material are utilized in buildings that use energy and release CO₂ through its life cycle, which is regarded as embodied energy and embodied carbon. As part of mitigation measures, assessment of embodied carbon of building materials is one of the fundamental approaches that can have a positive impact on carbon footprint. The selection of appropriate sustainable building materials can reduce about 30% of embodied CO₂ emissions over a lifespan of the building.

(Khozema A; Mardiana A; Yusri Y,2020)

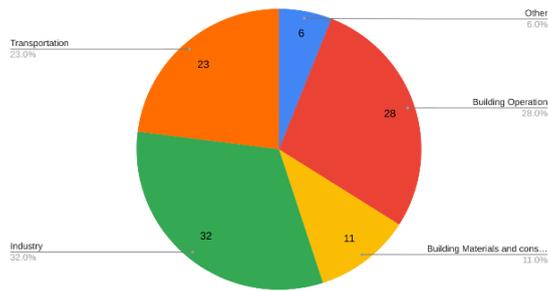


Figure 1. Global CO2 emission by sectors

Adopting low carbon technology

Low carbon technology is one of the technical strategies that can be adopted in buildings to reduce carbon dioxide emissions. Low carbon technology refers to the technology that has a minimal output of GHG emissions into the environment, specifically for CO₂ emissions. Examples of renewable and sustainable energy technologies are evaporative cooling, passive ventilation and cooling, solar photovoltaic, dehumidification, and energy recovery systems.

Urban areas are often particularly vulnerable to a range of climate change impacts. The built environment involves the large quantities of material and energy consumption. For example, the buildings sector consumes about 40% of primary energy utilization. Effective carbon reduction in the built environment relies on a combination of planning, design, construction and use. If designed, constructed and operated using a complete system approach, new buildings offer the largest potential savings in energy use (75% or higher). (Alhorr, Y.; Eliskandarani, E.; Elsarrag, E,2014.)

Energy efficiency improvement

Improvement of energy efficiency reduces the emissions of CO₂ from fuel and electricity uses which can be attained by using more energy-efficient equipment and by improving fuel efficiency. In general, the dry process is more energy-efficient than the wet process. The main opportunities in the kiln are the conversion to more energy-efficient process variants (e.g., from a wet process to a dry process with preheaters), improvement of preheating efficiency, improved burners as well as process control and management systems. Electricity use can be reduced through improved grinding systems, high-efficiency classifiers, and process control systems. Replacing high-carbon fuels with low-carbon fuels. One option for lowering CO₂ emissions is to reduce the carbon content of the fuel, e.g., shifting from coal to natural gas. An

important opportunity to reduce the long-eyelet carbon emission is the application of waste-derived alternative fuels. This could at the same time diminish the disposal of waste material and reduce the use of fossil fuels. Alternative fuels may be gaseous (e.g., landfill gas), liquid (e.g., halogen-free spent solvents distillation residues, waste oils), or solid (e.g., waste wood, dried sewage sludge). Waste may reduce CO emissions by 0.1-0.5 kg/kg of cement produced compared with current production techniques using fossil fuels. (Luo, Z.; Yang, L.; Liu, J.; Han, B, 2011)

Planning of landuse

Land use planning is a critical element in developing vibrant and liveable communities, increasing property values, ensuring economic vitality, addressing potential human health issues, promoting transportation efficiency, ensuring affordable housing, and improving environmental sustainability. Compact, efficient urban development improves the health and quality-of-life of area residents, revitalizes the local economy and increases environmental sustainability. Development of compact areas, even in small downtown areas, can reduce travel times, help preserve open space and reduce the commercial pressure to sprawl. Neighbourhoods with walkable areas stimulate a strong sense of place, encourage a healthier environment where individuals get more daily activity and breathe cleaner air and enhance an area's overall liveability, while encouraging the development of strong, vibrant communities with a reduced carbon footprint. Open green spaces not only contribute to emissions absorption and cleaner air but also promote recreational activity. (Luo, Z.; Yang, L.; Liu, J.; Han, B, 2011)

Best practices and solutions

Smart growth principles can be applied to a range of critical planning issues including community quality of life, urban design, economic development, environmental issues, human health, affordable and accessible housing, and transportation. Smart growth principles usually encompass the following:

- A range of housing choices and price points based around compact, walkable neighbourhoods.
- Mixed land use in the form of combined retail and residential development.
- Community and stakeholder collaboration in development decisions.
- Support for distinctive, attractive communities with a strong sense of place.

- Predictable development decisions that are fair and cost effective.
- Preservation of open space, farmland, natural beauty and critical environmental areas.
- A variety of transportation choices.
- Development directed towards existing communities and transportation corridors
- Compact building design.
- Appropriate remediation and redevelopment of brownfields.
- Formal parks and plazas in proximity to residential areas.

(Environmental Protection Agency, Planning for a sustainable future,2009).

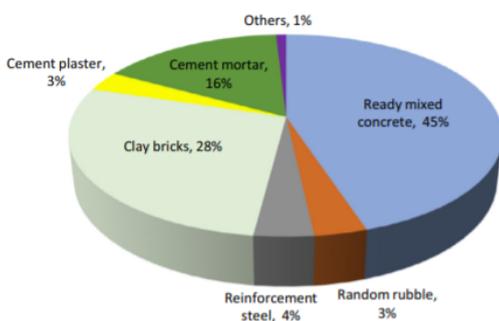
Understanding GHG emissions

Environmental protection agency promotes materials management approaches that serve human needs by using and reusing resources productively and sustainably throughout their life cycles, minimizing both the amount of materials involved and the associated environmental impacts. Land management refers to how we manage and use land to provide open space and habitat, food, natural resources, and places for people to live, work, and recreate.

Additionally, unlike many GHG mitigation options, materials and land management are heavily influenced by states and communities.

(Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices,2009)

Materials



Materials management seeks the most productive use of resources and focuses broadly on impacts and policies relating to all of the stages of material flow. By considering the impacts throughout the entire life cycle, materials management works to reduce environmental impacts, both (1) directly at each stage and (2) indirectly at multiple stages by reducing the amounts of materials used, and thus reducing system-wide environmental impacts, including GHG emissions. Through materials management approaches, the same level of service can be provided while substantially reducing GHG emissions. Some of the materials are mentioned below:

Cement

As a result of energy consumption, the building sector contributes as much as one third of greenhouse gas emissions, primarily through the use of fossil fuels during their operational phase, both in developed and developing countries. 14% non-energy use CO₂ emission is mainly owe to the cement production. Cement production is an energy and carbon-intensive process, due to the calcination of limestone and the combustion of fuels. Strategies and potentials toward CO₂ emissions reduction in cement plant include energy saving, carbon separation, as well as utilizing alternative materials. **(Environmental Protection Agency, Planning for a sustainable future,2009).**

Blended cements

In blended cement, a portion of the clinker is replaced with industrial by-products, such as coal fly ash, blast furnace slag, or other pozzolanic materials. These products are blended with the ground clinker to produce a homogenous product: blended cement. Blended cement has different properties than Portland cement, e.g., setting takes longer but ultimate strength is higher. The global potential for CO₂ emission reduction through producing blended cement is estimated to be at least 5% of total CO₂ emissions from cement making (56 Mt of CO₂) but may be as high as 20%. The potential emission reduction varied between 0% and 29%. The average emission reduction for all countries (producing 35% of world cement in the reference year 1990) was estimated at 22.

Fly ash

The climate-friendly fly ash brick technology produces bricks without using coal. It has the potential to eliminate carbon emissions from India's large brick-making industry, which burns huge amounts of coal and emits millions of tons of carbon dioxide each year. A further advantage is that fly ash bricks can be produced in a variety of strengths and sizes. This means that apart from their conventional use in building walls etc. fly ash bricks can also be used for the construction

of a variety of infrastructure projects such as roads and pavements, dams and bridges.

(Ashraful I;Tohidul M;2014)

Co2 emissions of a typical building

As brick and cement are the two main materials of construction sector; therefore here are the CO2 emission of them in a typical building.	Amount(ft)	Total item in no of bricks	Equivalent Co2 emission (50 tons per Lakh of bricks)
Item			
Brick	1730	207060	10.38 tons

Item	Amount(ft)	Total item in no of bricks.	Equivalent Co2 emission (50 tons per Lakh of bricks)
Cement	251	10040	8032 Kg

(C.A. Hendriks et al,2004)

1. Fly ash brick is also eco-friendly as it reduces CO₂emission too much. Our typical building plan is too small, if we think for a huge amount of project then it will be so cleared about cost and CO₂emission.
2. In case of cement production as a fuel coal is very important which emits CO₂. We have tried to review some processes for the reduction of CO₂ emission in cement production.
3. For modified ventilation we have discussed about the sensor idea .It may be seemed that it will reduce few amount of power but if we think about lot of houses even for a country or even for lots of

countries that it will be understood how much amount we are saving.

4. We have reviewed the natural method and Building orientation arrangement for ventilation system which are better for making comfortable temperature in room. These processes also help to reduce the use of electricity which emits CO₂in its production due to burning of coal, so ultimately we can reduce cost and CO₂emission.

Scope and limitations

1. Only the materials used for structure, envelope and finishes of the building were considered for the study and temporary works such as formwork, external works and materials and components for building services were excluded.
2. Study is mainly focussed on materials used in the residential sector.

Conclusion

1. Fly ash brick is also eco-friendly.
2. In case of cement production as a fuel coal is so important and which emits CO₂, We have tried to review some processes for the reduction of CO₂ emission in cement production.
3. In terms of the total mass, ready-mixed concrete, fly ash bricks and cement mortar were found to be significant among all materials.
4. To reduce embodied carbon content of buildings, special attention should be paid to two types of materials; materials used in mass quantities and materials with high carbon intensities.

Acknowledgement

This study is gratefully acknowledged by Prof. Amit Shirke, who contributed his noteworthy teachings which helped to complete the research paper successfully.

References

i) Huang, L.; Krigsvoll, G.; Johansen, F.; Liu, Y.; Zhang, X. Carbon emission of global construction sector. *Renew. Sustain. Energy Rev.* 2018, 81, 1906–1916. Retrieved from: <https://doi.org/10.1016/j.rser.2017.06.001>.

ii) Khozem A; Mardiana A; and Yusri Y; September 2020. *Issues, Impacts, and Mitigations of Carbon Dioxide Emissions in the Building Sector*. Retrieved from: <https://www.mdpi.com/2071-1050/12/18/7427/pdf>



iii) Alhorr, Y.; Eliskandarani, E.; Elsarrag, E. *Approaches to reducing carbon dioxide emissions in the built environment: Low carbon cities. Int. J. Sustain. Built Environ.* 2014, 3, 167

178. Retrieved from: <https://doi.org/10.1016/j.ijse.2014.11.003>

iv) Luo, Z.; Yang, L.; Liu, J.; Han, B. *Research on CO2 Emission Calculation Method and CO2 Reduction Strategies of Building Materials. Build. Sci.* 2011, 27, 1-8. Retrieved from: <https://www.mdpi.com/2071-1050/12/18/7427/pdf>

v) (Ashraf ul I; Tohidul M. *Reduction of energy consumption, co2 emission & construction cost of a model building, 2014* Retrieved from: https://www.researchgate.net/publication/308398895_REDUCTION_OF_ENERGY_CONSUMPTION_CO2_EMISSION_CONSTRUCTION_COST_OF_A_MODEL_BUILDING.

Waterworks And Hydraulic System In Mughal Gardens, India.

Author – Pradnya Jitendra Mahajan

Sinhgad College Of Architecture Vadgaon Bk , Pune.

Email ID – pradnyamhjn01@gmail.com

Abstract - Mughal gardens are a group of gardens built by Mughal Emperors in Islamic style of architecture which was influenced by Persian gardens. Significantly rectilinear designs were followed within the walled structure. The beauty of Babur's Charbagh was the central watercourse and their flowing waters. The purpose of the garden was to enhance the sense of luxury with scenic beauty such as the special garden for the king as their rest places. And, today these gardens are acting as best peaceful places for tourists. The main focus in the research is directed towards the study and emphasizing on working of water channels in Mughal gardens. Research illustrates the design consideration of both aesthetical and functional for the derivation of the form of channels, and to identify the origin of water supply to the Mughal garden with various climatic conditions. This research is based on the study of Mughal gardens, especially in the Indian context of the various regions with different climatic conditions. Through these case studies the research study reflects the main elements of Mughal gardens include running water channel. This research is conducted to study the working of water channels and the aesthetic water features in Mughal gardens. And it will be helpful For all these hydraulic works a high level water management is needed. Mughal garden is designed not to be seen itself but to give shape to the falling water. Thus, the water played most important role in the Mughal gardens.

Key words - Mughal gardens , charbagh , water channels , hydraulic system , Persian wheel , symbolism

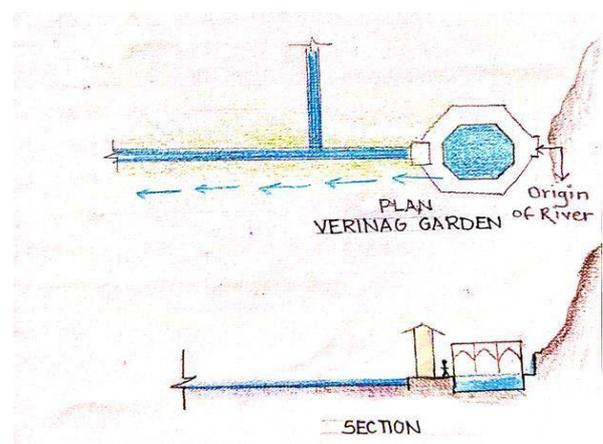
Introduction

These gardens are structured in the formal Charbagh design model on the Islamic version of Paradise. This was introduced in South Asia by the Mughal Emperor Babur. Then he brought the Persian wheel water supply system to create the gardens as the Indian plains were different from his homeland where the natural flow of water was used. Most of the Mughal gardens are divided into four parts known as the Charbagh concept. The waterworks inside the Mughal gardens were based on 'symbols and its concept of "Symbolism"'. And also the Hydraulic system which can be define on the basis of Adequate pressure on the fountains was applied through hydraulic pressure created by the movement of Persian wheels or water-chutes (chaadar) through terra-cotta pipes, or natural gravitational flow on terraces. The Persian wheel is a mechanical water lifting device. It is a partly submerged vertical wheel with buckets attached to its rim which is itself attached by a shaft to a horizontal wheel turned mechanically. The main features of Mughal garden were fourfold rectangular or square ground usually walled with intersecting water channels which makes cross lined with walkways , a tank is often one in the middle, well or wells subdivided to create the same module on different scale depending on the enclosed. Usually where the water channels intersect there could be either a water tank or pool or fountain or a chabutra. Basically, a water channel is a narrow straight or curved

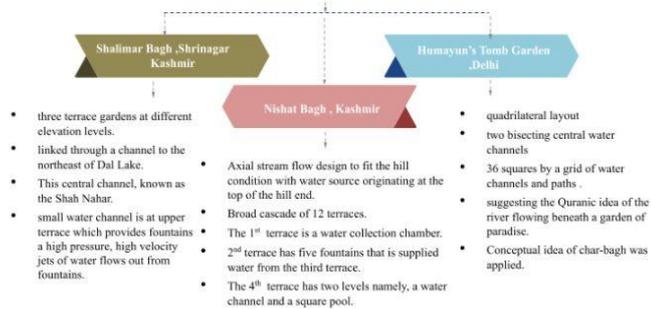
waterway between two landmasses or water bodies. These are manmade water bodies within the garden and complex. At the heart of the design is the idea that the bagh should be alive with the continuous flow of water whose primary purpose is to irrigate the garden and improve the aesthetics of the garden. These gardens were divided into four quadrants by two axes comprised with water channels and pathways to carry the water under gravitational pressure. Thus the Research will be limited to the study of water channels as an important element in the Mughal garden main source of water was well, tank and mainly the large river they developed hydraulic system by using Persian wheel to lift the water and obtained adequate pressure necessary for Mughal garden. Case studies will explain about the hydraulic system and origins of water supply and management of the water channels.

Material and Methodology

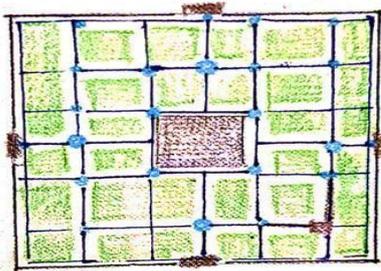
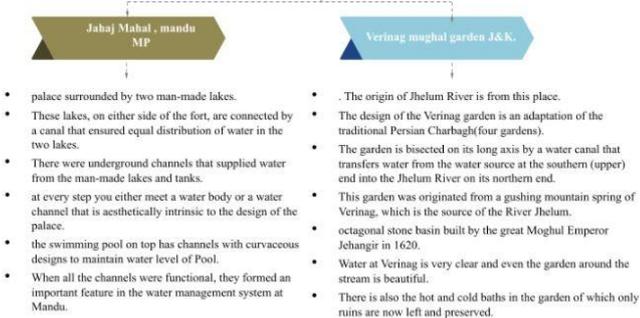
1. Understanding the concept of water channels as a feature of Mughal garden and emphasize on its functionality and purpose of water channels.
2. Documenting the designs of water channels.
3. Study the functions of waterworks with its relationship with the monument or building complex with respect to drawings and master plans.
4. Study of main sources such as wells, tanks, springs, etc.
5. Examine current condition of water channels through case studies.



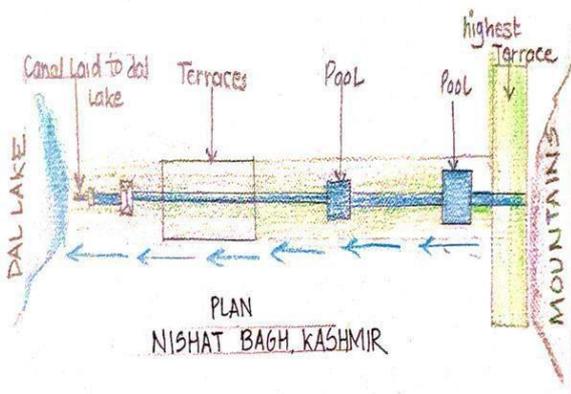
CASE STUDIES
(Focusing on water channels)



CASE STUDIES
(Focusing on water channels)



PLAN
HUMAYUN TOMB
GARDEN



PLAN
NISHAT BAGH, KASHMIR

Central water channel - Verinag Mughal Garden Humayuns
Tomb Garden-Water Channel Network Water Channel Thorough Terraces :
Nishat Bagh

Parameters	Case Study 1 Shalimar Bagh	Case Study 2 Nishat Bagh	Case Study 3 Humayun's Tomb Garden	Case Study 4 Jahaj Mahal, Mandu	Case Study 5 Verinag Mughal Garden
Planning grid	small water channel is at upper terrace which provides fountains a high pressure, high velocity jets of water flows out from fountains.	axial stream flow design Chahar bagh concept.	quadrilateral layout two bisecting central water channels	Palace itself comprises of water channels on 2 floors.	The design of the Verinag garden is an adaptation of the traditional Persian Charbagh(four gardens).
Functionality and working	small water channel is at upper terrace which provides fountains a high pressure, high velocity jets of water flows out from fountains	The 1 st terrace is a water collection chamber. 2 nd terrace has five fountains that is supplied water from the third terrace. The 4 th terrace has two levels namely, a water channel and a square pool	Central water channels running within quadrilateral layout.	There were underground channels that supplied water from the man-made lakes and tanks.	Canal running east-west intersects the main water canal at its southern end. The entrances to the garden lie at both ends of this east-west canal
Terrace garden/levels	Three terrace gardens at different elevation levels.	broad cascade of 12 terraces.	---	---	---
Climate	Below moderate (fairly cold in January)	Below moderate (fairly cold in January)	Warm and humid	Hot and warm	Below moderate (fairly cold in January)
topography	Semi mountain	terraced Mughal garden facing dal lake	Average elevation: 211 m	Standing in a narrow strip of Land between the waters of the Munja and Kapur lakes	steep hillside, with its water source at the top.
Flora fauna	The periphery is marked by giant chinars. he Persian lilacs are still a huge tourist draw in summers & cherry tree	English public park style with lawns and bedding plants Chinar trees imported by Mughals from Persia Cypress trees	Periphery: Mango and Neem. Over 300 plants of lemon and orange & floral plants	Evergreen gardens and grass lands with seasonal trees.	Pine trees and evergreen plants such as big size rose plants, old chinar trees.

III. Results and Tables
• **Parameters for study**

Existing and current situation

Case study	Past era / Existing situation	Current situation
Case Study 1 Shalimar Bagh	He Shalimar Garden in Srinagar is considered to be the finest Mughal-style hill garden and was made by the Mughal Emperor Jahangir in 1619 for his beloved wife, Nurjahan. It was built not merely as garden but also served as the summer residence of the Mughals.	A serene Mughal era gets revived with every visit to Shalimar garden as it changes its atmosphere in every season. Water bodies are running well all the time.
Case Study 2 Nishat Bagh	Is a terraced Mughal garden built on the eastern side of the Dal Lake, from the ancient times water got supplied to the garden by Persian wheel technique throughout all the terraces?	in winter time, the fountain gets dry but well maintained with water supply system.
Case Study 3 Humayun's Tomb Garden	In the Mughal era, garden was well maintained but in middle age it got neglected and In 2003, much of the complex and gardens were restored, with the historic fountains running once again after several centuries of disuse.	The whole complex is currently run and maintained by the Archaeological Survey of India (ASI)
Case Study 4 Jahaj Mahal , Mandu	Palace was famous for their water storage and supply techniques. With The water filtering system and rain water collecting system. There is a Turkish spa place which is the hamam for women residing there.	This fort is well maintained by ASI, but the water bodies are not maintained in that way pools and water bodies are surviving without water. Currently some water bodies have been converted to green lawns.
Case Study 5 Verinag Mughal Garden	Spring that gives birth to Jhelum river got originated from this place. the original shape of this spring was in the circular form of a kund. In 1620, the Emperor Jahangir had the shape changed into the traditional Mughal octagonal.	Pool of the deepest turquoise and surrounded by an octagonal stone basin still well maintain with its blue colour. This spring is known to never dry up or overflow.

IV. Conclusion

Like Persian and Central Asian gardens water became the central and connecting theme of the Mughal gardens. The main reason behind the location of gardens on the bank of river was that water was raised to the level of the enclosure wall by Persian Wheel standing on the bank from where it was conducted through aqueduct, to the garden where it ran from the top of the wall in a terra-cotta pipe which also produced adequate pressure needed to work the fountains. This research

reflects the values of the ancient beauty of gardens and tends to preserve and maintain this cultural landscape.

V. Acknowledgement

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Dr. Priyamvada Chitale and Ar. Kavita Patil for her valuable guidance, inspiration and encouragement. Her indulgence in this work helped me to reach an irreproachable destination.

References

- i. *Water management systems used in Mandu Jahaj Mahal palace.*
<https://www.inditales.com/ancient-water-management-system-at-mandu/>
- ii. *Water management systems and strategies*
<https://www.downtoearth.org.in/coverage/a-water-harvest-19169>
- iii. *UNESCO : Mughal garden sites , topography*
<https://whc.unesco.org/en/tentativelists/5580/>
- iv. *Water heritage at mandu and their management*
<https://blogvirasatehind.wordpress.com/2017/10/10/mandus-water-heritage-an-epicurean-delight/>
<https://whc.unesco.org/en/tentativelists/5580/>
- v. *Shalimar Mughal garden : water channels and features*
<https://srinagar.nic.in/tourist-place/shalimar-garden/>
- vi. *Nishat bagh :topography and water channel origin*
<https://www.jktdc.co.in/nishat-garden.aspx>
- vii. *Research paper : Mughal gardens*
<https://www.jstor.org/stable/44156328>
- viii. *Nishat bagh* https://www.gardenvisit.com/gardens/nishat_bagh
- ix. *Humayuns tomb garden : water circulation and systems*
<https://travelmelodies.com/humayuns-tomb-in-delhi-india/>

Use of Maratha Architectural elements in the streetscapes of Pune: case of Bajirao road from Abhinav chowk to Appa Balwant chowk.

Author 1: Prajakta Suhas Hulyalkar,

Fourth Year, B.Arch.

Email: prajaktahulyalkar@gmail.com

Author 2: Ar. Shubhashree Upasni

Assistant and professor at S.S.M.S.C.o.A.

Email: sdupasani10@gmail.com

ABSTRACT: *The essence of the Maratha empire is alive because of the structures built under their reign. Maratha architecture is wrapped in the elements of their structures that display beauty and style. Pune was one of the important cities back then and in present times too. In modern times urbanization in Pune is growing and making it a livable city, but on another side, it disregarding urban heritage. This paper studies the elements of Maratha architecture and uses these elements in the streets of Pune to create a linkage between historical and contemporary structures and elevate the elevations of the streetscape of Pune.*

KEYWORDS: Maratha architectural elements, contemporary streetscape of Pune, urban development and commercialization

INTRODUCTION

Maratha Architecture reflects the pride, culture, traditions and the turbulent history of Marathas. During this period 'Maratha Architecture' also had started taking shape. Initially, Maratha architecture had a great impact of Islamic and Gujrati elements on it e.g., forts erected like Daulatabad, Torna, the palace-fortress like Lal mahal, etc. one can easily find out the elements used in these structures like carvings, the style of carved column heads, style of arches. Later on, in the Peshwa period, it started contributing to the field of art and styles in their reign, Tanjore city is one of the best examples of it. The elements like Doors, Mahirapi arch windows, wall niches (devali), column head carvings started giving recognition to the Maratha architecture.

Maratha empire had various city centers in their vast empire. During the Peshwa period, Pune was the capital city of the Maratha empire. In the contemporary period, Pune is known as the cultural capital of Maharashtra and also as a fast-developing city. Contemporary Pune city is full of opportunities in almost every field which invites the crowd towards the city. With the crowd, it invites a lot of commercialization and materialistic view. This is adversely

affecting on heritage and culture of Pune and its streetscapes causing the loss of its traditional identity. The area chosen is one of the busiest and oldest roads of Pune 'Bajirao Road' located at the heart of the city area.

MATERIAL AND METHODOLOGY

Various surveys were undertaken, to study the features and characteristics of contemporary Bajirao Road. Primary and secondary data collection and study method has been employed to find out various aspects of Maratha architectural elements. Primary surveys and interaction with users helped to analyze the issue.

This paper is study of such busy and commercialized street in Pune. Bajirao road is very busy and most visited street in Pune. Also, the street has urban heritage of various time periods. The paper focuses on the issues of this urban heritage, impacting on the streetscapes of Pune. Bajirao road connects various sub roads as well as main roads like, Laxmi road, Kelkar road etc. Bajirao road have various structures from history.

DATA ACQUISITION

Elements used in Maratha architecture:

Wall Niches:

Wall niches is the 18th century feature. It was made to put candles/Diya's inside them as they protect the light from wind. (Fig.3)

Brackets:

The brackets are the end details done on the beam. These details were either depending the family and heritage or were influenced by the Asian designs of dragons and lotus. (Fig.1)

Windows:

The windows were of two kinds: half windows and full window. Half windows had four opening panels two above and two below depending on the weather and purpose the window panels were opened. The full windows were designed with carvings and had two panels. (Fig.5)

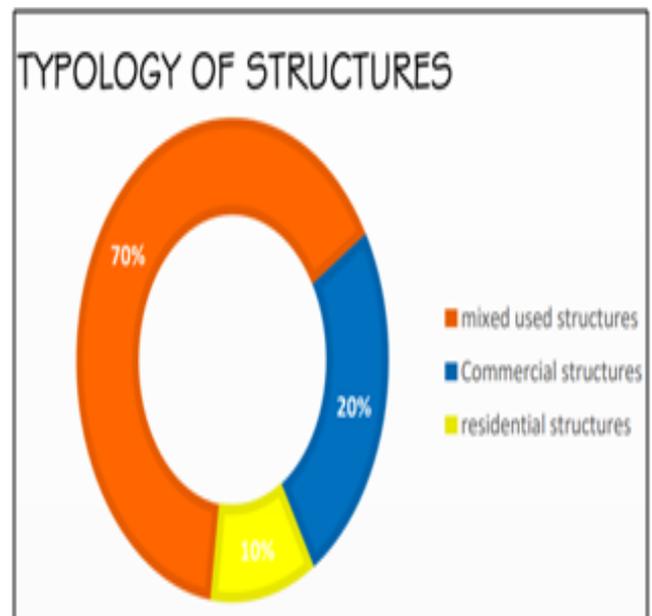
Doors:

Different types of doors depict the wealth and the social status of the owner. The more decorated the door is the wealthier the family while the simple doors belonged to middle class family. (Fig.2)

Square grid pattern and courtyard housing: The housing is also known as courtyard housing.



focus of study area is delineated to 0.913km From Shaniwar Wada to NatuBaug chowk. This road has various furniture and clothing shops. The entire road has one way traffic. The road which is undertaken for study have various main old residential as well as commercial spaces. This pie chart is the conclusion of the primary data collection. The observations are taken from the chart mentioned below. And tables (1,2,3) describes the structures and their construction period. Most of the structures from Abhinav chowk to Maharana Pratap



Structures on Bajirao road

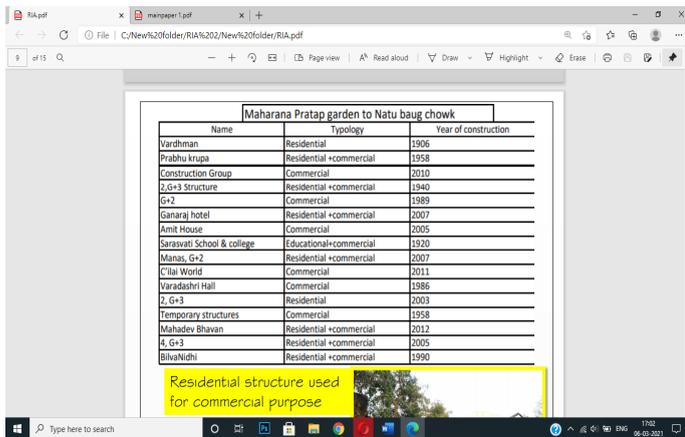
Name	Typology	Year of construction
Abhinav college	Educational	1955
G+3 Structure	Commercial	2003
Mehendale house	Residential + commercial	1875
Acharya Atrre Hall	Commercial	1981
Tandle chambers	Residential + commercial	1980-81
3, G+2 Structures	Residential	1956
Atrre, G+2	Residential	1980-81
Datta Chaya, G+2	Residential	1960
1, G+2	Residential	1937
Be-Bold	Commercial	2014
Aanandi, G+2	Residential	1990
Purti, G+2	Residential	1960
Hospital, G+1	Commercial	1997
Balaji House	Residential + commercial	2003
BSN	Commercial	2000
Limaye, G+2	Residential	1937
Mehendale House	Residential	1939
2, G+3 Apartments	Residential + commercial	1981
Maharana Pratap Garden		

Image 1: Different elements of Maratha architecture.

As every house is provided with courtyard. And theno. of courtyard defines the financial status of the family. The structural system is grid system

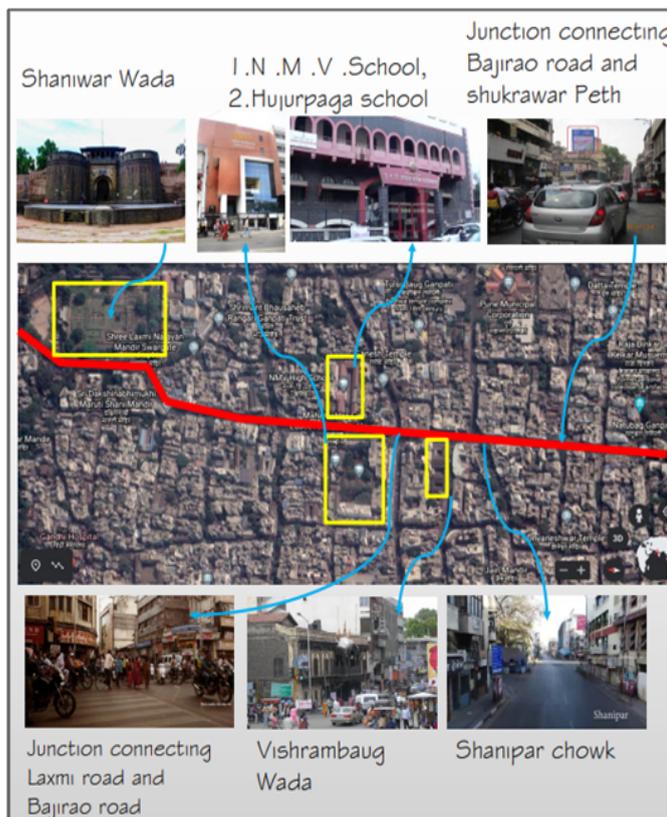
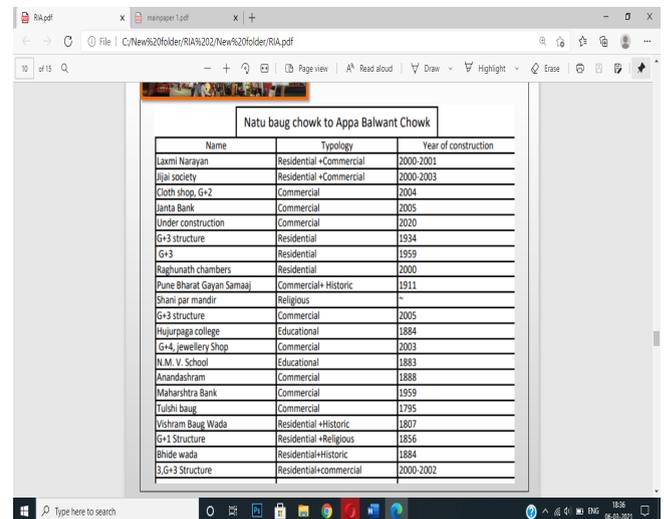
RESULTS AND TABLES

Bajirao Road is one of the famous and busy streets of Pune. Bajirao road connects various sub roads as well as main roads like Laxmi Road, Tilak Road, Kelkar road etc. Bajirao road have various junctions and various main structures from Peshwa period. The total stretch of the road is 2.6km. but the



Name	Typology	Year of construction
Vardhman	Residential	1906
Prabhu krupa	Residential +commercial	1958
Construction Group	Commercial	2010
2,G+3 Structure	Residential +commercial	1940
G+2	Commercial	1989
Ganaraj hotel	Residential +commercial	2007
Ami House	Commercial	2005
Sarasvati School & college	Educational+commercial	1920
Manas, G+2	Residential +commercial	2007
C'laal World	Commercial	2011
Varadashi Hall	Commercial	1986
2, G+3	Residential	2003
Temporary structures	Commercial	1958
Mahadev Bhavan	Residential +commercial	2012
4, G+3	Residential +commercial	2005
BilvaNidhi	Residential +commercial	1990

Residential structure used for commercial purpose

Name	Typology	Year of construction
Laxmi Narayan	Residential +Commercial	2000-2001
Jijal society	Residential +Commercial	2000-2003
Cloth shop, G+2	Commercial	2004
Janta Bank	Commercial	2005
Under construction	Commercial	2020
G+3 structure	Residential	1934
G+3	Residential	1959
Raghunath chambers	Residential	2000
Pune Bharat Gayan Samaj	Commercial+Historic	1911
Shani par mandir	Religious	-
G+3 structure	Commercial	2005
Hujurpaga college	Educational	1884
G+4, jewellery Shop	Commercial	2003
N.M.V. School	Educational	1883
Akandashram	Commercial	1888
Mahashtra Bank	Commercial	1959
Tulshi baug	Commercial	1795
Vishram Baug Wada	Residential +Historic	1807
G+1 Structure	Residential +Religious	1836
Bhilde wada	Residential+Historic	1884
3,G+3 Structure	Residential+commercial	2000-2002

The image 2 describes the Bajirao road and some historical structures from Peshwa period. The road has shops on both the sides of roads. The footpath provided is not sufficient for pedestrians. Most of the housing typology in that region is mixed housing. The issues of the road are the un-proportionate hoardings of the shops. There is no standardization in the hoarding advertisement and materials to be used in façade in newly constructed structure.

The elevations of commercial structures, especially that are newly constructed are also the main issue for the unpleasant view of the street.

The new constructed structures have different materials which are totally irrelevant with the surroundings, and makes the overall elevation of the street unpleasant.

Both of these issues are directly affecting on the historical structures which are examples of Maratha architecture.

The road is famous for commercial activities; shops owners do every possible thing to look the shop more attractive than the other one. But in this process, they are not considering the overall elevation of the road. The road is one of the visited tourists place the impression of road is considered as the

Image2: Google image of total stretch of Bajirao road

The structures from Maharana Pratap garden to Appa Balwant chowk are mostly mixed-use structures.

impression of the overall city by visitors. The tables given is a list of the structures at Bajirao road from Abhinav chowk to Appa Balwant chowk



facade pattern may it differ in planning, construction era, and techniques. Even though there is no standardization in hoardings and material to be used for advertisement but still it Have connectivity with other structure and surrounding environment.

CONCLUSION

Bajirao road the most visited road in Pune. The elevation of road is very disturbing because of the unorganized sizes, positions of hoardings also the shimmery elevations of shops. These elements from Maratha architecture help to standardize elevation. It will help to connect with the culture of Pune and tourists/visitors.

ACKNOWLEDGMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Ar. Prof. Shubhashree Upasni for his valuable guidance, inspiration and encouragement. His keen and indefatigable indulgence in this work helped me to reach an irreproachable destination.

REFERENCES:

- i. Sushma S. Dhepe, Dr. Sheeba Valsson-Traditional Approach towards Contemporary Design: A Case Study
- ii. Shilpa Dhawale-The study of decorative woodwork in Maratha Architecture and its conservation practices.
- iii. Rajashree Kotharkar, Roopal Deshpande-A Comparative Study of Transformations in Traditional House Form: The Case of Nagpur Region, India
- iv. Shradha Chandan, Ashwani Kumar-Challenges for urban conservation of core area in pilgrim cities of India.
- v. <https://www.re-thinkingthefuture.com/fresh-perspectives/a828-the-architecture-of-wadas-of-maharashtra/>: The Architecture of Wadas of Maharashtra
- vi. Temple Architecture of the Marathas in Maharashtra Volume One: Text - Ashutosh Sohoni
- vii. Maratha Wall paintings – Dr. B.K. Apte
- viii. Traditional Homes of Maharashtra: <https://heritage-india.com/traditional-homes-of-maharashtra-wadas/>
- ix. <https://freepost4u.blogspot.com/2016/03/bajirao-road-pune-shopping-destination-in-pune.html>-Bajirao road: shopping destination in Pune, Maharashtra.
- x. Illegal hoardings crop up Bajirao road https://punemirror.indiatimes.com/pune/pune-speaks/illegal-hoardings-crop-up-on-karve-road/articleshow/74087461.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst



Image 3: Different types of structures on Bajirao Road

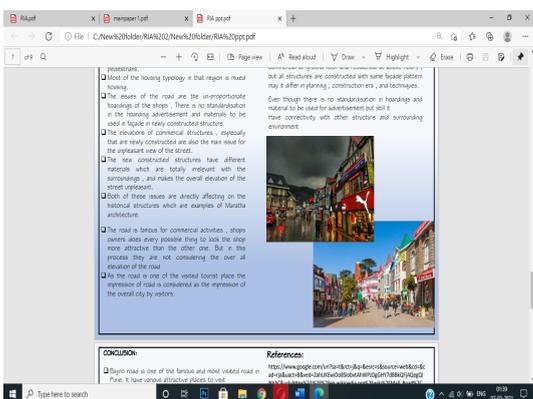


Image 4: Mall road Shimla

CASE STUDY (Literature review)

Mall road of Shimla for instance if Mall road of Shimla is considered, all the structures are mixed used structures, i.e., combination of commercial at ground floor and residential at above floors, but all structures are constructed with same

Skill Development for Rural Entrepreneurship: A study of Palghar district

Pranali Sanjay Lad, (Fifth year B.Arch.)
SSMS College of architecture, Pune
Email: lad.pranali01@gmail.com

ABSTRACT: Rural youth play crucial and substantial role in the development of nations, require the right education and training to develop skills to become entrepreneurs. Skills are important factor in improving employ ability, livelihood opportunities and enhancing productivity. The paper is based on secondary data collected from Government reports and books that highlights the need of such facilities in Maharashtra. it is found that, rural area of Palghar has been neglected and local people need more skills for self-upgradation. This paper focuses study of existing skill development system in rural areas and role of same in future for increasing employment and entrepreneurship opportunities among the people of Palghar district.

KEY WORDS – Skill development, Unemployment, Self-upgradation, Entrepreneurship Opportunity, Rural entrepreneurship, Rural development.

INTRODUCTION

“The future of India lies in its villages”- Mahatma Gandhi

Entrepreneurship plays an important role in the economic development of a nation and necessary for national growth and social development. Unemployment problems and alleviation of poverty can be solved through the entrepreneurship development. In India millions of the people are living in villages and majority of them are still living below the poverty line. Villages in India are still lagging behind due to various problems like poverty, unemployment, illiteracy etc. Rural entrepreneurship can be considered one of the solutions to reduce poverty, migration, economic disparity, unemployment and develop rural areas. It is more important for area wherein; Migration is prevalent due to unemployment and migration has an adverse impact on socio economic status of the people. Migration to metropolitan cities from rural areas happens due to employment opportunities over there. To mitigate the problem of unemployment, government organizes various schemes every year. One of the recent Government initiatives in skill development i.e., skill India mission launched by prime minister, aims to train 40 crore people in India in different skills by 2022.

Government initiatives for skill development

India values skills. Every year government of India, organized number of training programmes on self-employment for youths, women's and farmers, etc. Government launched several schemes such as PMKVY, Udaan, Rozgar mela and Mahatma Gandhi national rural employment scheme etc, to

empower the youth of the country with skill sets and make them more employable. The rural people are expected to participate in the process of skill development. In this regard the Government and other sponsors has important role. Social mobilization, through proper training and guidance inspire people and raises awareness on development. In Palghar district, growth of industrialization has taken place Also, district has historical background of art and craft culture of tribe however people from Palghar region are migrated towards urban areas for employment even though they have inbuilt skills to increase entrepreneurship. To stop migration and increase rural entrepreneurship quality people need right education and training facility in their vicinity.

Objective of the study:

- To study existing entrepreneurial activities of Palghar.
- To identify the role of existing entrepreneurial activities in future to increase employment and entrepreneurship opportunity.

LITERATURE REVIEW

Pradhan Mantri Kausalya Vikas yojana aims to train 24lakh youth to be industry skill based. Government says, a very less emphasis is laid on skill development in schools and colleges, the **government has decided to set up training centers**ⁱ

Skill development in india-2015, this paper states, Skill India's primary objective is to ensure a well-established infrastructure for skill development and focus on employment-oriented training to create skilled labour workforce. Government has put in place an **institutional structure for skill development in the State up to the district level**.ⁱⁱ

Samata foundation, working in Palghar for tribal artist and helped them gain financial independence.ⁱⁱⁱ

National rural livelihood mission aims “By building strong institutions for the underlying poor, earning employment opportunities for **the self-employed and skilled wages** thereby **reducing poverty**, resulting in a significant **improvement in their livelihood**” National livelihood mission works for rural areas of Palghar, provide employment to different organizations in the rural areas by increasing the

efficiency of the underprivileged youth. Some NGO's are working for tribal group to improve their livelihood.^{iv}

The present paper is based on secondary data collected from government reports on skill development and other sources. Qualitative data from Palghar district of Maharashtra was selected for the study purposively as more than half area of district is underdeveloped as well as it is one of the industrial districts of Maharashtra. Qualitative data collected from various research papers; these analytical research helps author to identify research gap of requirement of skill development centers for rural entrepreneurship



Figure 1 Government schemes logo (Source-mygov.in)

METHODOLOGY & MATERIAL

Primary data collected from Mr. Parikshit Patil (head of Abhinav Janseva association, working for Palghar district) describe to author that the need of self-upgradation programs for local people is necessary to start their own businesses also for daily wages. Some NGO's are arranging training programs but need proper infrastructure to work under one roof.

Profile of the study area:

Palghar is a town in the Konkan division of Maharashtra state, India. Since 2014 it has been the administrative capital of the Palghar district. Rice farming is the main occupation of Palghar. Agriculture is able to provide only a partial income during monsoon season while in the lean months (October onwards up to May) it is unable to provide employment opportunities. As a result of this, rest of the month migration is common. About geographic composition of the district of Palghar, jangalapatti, bandarapatti and plateau region broadly fall into geographic segment. These geographical situation results appear on the people's living and business.^{vi}

RESULTS AND DISSCUSSION

Existing skill development system for rural entrepreneurship

Based on secondary research, two types of entrepreneurial activities i.e., Agriculture and non-agricultural based. Also, industries are developing in Palghar due to demand for the products along with availability of resources and manpower.

Agriculture: Jawahar, Mokhada & Vikramgad mountain forest areas, the main business is of farming. rice farming, finger millet, and turmeric cultivation. Besides, from forest collecting firewood, honey and medicinal plants etc. are secondary products it is also a part of a business. In port strip areas the major business is fishing. Businesses is based on drying fish, prawn culture etc.^{vi}



Figure 2 Rice farming and fish farming (Source-indiatimes.com)

Non agriculture:

Warli painting: Palghar is the area where local warli tribes originated. It is a well-recognized and demand for the product too.

Bamboo and paper art and Fly ash brick making: People having skills and more interested in these ventures.

Clothes, handicrafts and handlooms: Women entrepreneurs were more interested in these works and they were having the skills as well.^{vii}



Figure 3 Warli art and fly ash brick making (Source-Fig A palghar.gov.in/Fig B Author)

Industries: Palghar is one of the industrial districts of Maharashtra. Mainly includes textile industry, chemical industry, engineering industry, steel industry etc.^{v i}



Figure 4 Industry (Source-Palghar.gov.in)

Problems faced by local entrepreneur:

- Lack of economics and knowledge of entrepreneurial opportunities due to this educated and trained youths mostly migrate to urban destinations in search of jobs.
- Absence of enterprising skills and lack of infrastructure facilities
- Rural entrepreneurs mainly depend on middle agent for marketing their products. But they are deceived by offering low prices to their goods.
- Lack of market information due to poor communication facility.
- Rural entrepreneurs cannot produce quality products due to inferior quality of raw materials and lack of modern technology.

Role of existing entrepreneurship in future for increasing employment

1. According to national skill development corporation, some of the potential areas where skilling can be done for tribal and rural people are: Water conservation, bamboo cultivation, mango & cashew cultivation, warli art, Solar energy conservation, handicrafts, textile & clothing, wooden toys and sports goods, coir manufacturing, food processing.^x
2. According to study, upcoming industries in Palghar required adequate raw material and manpower hence people need industrial based training. From small-and large-scale businesses and industries there is wide amount of job opportunities available and even get large amount of foreign currency in district.
3. Palghar has historical background of art hence it needs to promote ancestral art skill. Artistic products are produced to cater to the needs of different consumers.

Suggestions to identify research gap:

The following suggestions can be put forth to develop rural entrepreneurship of Palghar:

- Local entrepreneurs must be provided with skill development centers for training and technical education under one roof.
- Special training programs for local entrepreneurs should be arranged by the Government to improve their knowledge and skill.
- Training programs on agriculture and fish farming should be arranged as well as should provide

industrial training programs as per requirement of new industries in district.

- To provide training on ancestral art and craft to preserve history of Palghar district.

CONCLUSION

Migration is common from Palghar to urban areas; hence, rural industries need to be developed to stop migration and requires skill upgradation among local people to recognize potential of Palghar district. Skill development and training centers for rural population is need of the day to achieve decent livelihood and enhancing productivity.

ACKNOWLEDGEMENT

It is my pleasure to thank all who helped me in completion of this paper and the resources I utilized, also grateful to authors/ publishers of all articles, journals and books. I would like to thank my guide Prof. Shubhashree Upasani mam for their valuable guidance and encouragement.

REFERENCES

- i. <https://pmkvyofficial.org/Index.aspx>
- ii. <https://www.msde.gov.in/>
- iii. <https://samtafoundation.org/art/>
- iv. <https://rdd.maharashtra.gov.in/en/swarna-jayanti-gram-swarozgar-yojana>
- v. <https://medium.com/the-entrepreneurial/skill-development-in-rural-india-a81f4960bd12>
- vi. <https://palghar.gov.in/industrial-information/>
- vii. <https://arccjournals.com/uploads/Final-attachment-published-A-5014.pdf>
- viii. http://ijrar.com/upload_issue/ijrar_issue_316.pdf
- ix. <https://www.ijsr.net/archive/v3i8/MDIwMTUxNjQ=.pdf>
- x. https://www.nsdcindia.org/sites/default/files/files/maha-sg-report_s.pdf (Page no. 630)
- xi. <https://admission.dvet.gov.in/> (Page no. 356)
- xii. https://www.researchgate.net/publication/304112617_Rural_Development_in_India_through_Entrepreneurship_An_Overview_of_the_Problems_and_Challenges

Understanding The Effect of The Metro on The Surrounding Neighbourhood's Liveability

Pranjali Marathe (A17012.Pranjalim@Bnca.Ac.In)
Ar. Mahesh Bangad (Mahesh.Bangad@Bnca.Ac.In)
Dr Bhanuben Nanavati College Of Architecture, Pune
Year Of Study: 2021

Abstract:

Pune is undergoing massive changes in its urban context and has brought vehicular traffic and congestion. To counter the issue, the government has proposed a Metro rail project in the city under the Smart City mission. The paper aims to understand the effect the metro line will have on the liveability of the neighbouring areas and people's perception regarding the development of the metro. The study focuses on the residential and commercial aspect of the Kothrud metro line. The methodology is two-fold: a questionnaire survey and a literature review of the pre-published works. The analysis may reveal the factors affected by metro development and its awareness among the people. The conclusion may help in determining the design interventions to increase the quality of life in neighbourhoods along the metro line corridor.

Keywords: Liveability, metro station, people's perception, residents, commercial business owners, development

Introduction:

Pune is the second-largest city in the Indian state of Maharashtra, after Mumbai, and the eighth-most populous city in India, with an estimated population of 7.4 million as of 2020. ("Introduction" Wikipedia x)

Pune is undergoing massive changes in its urban context and has become an IT hub in the last decade. While this development is considered economically positive, it has attracted a large population of workers from all across the country. The horizontal growth of cities has led to urban sprawls. The cities are expanding, unplanned and inconsiderate of the transit system required for this unprecedented growth. Consequently, this has brought vehicular traffic and congestion as people prefer to use private transport than public transport. To counter the issue of vehicular congestion government has proposed a Metro rail project in the city (DPR of Pune metro, 2015) under the Smart City mission. Two lines, Line 1 from Pimpri Chinchwad Municipal Corporation Building to Swargate and Line 2 from Ramwadi to Vanaz, with a combined length of 31.25 kilometres (19.42 mi), are being constructed by Mahametro, a 50:50 joint venture of the State and Central governments. Line 1 will run underground between Swargate and Range Hills be and elevated until Pimpri Chinchwad. Line 2 will be

completely elevated and will intersect Line 1 at the Civil Court interchange station in Shivajinagar. Line 3 between Hinjawadi and Civil Court, Shivajinagar was approved by the state and central governments in January and March 2018, respectively. ("Public transport: Metro" x) This 23.3-km line is being implemented by PMPRDA on a public-private partnership basis. The primary users of this intervention are local citizens. The paper aims to understand the effect the metro line will have on the liveability of the neighbouring areas and people's perception regarding the development of the metro.

The objectives of the paper are as follows:

1. To Determine factors affected by the metro line
2. To Determine the liveability of the locality by examining the quantified data
3. To study people's perception of the changes caused by the metro line
4. To suggest interventions for increasing liveability

The study is a quantitative research. The scope of the study is a 1km radius along the Kothrud metro line corridor. The sampling strategy is stratified sampling with respondents consisting of the residents and commercial business owners in the specified area.

Material and methodology:

The study was conducted in two stages:

Stage 1: A questionnaire survey

Stage 2: A literature review of pre-published works

Stage 1: The questionnaire survey was divided into four parts and had two target user groups: Residents and commercial shop owners.

The first part comprised rudimentary questions concerning both user groups. Questions were mainly focused on the basic

information of the respondents, their awareness about the metro project. It includes questions like age, gender, occupation contact info etc. It also covered questions like- 1. Are you aware of the upcoming metro station in your area? 2. Do you think it is a good opportunity for the development of the neighbourhood? 3. Will the introduction of metro station increase or decrease the vehicular traffic on roads? 4. Will the metro station increase community interaction? 5. Will the proximity to public transport result in less use of private modes of transportation? The questions asked for simple Yes/No answers.

The second part of the questionnaire focused on commercial business owners. It includes two questions - 1. The metro station will be beneficiary for the commercial shops in the neighbourhood. 2. Commercial shops nearest to the metro station will benefit more than the shops further away from the metro station. The respondents were asked to rate their preferences according to the Likert scale. (1. Strongly disagree; 2. Disagree; 3. Neutral; 4. Agree; 5. Strongly agree)

The third part of the questionnaire focused on the residents of the area. It includes 3 questions- 1. Are you willing to live close to the metro station? 2. Will the increased noise be a cause of concern for the residents? (These questions expected a Yes/No answer.) 3. The metro station will discourage people from living in the neighbourhood. (The third question expected a rating on the Likert scale).

The fourth part of the questionnaire focused on personal response. It includes two questions- 1. In your opinion, what issues will arise due to the introduction of the metro station in the neighbourhood? 2. What measures will you suggest to overcome these issues?

Stage 2: A literature review of pre-published works included reviewing old research papers and newspaper articles related to metro development. Case studies of research papers involved papers focusing on impacts of metro development on liveability, neighbourhood quality, land-use, transport system and the traffic environment in the west and south India, Europe, Middle-east etc.

Newspaper articles were referenced from papers like Sakaal, Times of India, Maharashtra times etc.

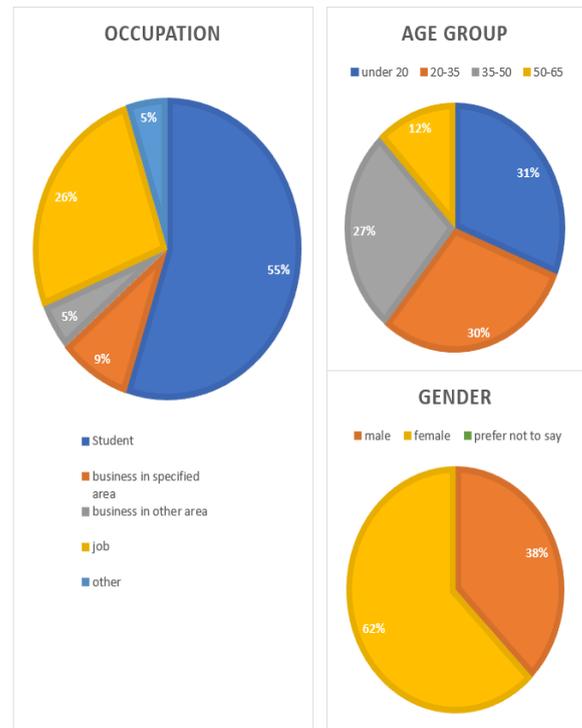
Results and Tables:

The data collection was conducted via a web questionnaire for the residents and personal face to face interviews for the commercial shop owners. A total of 85 responses were documented. Fig 1 shows the demographic variables of the responses (gender, age and occupation). 55% of respondents were students, 26% had jobs, 9% of respondents had business in the specified area, 5% had business in other areas and the

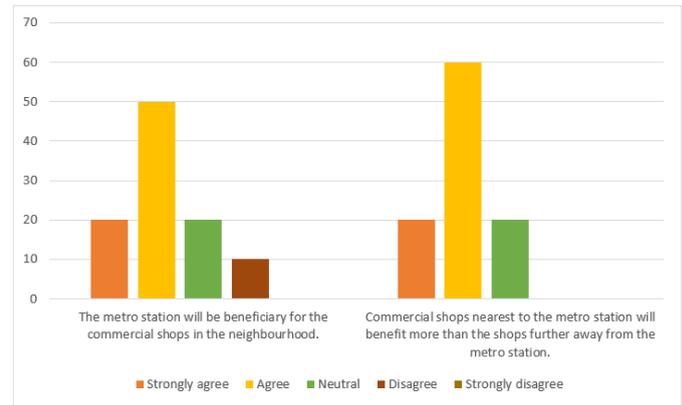
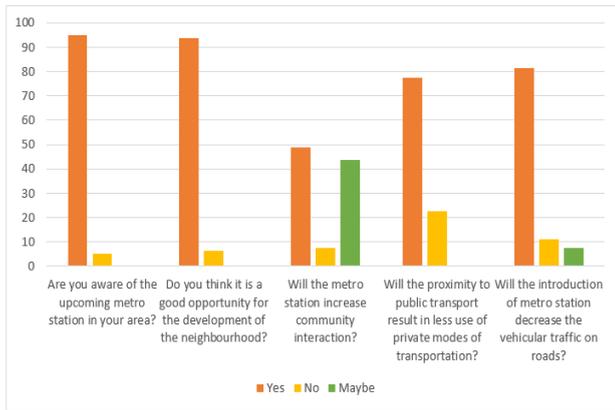
remaining occupations were artist, housewife, teacher and retired.

of the respondents were aware of the metro construction in their area. 94% agreed that the metro is a good opportunity for the development of the neighbourhood. 81.4% of respondents think that vehicular traffic will decrease due to the introduction of the metro, 11% of people think traffic will increase. 48.8% of the respondents suppose the community interaction will increase due to the metro and 43.8% are unsure. 77.5% of the respondents think proximity to metro station will decrease the use of public transport.

respondents are of the opinion that the increased noise factor is a cause of concern. Although a majority of respondents i.e., 40% are neutral about this statement, 34% of respondents disagree and 26% agree with the statement that metro development will discourage new residential projects and people from wanting to live in the neighbourhood.



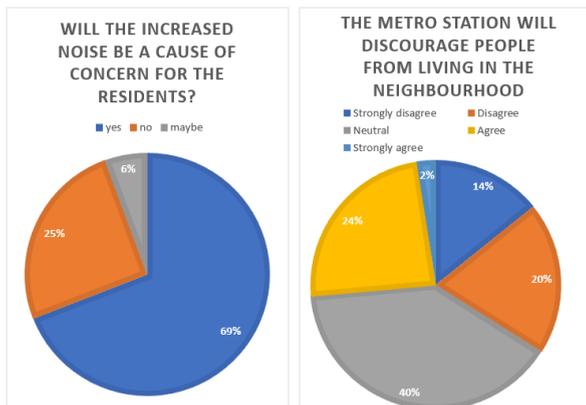
(Fig2) 95%



(Fig 3) 52% of respondents are willing to live close to the metro station. 62% of

agree that the metro station will be beneficial for commercial shops in the neighbourhood. 50% agree that commercial shops nearest to the metro station will benefit more than the shops further away from the metro station, 25% strongly agree and 25% are neutral.

The respondents stated diversified issues arising due to metro development. The most common issues were scarcity of parking facilities, air and noise pollution, pedestrian crowd clusters and traffic congestions during rush hours etc. Blocking of sunlight and open spaces, concern about maintenance of these new facilities, merging of residential and public spaces are some of the contemplated issues put forward by the respondents.



(Fig 4) 75%

The most notable measures suggested by the respondents to overcome these issues include:

1. Effective traffic planning and management via alternative routes and its effective implementation.
2. Developing strategies for intermodal services that extend the reach of the metro.
3. Proper management of the metro stations by the authorities
4. Provision of parking lots near metro stations
5. Moving the residential area away from the metro station.

Analysing the collected data, it can be concluded that the liveability of the neighbourhood depends on factors like noise levels, proximity to public transport, surrounding land use. Considering people's perception, it is observed that most people are aware of metro development and consider it helpful for the development of the neighbourhood. Issues created by the metro can be solved by simple design interventions suggested by the citizens.

Conclusion:

Analysis reveals that metro development is beneficial for neighbourhood development. It shows that people are aware and accepting of the proposed metro line despite the upcoming problems that may arise. Crowdsourcing the answers to these issues might be an excellent method of ensuring satisfactory development and liveability of the neighbourhood.

Acknowledgement:

The completion of this research paper would not have been possible without the help of everyone who took the time to respond to my questionnaire. Their contribution is appreciated. I would like to express my gratitude to my mentor, Prof.

Mahesh Bangad for guiding me throughout the process of my research paper.

References:

- i. Understanding Transit Oriented Development and Its Effect on Livability by Vrinda Panse, Sujata Karve, Rahul Nawale
- ii. Impacts of a Metro Station to the Land Use and Transport System: The Thessaloniki Metro [A.Roukouni;S.Basbas;A.Kokkalis](https://www.sciencedirect.com/science/article/pii/S1877042812028273)
(<https://www.sciencedirect.com/science/article/pii/S1877042812028273>)
- iii. Impact of metro rail construction work zone on traffic environment by Ravi Bhutania, Dr. Sewa Rama, Dr. Kayitha Ravinder
(<https://www.sciencedirect.com/science/article/pii/S2352146516307281>)
- iv. Impact of metro station in its immediate neighbourhood – a case study of Chennai metro rail corridor by D. Karthigeyan, Dr. Sheeba Chander
(https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3565103)
- v. Pune metro (<https://www.punemetrorail.org/>)
- vi. Hindustan Times
(<https://www.hindustantimes.com/pune-news/no-parking-on-karve-road-as-pune-metro-work-begins/story-oMPdxABixcGUWr5VPXI8uM.html>)
- vii. Times of India
(<https://timesofindia.indiatimes.com/city/pune/poorly-lit-roads-near-metro-sites-increase-accident-risk/articleshow/79344811.cms>)
- viii. The Influence of Metro Station Development on Neighbourhood Quality the Case of Tehran Metro Rail System by Reza Kheyroddin, Aliakbar Taghvaei, Amir Forouhar
(https://www.jstage.jst.go.jp/article/irpsd/2/2/2_64/_article/-char/ja)
- ix. <https://timesofindia.indiatimes.com/city/pune/trials-on-vanaz-garware-college-metro-stretch-in-two-months/articleshow/80122720.cms>
- x. Pune Wikipedia (<https://en.wikipedia.org/wiki/Pune>)

‘Challenges faced by the architects while adapting vernacular architecture into contemporary architecture style.’

Author - Prarthana Parate

Authors Affiliation- STES’s Sinhgad College of Architecture, Pune- Fourth Year B.Arch.

Corresponding Email id- preparate07@gmail.com

Abstract-

Vernacular buildings across the globe provide instructive examples of sustainable solutions to modern building problems. The application of vernacular solutions to modern structures is necessary to create a sustainable future. Challenges associated with such adaptation are addressed by interviews conducted and by addressing the practical exercises and fieldwork studies in the application of vernacular architecture to current problems. The blurred edges between the traditional and modern technical aspects of building design, as addressed by both vernacular builders and modern architects, are explored. This study identifies some of the past strategies and describes them in detail with analysis for transformation and connections with modern and traditional fundamentals.

Keywords-

Vernacular architecture, contemporary architecture, sustainable development, vernacular elements/features, climate responsiveness, local resources, challenges, innovation

Introduction-

‘Right amount of involvement of vernacular ideologies in the design of the buildings for the future is Contemporary Vernacular Architecture’.

Vernacular architecture is the style of architecture developed by the locals to overcome contextual issues. This style of architecture takes into account, all the needs and requirements of the residents, nature, and reflects the traditions and culture of the region. Vernacular style is substantially experienced, surrounding conditions and local materials are taken into consideration. Continuity in vernacular is related to space and time, involves structural, typological, functional, and social issues. Vernacular architecture adheres to basic green architectural principles of energy efficiency and utilizing materials and resources in close proximity to the site.

Contemporary architecture is highly progressive, takes into consideration modern materials, is high-tech and expressive. The contemporary style has been evolved in the 21st century, which depends on the usage of advanced materials and is spread across the global level. This

advancement has been hampering the environment and the climate overall.

Recently, though vernacular aspects are seemingly forgotten in modern architecture, architects have started embracing regionalism and cultural building tradition. The study of history, social, cultural, and climatic conditions, and techniques of many regional styles, shows that low-tech methods of construction perfectly adapt to its locale. Many structures have been established to be not just energy efficient but sustainable as a whole, by using materials and resources close to the site. Modern architects have realized the significance of simpler, ecological principles incorporated in vernacular architecture. With an introduction to modern technologies and materials, people are trying to adhere to some principles from vernacular architecture. With rapid technological advancements and urbanization, incorporating knowledge of vernacular construction has proved to be a step forward in terms of sustainable architecture. Lessons learned from sustainable architecture can be facilitated in the design of modern structures, which actually are against all “green principles”.

The adaptation of vernacular features into today’s design is quite essential as the increasing threat to the climate due to construction needs to be reduced. The key challenge is to learn fundamental lessons and principles of vernacular architecture and to find ways of integrating those principles into development programs to plan new settlements or to upgrade existing ones. The incorporation of vernacular methods into the contemporary building makes the design region-specific and responds to that specific considered climate. While considering features like light and ventilation into their respective projects, it is necessary to study all the aspects of that, sometimes calculations and the analysis of climatic factors need to be undertaken. The evolution result in a completely new and unique solution for contemporary and generation of all of the mentioned factors affecting the users designs.

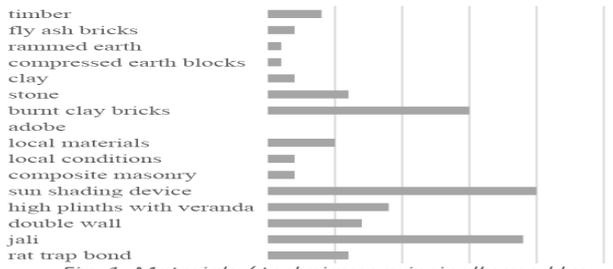


Fig. 1. Materials / techniques principally used by 25 architects

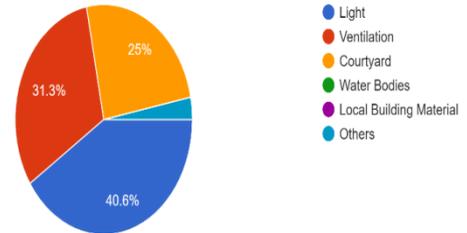
Methodology-

The primary data for the research has been collected through the survey and the interviews conducted over the telephone. The secondary data for the research was collected through the case studies of a residential complex in and around the Pune region. Literature review of similar research topic has been done to collect the secondary data for the research. Based on the secondary data the questions asked during the interview were formulated.

Primary data collected includes the examples of built structure and the ways/methods adopted to do the same. The study corresponds to the actual built structure in and around the region of Pune city. The techniques used for the same have been studied through applications of both local and modern materials and the challenges faced while doing so have been laid out.

Literature review of a few selected research papers emphasized bridging the gap between the vernacular and contemporary designs, this is done through comparison between the vernacular structures and the contemporary designs. The contemporary designs are a part of vernacular architecture which has evolved and is not only adapted in that specific region but in different climatic zones, making the designs not specific to their climate. The ideas and issues opened up for the exploration and identification of new design directions in green/sustainable and innovative techniques might be channelled and filtered through local knowledge, practice, and wisdom. The research has raised issues and awareness of energy efficiency in vernacular architecture by investing in the factors affecting the vernacular systems and improvising it within the contemporary designs. The importance of learning through the vernacular style is not only about studying but knowing about the contribution of it to

4. Which elements do you use most preferably use while designing?
32 responses



Study and analysis-

The vernacular structures respond to the climate of that specific region thereby creating a design responding to those climatic conditions and local traditions. Vernacular architecture is about responding to natural forces such as sun and wind to improve the efficiency of building performance and creating a design that is well suited for the people residing there and complementing their mindsets.

To learn from the vernacular style is to adapt the ideologies of that style, which has been evolved with time in terms of the structural systems, the adaptation of climate through the wall enclosures, the openings: their locations and sizes, which need to be altered according to the climate of the structure being built in. The enclosure of each such opening needs to be detailed out carefully so as to prevent dust, harsh light, and other harmful plague of insects. The vernacular style focuses minutely on the thermal lag and temperature difference between the interior and exterior that can be achieved partially if the windows and their enclosures are designed properly. Apart from being climate responsive; vernacular is also about the use and exhortation of local materials. Materials like Adobe, Rammed earth, fly ash bricks, clay, Burnt-clay Bricks, Compressed earth blocks, Stone, Timber, etc. are used within the structures depending upon their availability in that specific region. These materials are not only locally available but are also sustainable and are zero energy consumption materials, thereby reducing their impact on the environment.

The survey found out that many of the architects today try to experiment with the local materials by fusing them together along with the modern-day materials like combining the stone walls with the RCC frame structure, mud plaster mixed with cement, reclaimed wood; which not only influences the younger generation to adapt to these local materials but also face those challenge and overcome them. The problems associated with adapting such concepts are highly related to site management like the workmanship, the cost of materials,

and the high maintenance of the structure. The problems faced while using sustainable materials are mainly regarding the budget issue, the workmanship available for these materials; that has been reduced over the period of time, the availability of these local materials, awareness among the



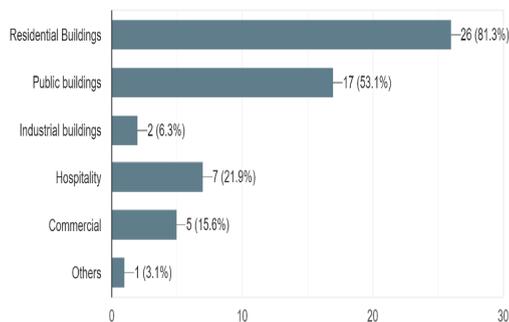
Case studies in and around the Pune region-

The study was done on the selected structures near the Pune region and the data was collected through the interviews of those architects

the maintenance required for these same. .

7. What types of project do you use the vernacular style of architecture?

32 responses



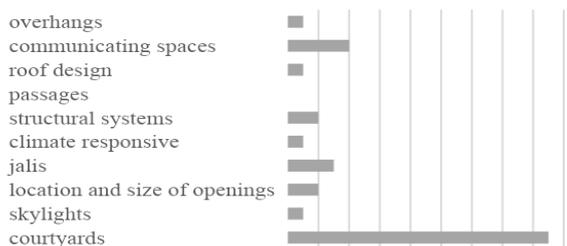


Fig no. 2- Vernacular Elements preferably adopted

The 'Krupacharya farmhouse' (fig.4) located in Mulshi, Pune is designed on the principle of contemporary-vernacular design. The materials used for this house were the locally available laterite stone and Mangalore tiles. Responding to the site and the climate of that region, sloping roofs are designed along the north and east side to drain out the water. The roofing has two layers one of the Mangalore tiles and the other of ceiling tiles beneath it. The contemporary essence to the house is procured through the glass tiles used as skylights and full height glass windows within the load bearing structure, by using timber and steel as the lintel of these glass windows. The wood available on the site was re-used to create doors and window frames of the house.

The other case study 'House in the Valley', located in Panchagani, Maharashtra (fig. 5) is designed on the same principles of contemporary vernacular style. The principle behind the design is to have utilities/spaces in the context of contemporary way, whereas having a vernacular experience and look to these spaces. The elements from the vernacular context used herein where the courtyards, water bodies in the form of mini pools and spaces arranged according to the vastu purush mandala and obeying the axes; creating a climate responsive design. Materials such as stones and bricks along with Mangalore tiles and Terracotta tiles and the reused doors and stones and stained glass are predominantly used within the project. They have incorporated the idea of not providing a slab on the upper level but to provide steel girders laid over by the Shahabad flooring to create a space therein.

The challenges faced within both the projects while amalgamating two different styles of architecture were the lack of workmanship required for this type of construction, as the process being labour-intensive and detailed intensive. The mindsets of the users have been created nowadays so as to have a clean and finished look for their structures, on the other hand, this type of construction gives raw look and feel to the structure, thereby making it a task itself of assuring them. The maintenance of such structures is high as the materials require continuous treatment.

Results-

Workmanship is a huge problem faced, as the craft of construction through local materials is being lost and the labours needs to be trained especially for that specific project to work with the different materials. Maintenance of local materials is high and needs to be done regularly over a certain period as their surfaces have raw finish. The local stone like laterite being a porous material needs to be plastered internally to prevent the seepage of water in the interior spaces. Such precautions and maintenance need to be taken for all the local/sustainable materials due to their unfinished surfaces.

The awareness among the architects as well as the common people regarding such structures has been not created impactfully. The root problem of such adaption being lessened, is the absence of curriculum for architecture does not focuses on the Indian Vernacular style concerning the details and techniques used, whereas the other forms of architecture style are being taught with every small detail. This creates less inclination of the architects towards creating a region-specific design. The other possibility of people overlooking this concept is that the commoners having a mindset of creating a clean and finished surface, that shows their status in the society and using local materials wouldn't help. The idea of being carried away by the international style of architecture has made us forget the roots of our style of architecture.

Apart from the site management challenges, the applicability of vernacular style is limited to the residential and commercial type of the buildings. The exploration within this style might influence the rest other typology of buildings to include such concepts within their designs. The issue of adapting this method within the high rise or heavily loaded structures is a concern in terms of the structural system, but whereas if the vernacular style is not only adapted for the structural system but also other different aspects, would then allow the fusion of such contrasting philosophies.

Now-a-days, the adaptation of international scene of architecture is done on a huge scale and thereby it is the responsibility of the architect to create awareness among their clients and other common people, the importance of creating

such region-specific designs and allowing the climate responsive construction for their use.

Conclusion-

Problems architects face while adopting this style are related to the site management which are workmanship, maintenance and availability of local materials. This study leads to the understanding that these problems can be tackled shortly and more such systems could be adopted for a better environment.

Acknowledgement-

Author acknowledges the Professors of Sinhgad College of Architecture, for their unwavering encouragement and useful critiques. Ar. Anand Kulkarni of Q Designs and Ar. Sonali Dahotre of Ground Designs for contributing through interviews. Lastly and foremost, also would like to thank all the professors and alumni who have participated in the survey.

References-

- i. <http://www.qdesign.in/>
- ii. <https://www.groundesigns.com/>
- iii. <https://www.scribd.com/presentation/443287342/Contemporary-vernacular-architecture-in-india>
- iv. https://www.researchgate.net/publication/341100086_An_Overview_Of_Vernacular_Architecture_In_India
- v. https://www.researchgate.net/publication/341100086_An_Overview_Of_Vernacular_Architecture_In_India
- vi. <http://www.itpi.org.in/uploads/article/Vernacular%20Architecture%20of%20India.pdf>
- vii. <https://www.sciencedirect.com/science/article/pii/S2095263519300603>
- viii. https://www.researchgate.net/publication/271438016_Vernacular_architecture_as_a_model_for_contemporary_design
- ix. <https://www.re-thinkingthefuture.com/fresh-perspectives/a1935-10-examples-of-contemporary-vernacular-architecture/#:~:text=While%20contemporary%20architecture%20is%20of,varies%20from%20region%20to%20region.>
- x. https://docs.google.com/forms/d/12-blz5s9Gf6-n1mErMVIEFlycbhmYzkXVRXUfyPU_b4/edit#responses

SITE SELECTION CRITERIA FOR DESTINATION FIVE STAR HOTEL

Prarthana Patel, Ar. Prof. Mukta Latkar Talwarkar

Bharati Vidyapeeth Deemed University College of Architecture, Pune

Email: prpatelpune@gmail.com

ABSTRACT: *Five-star hotel provides a luxury service through all its means of operation. It's geared towards catering to the guest at the excellent level. Therefore, when it comes to a destination five-star hotel the destination itself becomes a crucial factor. Right from the hill stations to historic places, palaces and beach every site is taken into account to be a destination, but the criteria for choosing the same as the destination may differ from person to person. The paper focuses to find out the general preference of the people while choosing the destination hotel to conduct their functions.*

Keywords- *five-star hotel, destination, site selection criteria.*

INTRODUCTION

The first thought that ventures a person's mind when they hear of a 5-star hotel are weddings. With the diverse trends of the millennials of the 21st century, destination weddings have taken up the pinnacle. Destinations gives one the opportunity to enjoy the wedding with some exclusiveness and uniqueness. Wedding is not only a ceremony but people are also emotionally attached to the rituals of the same. It is one in a life time experience and to make it memorable people run into "different" destinations.

In recent times some of the palaces are converted into five-star hotels. Old heritage buildings are used as a drop back for the weddings to make it look rich and royal. One of the famous actresses booked an entire hotel that was converted into a palace which became a wedding venue for her. Some of the rich and famous personalities of the country even goes out of the country in search of this locales.

Due to the current situation of pandemic, people prefer a small wedding only with close knit community with small number of people. Hence people choose a nearby small but special destination hotel for the ceremony.

From swank palaces to town hotels to coast escapes, India boosts a spirited, versatile choice of destination hotel. People now a day want to experience the native culture and history of the destination while choosing a hotel. This will give the guest a lifetime memory and an experience that they want to share with their friends and family. Hotel not only gives

relaxation and recreation however additionally offers stunning surroundings.

Hotels vary considerably in locations, natural resources and close attractions, and thus aim for destination.

CONCERNS FOR LOCATING AND DECIDING THE SITE FOR DESTINATION

Access - Due to the upcoming technology GPS has made one's life easy in finding ways even to the difficult locations. Hence with GPS guest ought not to worry about the tough route.

Availability of transport - People choose the locations that has as easy access to the nearest airports and railway stations. Transportation is the major factor that has influence on site selection for destination. If the site is located in the outskirts of the city there should be a proper mode of transportation to reach the same.

Visibility - While travelling we usually do site seeing, while doing the same we encounter many places and keep in mind the same. Similarly, the site for the destination should be visible for people to so that they come to know about it and prefer it for their occasions.

Availability of services - Every site needs to have the basic services like water, electricity and developed roads. Along with this the basic services like first aid facilities and food stalls should be easily accessible from the site.

Aesthetics - When it comes to a wedding ceremony people look into the aesthetics as a major factor. Even though ambience and backdrop can be self-created it cannot be overlooked while locating a site.

AIM

The main aim of the study is to find out the site selection criteria for all and any type of destination especially focused on the wedding occasions of the five-star hotel.

OBJECTIVE

- To understand the various aspects and design criteria of the destination for selecting the site.
- To study various factors like location, transportation and services simultaneously and reaching an acceptable and proper decision with appropriate reasoning which is satisfactory at the same time.

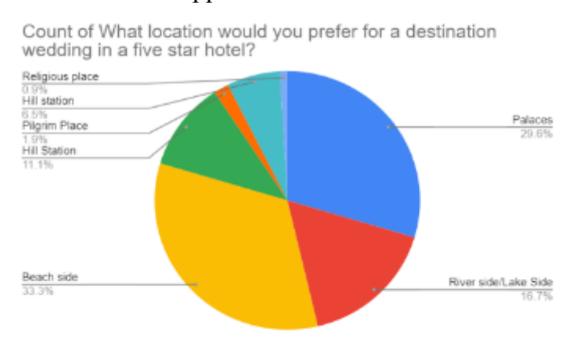
- 2) **Survey questionnaire with people on virtual platform-**A self-determined questionnaire survey from varied age bracket and professions was collected to know the site selection criteria for destination five-star hotel.

METHODOLOGY

The methodology adopted to study and investigate the aim were-

- 1) **Literature review-** reviews of the similar topic research paper was studied to understand to topic in deeper sense.

As per the investigator, **Christine Loomis** in his paper **The Art of Site Selection**, says that while selecting a site the security aspects become a crucial thing. the natural disasters like earthquake, weather-related ground stoppages or delays, fires, floods, hurricanes affect the site selection criteria. As per the investigator they firmly indicate that even though budgets have raised, buyers are trying to find ways to scale back costs, which leads to selecting less costly amenities and fewer expensive destinations and hotels. the buyers the minute, they apprehend that they are going to have to be compelled to get in front of something that haven't even happened nonetheless.



In the international journal of **Multi-Criteria Decision Making in Hotel Site Selection** by **Ranya Fadlalla** states that a large range of tourist orient to hotel seeking sun and watercourse, thus a waterbody, road, settled spaces are planned to be used as a result of the most four criteria's selection of site. The road network is the necessary issue to figure out the quick and simple accesses which communicates with the explicit areas. Riverside is considered as the necessary factor for the hotel site choice. The nearest space is the foremost potential space.

An online survey of 100 people from various age groups and professions including architects and architecture students was carried out during the period of February 2020 to know which places are preferred as destination with respect to places, cities, climate, mode of transportation, architectural importance of the city by actually asking the users for their desires who will be the guests of the hotel, helps in decision making for site selection. Multiple choice options were given for the same.

The questions were as follows: -

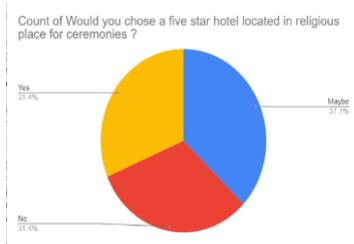
- Are you an Architect or Architecture Student?
- What location would you prefer for a destination wedding in a five-star hotel?
- Which city of India would you choose as Destination and Why?
- Would you choose a five-star hotel located in religious place for ceremonies?
- Should your site be located in a city with a predominant architectural style?
- Consider the Destination is accessible by all modes of Transport, which would you Prefer?
- What is your desired wedding ceremony location?
- In which season would you prefer the marriage?
- Number of invitees you would prefer?

OBSERVATION AND ANALYSIS OF INTERVIEW

From the responses that were received, from 100 people answering the survey, the number of observations and conclusions were derived on the responses given by the people to the answers that were asked. Some of them are represented here to highlight the observations.

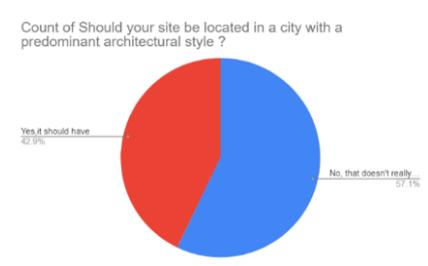
- a. For question number 2 the options given were religious places hill stations palaces, beach and river side and the results observed were: With respect to the personal choices of people. Some people prefer religious settings while some prefer exotic or fun setting. It was observed that beach and riverside places are preferred more which has a character touch along the site with the gorgeous scenario.
- a. For question number 4 the results observed were: Now a days there is a trend of developing any five star hotel in religious places .There are new upcoming hotel properties in the pilgrim

places of India and according to the survey people will prefer the religious place as destination when all the luxurious facilities are provided.



c. For question no 5 the results observed were:

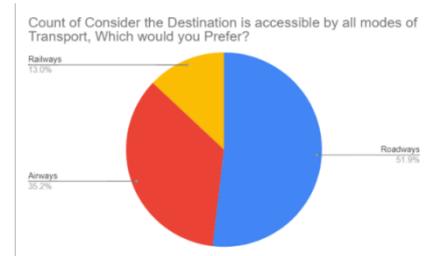
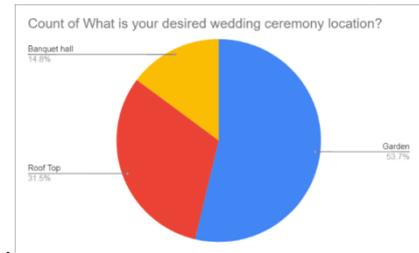
Culture and history of the city has a strong impact on the site hence predominant architectural style is also considered. But when observed people will not see into the architectural style o the city as they are experiencing exclusiveness in the hotel itself.



d. For question no. 6- the results were:

Accessibility is the major concern while locating a destination and it is observed that users will prefer roadways and airways as their mode of transportation.

e. It is also observed that 53.7% of users will prefer to do their ceremonies in gardens, where as 31.5% will do on rooftop and 14.8% in banquet halls. Also 80.6% users will prefer their wedding occasions in winter season whereas 14.8% in summer and 4.6% in monsoon. When asked about the no. of invitees 38.9% will invite 250 and above guest, 26.9% will invite 50-150 guest, 26.9% with 150-250 guest and the lowest of 7.4% with 50 and below invitees



CONCLUSION

As per the observations the maximum preference given by the surveyed people were beach, riverside and religious places that has a proper road networks, as a suitable site for destination hotel. The selection criteria for the same are complex and different aspects are to be considered for the same. It also depends on the activity scheduled in destination which effect on the choices of people and on the different aspects that people want to do. Not only this, but this being a five-star hotel services are the significant aspect, hence the availability of services and infrastructure is also to be considered.

ACKNOWLEDGEMENT

I would like to express my gratitude to my guide and mentor Ar. Prof. Mutkta Latkar Talwarkar ma'am for her kind co-operation and encouragement that helped me complete my research subject. I would also like to thank all the surveyors for giving their valuable time for filling out the forms.

REFERENCES

- i. Multi-Criteria Decision Making in Hotel Site Selection Ranya Fadlalla Abdalla Elsheikh International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726 www.ijesi.org ||Volume 6 Issue 1||January 2017 || PP. 15-18
[http://www.ijesi.org/papers/Vol\(6\)1/C06011518.pdf](http://www.ijesi.org/papers/Vol(6)1/C06011518.pdf)
- ii. Tourist hotel location selection with analytic hierarchy process – Journal Life of Economics

<https://www.researchgate.net/publication/281393363>
[TOURIST_HOTEL_LOCATION_WITH_ANA](#)
[LYTIC_HIERARCHY_PROCESS](#)

- iii. The Art of Site Selection MARCH 1, 2018 Four Experts Weigh in on the Shifting Landscape in Destination Due Diligence By Christine Loomis

<http://www.themeetingmagazines.com/cit/art-site-selection/>

- iv. Theoretical, empirical operational models in hotel location research January 201 International journal of hospitality management by yang yang
<https://www.researchgate.net/publication/259123892> [Theoretical empirical and operational models in hotel location research](#)

- v. A new look at new considerations for choosing hotel building site by kostuch media ltd, April 26,2018
<https://www.hoteliermagazine.com/a-look-at-new-considerations-for-choosing-hotel-building-sites/>

Entwined - A Textile Innovation Hub

Pratha Kiran kanpara, Prof. Ar. Pushpagandha Shukla

CTES College of Architecture, Chembur, Mumbai

Email: pratha.kanpara@gmail.com, gandha.shukla@gmail.com

ABSTRACT:

The growing population of India leads to ever increasing demand for textiles. To be distinct in the crowd and create an individualistic statement, fashion design and its diversification become ENTWINED to textile manufacturing. It is also crucial to interweave creativity and innovations to the field of textiles. In the process of the research, it was observed that the textile industry had many different facets, which also dealt with the history of textiles, the process of manufacturing, age-old artisanal practices, etc. In India, there are many textile museums, labs, institutions, etc. but there is no singular facility where all the aspects are interwoven under a single roof. To innovate from the past and to revolutionize the present, there is a need to create a one-stop-solution in the textile industry. This research proposes a facility correlating these facets to the fading textile industry in the metropolitan city of Mumbai.

Keywords – Diversification, Creativity & Innovation, Facets, One-stop-solution, Derelict Textile Land, Textile & Technology

INTRODUCTION

Today, Fashion is not only about attire, but also the nature of the fabric, use of thread, blending of different colors; that marks the statement. The Textile industry is one of the large-scale industries in India including manufacturing services, innovation, fashion, handicrafts, etc. India's Textile Industry is one of the oldest establishments in the Indian economy dating back to the nineteenth century (i.e. manufacturing units and power looms). The ancient culture and traditions of the nation's textiles, make the Indian textile Industry unique in comparison to the ventures of different nations. The textile industry covers around 4.5 crore workers including 35.22 lakh handloom laborers everywhere in the nation. It is the second biggest employment provider in India after Agriculture. India is the second-biggest producer and exporter of cotton in the world at \$6.3 billion which is imperceptibly near China. The Indian textile industry is extremely varied, with the hand-spun and hand-woven textiles sectors are Labour driven and towards one side of the range and the machine-driven sector and synthetic fibers on the opposite side of the range. (Mishra, 2020)

Challenges faced in the Textile Industry:

Highly fragmented facets pose a serious challenge to the Indian textile industry. The business faces a lack of admittance to the most recent technology. The artisans and laborers face the threat of wages and proper facilities to work with. The furious rivalry from China, Bangladesh, and Sri Lanka in the low-value price of clothing market leads to environmental and social issues like child labor and flaunting of personal safety norms. This research proposal through its design will help to overcome some of the current challenges faced by the textile industry in India.

The paper intends to highlight the importance of the preservation of arts and crafts related to textiles while integrating innovation and commerce; enlightening people about the existing conditions of the industry and encouraging them to experiment in the field of textiles; will prove to be serviceable for the future of the industry interweaving various zones, such as Heritage, Knowledge, Innovation, and Exposition will benefit the economic growth of the Textile Industry.

Justification:

The research paper envisages design intervention on the derelict land of a textile mill in Mumbai taking into consideration the different facets and understanding the current state of the Textile Industry. The textile industry is one of the large scale industries, which is lacking proper services, designing, sample-making, sample testing, workshops, etc. The entwined spaces will help in overcoming the major issue of fragmentation in the industry and will be differentiated from other commercial complexes. The intertwined space which will act as a focal point for tourists, students, retailers, designers, and manufacturers under one roof, will also be a space that will bring transformation in the field of textiles.

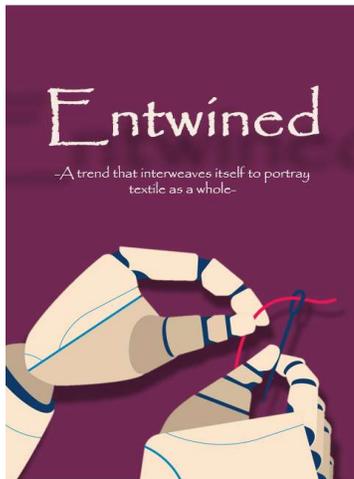


Figure 1: Entwined poster, Source: Author

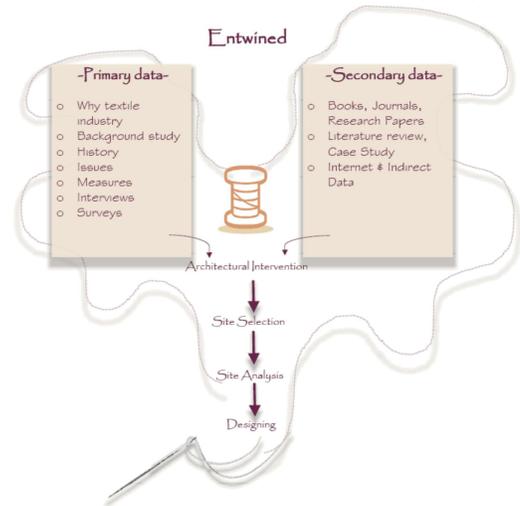


Figure 2: Methodology, Source: Author

METHODOLOGY

The research explores different facets of the textile industry. To accomplish that, the study was conducted by collecting information in terms of primary and secondary data. The primary data consisted of studying numerous built forms of different facets in the industry followed by gathering information about the issues and challenges faced by the industry. Multiple sectors were studied and analyzed to give a gist about the functioning of the textile industry. A Questionnaire was generated and forwarded to the recognized individuals of the industry which helped to collect important insights about the textile Industry.

The secondary data includes the information received from the internet and via case studies, literature reviews, journals, etc. This data helped in the complete understanding of the existing structures and developing and design brief.

The derelict mill lands which once marked their statement in the city have now lost their ground. To encourage the mill land and to bring back its significance in the city, this proposal was finalized and further worked upon keeping in mind the historical essence of textile mills.

CORE RESEARCH

Indian Textile history:

The textile was not evolved overnight or was not a technological evolution; it was a basic need from ancient times. There were many technological innovations and methods adopted in prehistoric times about clothing. Without knowing about the rich history of Indian textile, it would be incomplete to study manufacturing and innovation regarding the textile industry.

There is archaeological proof of a cotton textile industry at Mohenjo-Daro in the Indus Valley around 3000 B.C., and a couple of pieces survive from a lot later periods. A handbook of organization, the Arthashastra, tentatively dated to the third century B.C., managed techniques for dispersing materials to spinners and weavers whether the laborers were society individuals or worked secretly at home. In reality, ladies who chose not to wed were not permitted to hold occupations & weaving was allowed to widows and resigned prostitutes. Among the materials mentioned were whitebark fabric from Bengal, cloth from Banaras, cotton from south India, and a few sorts of covers, the best portrayed as being elusive and delicate. In old and medieval India texture names represented the places where they were woven, and insights regarding weaving techniques were inadequate. Marco polo referenced seeing on the Coromandel Coast the best and most lovely fabric in all the world-buckrams like the tissues of cobwebs, and he noticed coloring with indigo in the incredible textile focus of Cambay and turning of cotton in Gujarat. The East India Company in 1600 sent their first boat to India with bullion to trade for the cotton materials that could be dealt for flavors in the Malay Archipelago. Eventually, the Dutch picked up an imposing business model in Indonesia, with

exchange focused in Java, and the English pulled out to India to set up exchanging stations known as “factories.” By 1649 the British were sending chintz and modest cotton from calico to England. Much was for re-export to America, the Near East, West Africa, and the slave plantations in the West Indies. A four-cornered was exchange created.

Indian Textile mill History:

The textile mill history in India and specifically in Mumbai becomes necessary in the research because the machine-driven manufacturing of textiles took over the textile industry for the longest period. In the pre-industrial era, craftsmanship and historical textiles were significant. And in the post-industrial era manufacturing through mills and factories started gaining more importance. The historical importance of the derelict textile mills calls for one such integrated development for the proposals of converging the development of textiles & technology.

1854 - Cowasji Nanabhai Davar set up the first plant, called the Bombay Spinning Mill. It delivered cotton materials for Britain.

1860-1915 - There was a critical ascent in plants from 13 out of 1870 to 70 out of 1875. Later 83 factories in 1915.

1920-1960 - Mr.Dange leads the plant laborers association since the 1920s and had struck in 1928-29. In the 1960s Shiv Sena took over known as Bharatiya Kamgar Sena.

1982 - On 18 January, 2.5 lakh laborers took to the streets against the Bombay Mill Owners Association. The strike ends up being a debacle with the conclusion of 58 plants and 1.5 lakh laborers lost their job.

1991 - The government acquired DCI Rule 58, a. BMC should be given 1/3rd land, b. MHADA to get 1/3rd land. c. 1/3rd land is to be created by the Mill proprietor.

2001 - The DC rule was altered and the state government said that it applied distinctly to “open land” and not all the places where there are factories.

2005 - NTC had 25 factories in the city worth almost Rs.5000 crore. Jupiter Mills, Mumbai Textile Mills, and Kohinoor mill were the first ones sold.

2006 - The Supreme Court said the offer of the plants was lawful and that changes to the guidelines for creating factories were legitimate.

2010 - NTC has chosen to resume three plants – India United Mills no. 5 at Kalachowkie, Poddar Mills at Chinchpokali on January 19, and Tata Mills at Hindmata.

Existing Textile Manufacturing Hubs in India:

The states of Andhra Pradesh, Telangana, and Haryana are on the top in the ranking of ease of doing business and are well-established hubs in India followed by Jharkhand and Gujarat.

The list has been released by the Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry (MoCI). Other states with promising established or emerging textile or apparel industries are Rajasthan, Uttar Pradesh, Maharashtra, Odisha, and Bihar. (Top 5 textile and clothing manufacturing Indian states, 2018)

Issues:

Issues are varied in the field of the textile industry, they are related to many other facets of the industry such as its manufacturing, marketing, working conditions, etc. The paper and proposal will deal with the interweaving of issues, history, and innovation together. Some of the issues faced in the industry are:

Environmental Issues: The major environmental impacts of the textile business are the release of high measures of chemical loads coming about because of the intense usage of water and hurtful synthetics utilized in this area and the associated water pollution.

Poor Working Condition: Mishaps, fires, wounds, and disease are extremely successive events on textile production sites. On top of that, textile workers regularly face verbal and actual maltreatment. Now and again, when they neglect to meet their (inaccessible) everyday target, they are offended, denied breaks, or not permitted to drink water.

Infrastructure Bottlenecks: Indian textile industry is hit by infrastructural bottlenecks because of the helpless states of streets, expressways, and so on, which makes deli network limits and expands lead time, stock holding cost, and stock conveying cost. India has a tremendous extent of progress in the essential parts of a foundation like the nature of streets, ports, and the natural power supply.

Fragmented: How the entire industry is scattered and not interconnected in any way. Many cities not even having proper facilities that will cope with the demand and hence the interest declines due to unavailability. Different difficulties incorporated are reduced export incentives, worldwide value weights, and rivalry, cotton value unpredictability, coordination setback, delay in framework projects, which are influencing the development of the area.

Mishaps:

Awareness center becomes another major aspect that needs to be introduced in the textile industry. It deals with the social issues which take place due to lack of proper facilities. Education should be provided regarding the safety measurements to be taken in case of perils. Few major mishaps that took place in the textile industry in India are:

The fire breaks out in Ludhiana merely took 11 hours to extinguish and caused 3 deaths along with abundant loss of raw material and machinery. Surat, in the past 3 years had 84 fatal accidents which lead to the death of 114 workers. A Similar threat was posed on Tirupur, as to Bangladesh. Due to power deficiency and poor infrastructural facilities, many accidents were caused which resulted causing the lives of many artisans working in the building.

Measures:

The textile industry not only encounters issues related to manufacturing but also the environment, health, working conditions, etc. Some of the measures to be taken to avoid mishaps and to take good care of the laborers are stated below:

Sustainable Development: Sustainable style, in a way, is about delivering garments, shoes, and frills in ecologically and socio-monetarily reasonable habits. Additionally, more about Sustainable patterns of utilization and use, which require shifts in individual perspectives and conduct.

Proper Facilities: The industry needs to focus on investing resources into innovation up-gradation and grow weaving limit. With focused mediations on advancing the home-grown textile industry, improves execution as far as a greater venture, work age, and fair income.

Healthy working environment: Security and wellbeing estimates assume a significant part in any industry. Fundamentally, the laborers should know about the different perils in the business.

The accompanying proposals can be made to improve the security and ailments in Textile units:

There should be appropriate lighting in the work environment so that eye strain can be evaded. Machinery should be well maintained around kept up to decrease the degree of noise. If important, certain pieces of the machines can be supplanted.

If the commotion level can't be controlled, laborers should be given earplugs so that noise exposure can be diminished. Prepared clinical staff and medical aid offices just as wellbeing, for example, fire doublers and alarms should SWOT Analysis of Indian Textile Industry in units where there is a weighty introduction to risky synthetic compounds, laborers should be provided with security gloves.

Technological Innovation:

Technology is the future of the textile industry in a way that it helps in solving the major current drawbacks e.g. in manufacturing, labor intensity, wastage of material, etc. But along with machine-driven technology, it is also imperative to involve innovation which will help not only with environmental concerns but also give futuristic solutions and will bring revolution in the field of textiles. Sustainable textiles, technical textiles, etc. are a few of the innovative ideas which are been worked upon in many different countries. But most of the places lack in providing proper space and amenities to experiment. It is necessary to interweave textiles and innovation for the betterment of the industry. Some of the innovative textiles that are been worked upon are:

3D Printed clothing: Fashion designers have just uncovered attire made through 3D printing which given its significant expenses, is so hard to make solid 3D-printed "textures".

NFC Interactive Clothing: NFC (or Near Field Communication) is the innovation that is utilized in stores, showcasing occasions to anybody slanted to drift their cell phone over one of the little chips.

VR Models: Style brands have been planning attire utilizing 3D delivering programming for quite a while, as it permits them to change and refine parts of the cut and fit rapidly, with negligible expense.

Colour Changing Fabrics: What's generally energizing about current color-changing technology is that it's advancing from a few distinct headings, which are based on unique scientific standards.

Self-Healing Fabrics: Specialists at Deakin University in Australia have been chipping away at texture with super amphiphilic (exceptionally waterproof) properties that can fix itself after harm and still keep fluids out. (5 sci-fi technologies ready to change fashion, n.d.)

DATA COLLECTION

As the topic encompasses many different layers for understanding the major facets of the textile industry, many literature reviews were taken into consideration, the key ones are specified below:

Literature Review	Architectural Aspects	Miscellaneous Aspects
Topic : Fashion For Good Date of Publication : 19 th March 2015	The fashion industry can transform from the linear 'take-make-waste' model to a circular Good Fashion approach that is restorative and regenerative by design.	Importance should not be given to things that is the pleasing to eyes. Things like material, conservation of energy, growth of economy, wastage of water etc. should be taken into consideration.
Topic : Agencies of Indian textile Industry Written By: Dr. P chellaseamy and N. Sumathi	Innovations can be done in the field of textiles in India, using the abundant raw materials produced, and labour forces available.	Gives the generic idea of the different authorities related to textiles like ministry of textiles, CCI, TUFIS etc.
Topic : Innovative Approach to Fashion services & Sustainability Date of Publication : 13 th October 2017	The Textile Industry could use more ideas that helps in decreasing the Amount of Waste generated.	There are many people who doesn't wear clothes they wore once. Clothing Rental Shops can be a perfect way for them to inculcate sustainability into their lives.

Table 1: Literature Review, Source: Author

The following case studies are selected on the basis that it simplifies the concept that is being studied. The four major aspects are Heritage, Knowledge, Exposition, and Innovation.

The case studies are selected in such a manner that they provide information regarding museums, Institutions, Retail, and Innovation labs. It will help to generate new ideas and ways to implement the said ideas into the project. The case studies studied for understanding the Textile museums were:

Calico Museum: It was studied for understanding its historical importance and way of displaying traditional textiles.

Khamir: It was a collective space for artisans to work & display their work.

National Handicrafts and handloom museum (N.H.H.M.): Its configuration to connect different spaces with multiple courtyards

Sanskriti Kendra: Its design posed Landscaping as a binding factor.

The case studies that were also looked into for understanding the Institutions were:

NIFT Mumbai: To study the Institution for Fashion Technology and labs for research.

Pearl Academy: To study Institution for Textile, Technology, fashion & Management.

The case studies researched for understanding the Innovation lab and Retail respectively were:

Birla TRADC: To understand the workings of an Innovation hub for generating and launching new products in the market.

Birla cellulose: To study the Global Textile market and the method of communication this was meticulous

Case Studies	Architectural Aspects	Miscellaneous Aspects
o Calico museum (Ammedabad) Site Area: 49400 sq.m. (calico museum – 1000 sq.m.)	Natural light and ventilation. Reflects the image of traditional pol houses element like facade, chowk, chabutra, etc.	Interior walls, columns are covered with traditional fabrics. Showcases historic fabrics.
o Khamir (Kutch) Site Area: 2 acres. (museum – 2200 sq.m.)	Traditional construction(rammed earth wall).Roofs are designed taking into consideration the sun and wind direction.	Workspaces are mostly designed as otias to make artisans feel at home.
o National Handicrafts & Hastakala Academy (New Delhi) (museum B.U.A. – 6500sq.m.)	Connectivity through courtyards. Open to sky concept, space management is taken into consideration.	Cultural aspects is given utmost importance.
o Sanskriti Kendra (New Delhi) Site Area: 5 acres.	Clear movement pattern. Landscapes are taken into consideration. Monotonous colour scheme(Earthly).	Design and art inspiration taken from 5000 years ago in villages seen all across the country. Holistic aspect.
o Vimor museum of living textiles (Bengaluru) Site Area: 1300 sq.ft.	Exposed bricks. Made in such a way that visitors and customers can talk to artisans while they are working.	Sale and revival of ethnic and antique traditional sans.
o Fashion Technology Park (Dhaka)	Organic form. Fashion ware house, fashion college, exposition centre, connectivity to neighbourhood.	Elements are strategically placed. Fashion warehouse in between the other two to act as connectivity and also a shopping hub.

Table 2: Case studies, Source: Author

Structured Interviews and inferences:

The structured interview was formulated with a questionnaire to find a way to further the research. There are other areas in the industry that needs to be explored. The inputs and shared knowledge from the personalities close to the industry will enhance the understanding of the fashion and textile industry. The following list of experts allowed me to formulate the base for research proposals:

Ar. Abhay Narkar: Principal Architect and founder of Vertex inc. Worked with many reputed Architects and involved in designs related to the Textile Industry.

Dr. Shekhar Krishnan: A Historian & Archivist. Advisor to the Director-General, Maharashtra State Police & the Heritage Department, Municipal Corporation of Greater Mumbai.

Madhura Wairkar: Textile Conservator and Senior Manager of collection and Exhibition at MAP (Museum of Art and Photography).



Akanksha Nautiyal: Textile Designer and asst. Prof from NIFT Textile Department.

Mallika Sarabhai: Indian Classical Dancer, An activist, and a publisher.

Ar. Shreyash Sarmalkar: An Architect and Textile Designer.

The following write up indicates the gist of the takeaways from the structured interviews:

1. Mumbai will be an appropriate Site for a textile innovation hub. There are many mills in Mumbai that have the proposals to have been worked upon. India united mill No. 2 and 3 can be a suitable site for the project as there are proposals for building a textile Museum.
2. The manufacturing of Textiles causes Environmental Issues, so typically it should not be built near residential complexes.
3. The creation of a Textile Innovation Hub which has diverse Facets related to the field may prove to be beneficial to the overall development of the Textile Industry.
4. Contemporising the Traditional Textiles is the key to the future of the Fashion Industry.
5. Artisans can migrate if they are provided with better facilities and a Higher Standard of Living.
6. With proper Exposure, Innovative Textiles can become revolutionary in the field of textiles.
7. Lighting and humidity should be taken into major consideration while Designing exhibition space for Textiles. As they can affect the quality of the traditional and antiquated textiles. Textile Innovation Hub should be Interactive, Engaging, and innovative.

SITE

Why Mumbai?

The first cotton textile mill on modern lines was started in Mumbai in 1854. Mumbai in Maharashtra and Ahmedabad in Gujarat are important Centres in the leading States for cotton textile Production in India. Mumbai and Ahmedabad are known as Lancashire's of India.

Why Gurgaon?

“The central Region of Mumbai is largely occupied by several Textile Mill Lands. The Word ‘Girangaon’ in Marathi - The Local Language of Mumbai, means the ‘Village Of Mills’.”

Why IUML no 2& 3?

India United Mills number 2&3 (IUML) is the very first mill structure to be a part of Mumbai's heritage list. The naturally

present water body and overgrown vegetation on-site demonstrates a major potential for the development of a green retreat within the city. The size and central location of the site in the study area increase the importance of the overall strategy of this design project.

About the Site:

India United Mill no. 2 and 3

Location of site: The site is located in 18°59'15.2" N 72°50'26.0" E coordinates. The address of the site is at 8, Dattaram Lad Marg, Kalachowkie, Byculla East, Byculla, Mumbai, Maharashtra 400033.

The overall area of the site is 16 acres or 64,700 sq. meter. Many prebuilt structures are kept as heritage buildings reserved by the government for reuse. The site currently is owned by the BMC and was earlier owned by the NTC.

CONCLUSION

The research looks into the existing mill lands, challenges faced, and measurements that can be implemented to improve the condition of the textile industry and interweaves itself into a proposal of a textile hub. The project highlights the vast industry and focuses to innovate and revitalize the long-lost significance of the textile mill.

ACKNOWLEDGEMENT

This research has profited significantly from the help of numerous individuals, some of whom I might genuinely want to thank here. I would like to thank my mentor, Prof. Ar. Pushpagandha Shukla and co-mentor, Prof. Ar. Mitali Hindlekar for guiding me through my thesis and helping me throughout my journey. I am very Grateful to Ar. Abhaya Narkar, Dr. Shekhar Krishnan, Madhura Wairkar, Akanksha Nautiyal, Mallika Sarabhai and Ar. Shreyash Sarmalkar for giving me their inputs in their field of expertise.

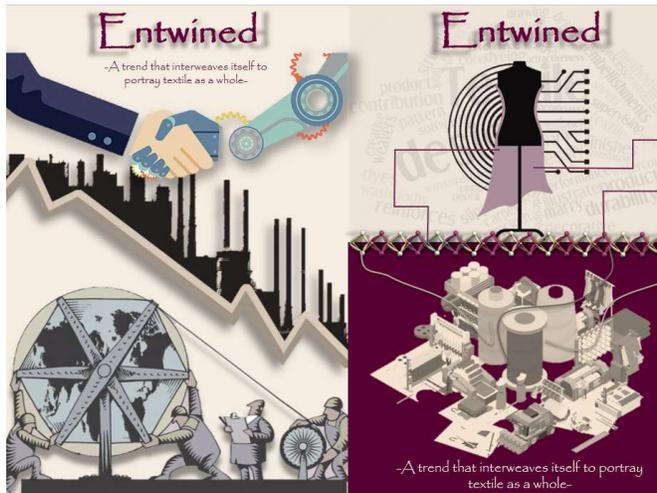


Figure3: Dissertation Posters, Source: Author

REFERENCES

- <https://baliyans.com/daily-current-affairs/editorial/indian-textile-industry>
<http://char.txa.cornell.edu/IndianTex.htm>
<https://memumbai.com/textile-mills/>
<https://apparelresources.com/business-news/sourcing/top-5-textile-and-clothing-manufacturing-indian-states/#>
<https://www.highsnobiety.com/p/future-textile-technologies/>
- vi. <https://www.counterview.net/2018/03/84-fatal-accidents-114-deaths-in-three.html>
 - vii. <https://economictimes.indiatimes.com/industry/consumables/garments/-textiles/indias-textile-hub-tirupur-less-likely-to-witness-a-garment-factory-collapse-like-bangladesh/articleshow/20497919.cms?from=mdr>
 - viii. <https://apparelresources.com/business-news/sourcing/fire-mishaps-at-textile-units-market-across-india-claim-3-lives-in-punjab/>
 - ix. <https://www.fibre2fashion.com/industry-article/543/indian-textile-industry>
 - x. <https://www.indianfolk.com/story-bombay-mills-now-edited-opinion-editor-6/>

RETHINKING SCHOOL DESIGN A CASE OF ZILA PARISHAD SCHOOL.

Pratiksha Ganesh Thakur, Prof. Chaya Chavan-Tirvir

Student of Fifth Year B. Arch, Dr. D.Y. Patil College of Architecture, Akurdi, Pune, India.

Professor at Dr. D.Y. Patil College of Architecture, Akurdi, Pune, India.

E-mail address: gnpd21@gmail.com

ABSTRACT- *School being a basic foundation of knowledge gives a chance to children to acquire knowledge on various fields of education. India has a prosperous history in education. But in recent times, especially in rural areas, many children are deprived of proper education facilities as per current pedagogical needs. The present scenario strongly defines the need to innovate and integrate measures that can help to redefine the rural schooling facility. The paper deals with the study of current aspects of schooling facilities and opts for exploring new possible measures to enhance its developmental scope. The report analysis provokes us to think about the present requirements and typologies, the design phase is the architectural outcome of the above study.*

Keywords: schools, Zila Parishad, regulations, estimation, NEP, strategies, infrastructure, pedagogy.

INTRODUCTION-

Children of today will be the pioneers transforming the future tomorrow. They will develop our society and be innovative, solving problems we could only dream of finding solutions to. India has the largest education system in the world after China. The role of education in facilitating social and economic progress is well accepted. Keeping given this accepted fact there has been a major thrust on education since independence, but as far as ensuring quality education in rural India is concerned it has always been one of the biggest challenges for the governments.

Even though the government is working to improve the state of education in the country, there is still a lot to be improved. There is a growing awareness among people about education; however, the lack of infrastructure is being a major obstacle that needs an active intervention of the government. When this issue is nailed down on the state level of Maharashtra, the impact concentrates on a larger scale as we can't deny the fact that a huge part of the state's population still resides in rural zones. The rural education system is governed by Zila Parishad which provides all the facilities and amenities to 80% of the government rural schools across the state. Nurturing these children with competencies and motivation is key for our society to develop at a larger pace.

PURPOSE OF STUDY-

Due to the lack of improvement in the literacy rate and overall student growth, the government too has made certain amendments related to spatial infrastructure

which almost 86% of the rural schools and ashram schools lack. To raise the standards of the government rural schools there is a sudden obligation to propose a proper spatial module for these structures.

AIM-

The thesis project aims to study and redesign Zila Parishad infrastructures to blend with the current scenario.

OBJECTIVES-

- To elevate the educational standards of the existing schooling facility of Zila Parishad schools across the state.
- To understand the briefing assisted by the National Education Policy 2020 and accordingly provide low-cost construction possibilities for the schools concerning the material and workmanship availability as per the location.
- To break the existing rigid shell of the schools and introduce as much flexibility as possible.

SCOPE OF RESEARCH-

In the recent central document named NEP 2020, it's been stated with all the requirements regarding the upcoming schooling facilities that have to be incorporated under the new curriculum. According to which the spatial definitions of these schools will change and will be flexible enough.

As per the number of such rural schools across the state, the proposed interventions can be used on an urban spectrum. Those interventions can act as a module that can also be replicated across the state which will lead to the main goal -achieving maximized literacy standards of the state education system, which is lacking to date despite the RTE act 2009.

LIMITATIONS-

The project is abided by the norms and requirements formulated and stated by the National Education Policy 2020. It is only concerned with the design aspects of the schooling facilities and their spatial definition. The work is neither supposed to touch the political sections contained in the current education system nor deal with any sort of official acquisitions that are currently carried out alongside this topic.

MATERIAL AND METHODOLOGY

The methodology commences with the study of the current scenario and status of the education infrastructure of the state government and finds out the factors responsible for the degrading of the system under the spatial spectrum followed by the study of the issued education policies reformed for the betterment of these schools. The critical analysis of these aspects will be further used to propose solutions based on supporting case studies and analytical data. Hence will define a finer spatial environment for such schools.

Present scenario of rural education:

Right to Education is the primary right of every citizen of India, whether a child resides in a high-profile society or a faraway not so developed secluded village. In India, the condition of rural education is still improving, the conditions of these rural schools are still very poor.

Major hiccups in the rural education system:

However, there is hardly any attention being paid to the education system existing in rural regions.

INDIA'S LITERACY CHALLENGE

Why rural India still has poor access to quality education?

Reasons include poor school infrastructure, poor access to toilets, sanitation facilities, teacher absenteeism... Initially, it's been almost a decade of the passing of the RTE Act.



Inder Singh

Teachers especially in rural India, often take on auxiliary tasks such as attend to the maintenance of school infrastructure, mobilise students & sometimes community for the requirements of education, ensure implementation of social schemes at the school level, attend to the welfare of the students, and take care of the quality of classroom delivery. In 2017, a large portion of students across had trouble with the quality of teaching and learning. The quality of teaching and learning is still a major concern for the government.



2017 data showed that only 49% of rural schools in India have access to electricity. The quality of teaching and learning is still a major concern for the government.

Teachers especially in rural India, often take on auxiliary tasks such as attend to the maintenance of school infrastructure, mobilise students & sometimes community for the requirements of education, ensure implementation of social schemes at the school level, attend to the welfare of the students, and take care of the quality of classroom delivery. In 2017, a large portion of students across had trouble with the quality of teaching and learning. The quality of teaching and learning is still a major concern for the government.

Teachers especially in rural India, often take on auxiliary tasks such as attend to the maintenance of school infrastructure, mobilise students & sometimes community for the requirements of education, ensure implementation of social schemes at the school level, attend to the welfare of the students, and take care of the quality of classroom delivery. In 2017, a large portion of students across had trouble with the quality of teaching and learning. The quality of teaching and learning is still a major concern for the government.

Teachers especially in rural India, often take on auxiliary tasks such as attend to the maintenance of school infrastructure, mobilise students & sometimes community for the requirements of education, ensure implementation of social schemes at the school level, attend to the welfare of the students, and take care of the quality of classroom delivery. In 2017, a large portion of students across had trouble with the quality of teaching and learning. The quality of teaching and learning is still a major concern for the government.

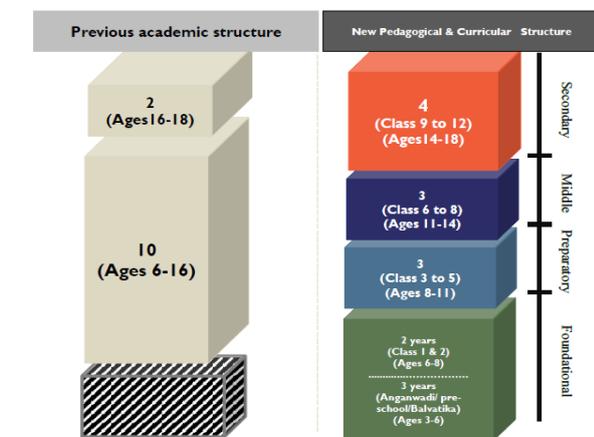


Figure no.2 – school restructures.

Figure no.1 – times of India article.

This underlines various issues that are crippling our rural education system:

1. The dearth of an adequate number of efficient schools.
2. Lack of pocket-friendly educational institutions.
3. Inadequate infrastructure.

Rural-Urban divide: Even though we are one nation, we continue to have a rural-urban divide in every aspect and education also falls in that sphere. Several studies have demonstrated a wide gap coming in between rural and urban education. The gaps can be witnessed in various ways. Thus, there is a need to improve the overall education standards to cope up with the rural educational standards.

The government has also initiated for finding solutions regarding this issue and has formulated certain policies for the same that can be used as new guidelines for redefining the infrastructure of these schools. The most updated policy is **NEP 2020**.

National education policy 2020-

The policy defines the new curriculum and its enhancements are done and to be taken into consideration elaborately that will help to reform the schooling facilities across the nation.

These amendments eventually will act as decisive guidelines in formulating spatial functions of these schooling facilities that are being proposed as the thesis solution.

CASE STUDIES-

Two live case studies of Zila Parishad schools have been compared and analyzed for their current functionalities:

Criteria of comparison	Zila Parishad primary school, Ghodegan.	Zila Parishad Primary school, Mehunbare.
Site detail	The site is centrally located in the village surrounded by residential settlements.	The site is located on the outskirts of the village. Surrounded by agricultural land.
Site area	4761 sq.m	13000 sq.m
Built to open ratio	88-22	80-20
Circulation	The building blocks are placed at the peripheral	No circulation in site. Building blocks

	edges of the site. No demarcated and planned transitional spaces.	have linear circulation.
Internal spaces	minimum internal spaces are provided. The library is provided. Science or activity labs are provided. Classrooms are built in traditional ways.	This is a residential government school having dormitories and a primary schooling facility. No library or computer labs.
Open spaces	No demarcated outdoor activities are provided. The land is left open and unplanned.	No demarcated outdoor activities are provided. The land is left open and unplanned.
Footfall	Around 750 per day	Around 450 per day
Construction mode	RCC construction	RCC construction
Community response	Students don't get to learn other than the curriculum and that too is inadequate. Low infrastructure.	The accommodation facility is very poor and the school outdoor spaces are not planned.

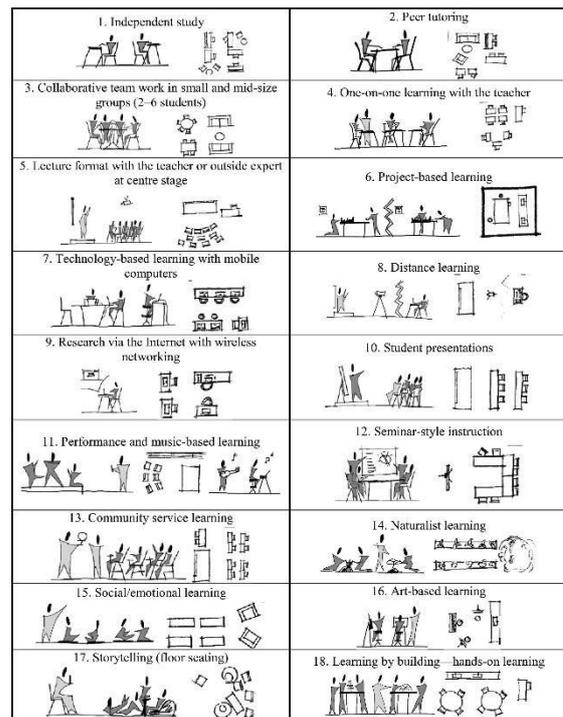


Illustration: Larissa Neiris de Souza.

Figure no.3 – learning modalities.

RESULTS AND INTERVENTIONS-

While performing the case studies several domains of the inadequacy of these schools came into the picture.

Many of these schools lack fundamentals. The Zila Parishad hasn't been thought into making any spatial amendments for facilitating these schools. They have been following the same credentials for the last 30 years for schooling construction. Looking into the new pedagogical aspects defines the crucial need to reframe these schools in attaining the educational goals. The school sites should also be capable of providing temporary functionalities other than just schooling as the premises also function as many other needs such as election booths, village medical camps, disaster shelters, etc. as per the need.

These should undertake certain strategies to elevate its spatial value. The spaces can be planned to fulfill the schooling needs in low budget and high energy efficiency.

The spatial definition should be formulated as per these learning modalities which will help the spaces to function efficiently.

The crucial intervention in increasing its efficiency is redesigning these spaces as per energy efficiency and new schooling strategies which when incorporated, will enhance these spaces to a very larger extent. These strategies can be used as modules that can be replicated in all the schools all over the state.

CONCLUSION-

The topic of schools is something that almost everyone can relate to. Many aspects were missing in the earlier schooling system which came into the picture after thorough research and data analysis which brings you to a conclusion and makes way for your further design journey by rethinking and redesigning those premises. The research eventually helped in the proper understanding of various domains of the conceptual design program that paved way for better conceptual realizations.

ACKNOWLEDGEMENT

This paper and research behind it would not have been possible without the guidance and support of my faculty, Prof. Chaya Chavan-Tirvir. I would like to express my gratitude for her valuable guidance, inspiration and encouragement. Her keen and indefatigable indulgence in this work helped me to reach an irreplaceable destination.

REFERENCES

- i. <https://www.indiatoday.in/education-today/featureophilia/story/what-is-the-rural-education-scenario-in-india-and-how-can-we-change-it-1577444-2019-08-05>
- ii. <https://www.scoonews.com/news/dattatray-ware-on-his-unique-pedagogy-making-a-zp-school-india-s-1st-zero-energy-school-9146>
- iii. https://www.scielo.br/scielo.php?script=sci_arttext&pid=S1678-86212018000300375
- iv. <https://punezp.mkcl.org/>
- v. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Critical Challenges in The Management of Heritage Conservation In India

Pratiksha Mahakulkar

D. Y. Patil School of Architecture, Lohegaon, Pune Email-

pratikshamahakulkar17@gmail.com

The process of conservation is very tedious work. This can be achieved by mapping a management plan which involves the history of the structure to the date conservation process. The purpose of this paper is to analyse the practices and models for cultural heritage conservation, which are practically used, and the factors affecting its performance. This paper has presented a broad overview of the challenges faced by heritage conservation projects in general. Further, it will try to identify major challenges of the sector and assess their relative importance, which can help in developing a project conservation strategy for future projects.

KEYWORDS: History, Heritage, Conservation projects, Strategy, Performance, Challenges.

INTRODUCTION

Heritage refers to what we preserve from the inheritance of structures built in past, which emerged with their importance in terms of spiritual, religious, social, or political significance within the society. In other words, it refers to those buildings, monuments, artifacts, spaces, that are of historic, aesthetic, architectural, or cultural significance, which include natural features within, such as areas of environmental significance or scenic beauty such as sacred groves, hills, water bodies, wooded areas, etc. In India, heritage comprises archaeological sites, remains, ruins. The primary custodian of 'Monuments and Sites' in the country, i.e., Archaeological Survey of India (ASI), and their fellow members protect them. Besides, many groups of structures that are unprotected, particularly neighbourhoods and public spaces including landscapes and natural features that provide character and special identity to settlements are taken under protection. Further, there wasn't any formal architectural education system persistent in the past in India. It was only a couple of decades back that enthusiasts in power and educationalists thought of formulating a well-connected, efficient and progressive system that would inculcate a proper system to satisfy the changing needs and aspirations of human lifestyle, also to cater the functional aspects of spaces. Nevertheless, it's stunning that structures that were erected in past followed an entire sense of data about proportions, stability, and aesthetic value.

Preservation and conservation work often unfold amid unstated or under-theorized assumptions about the

importance of conserving things. In major conservation projects, a curatorial model of high art has often held the middle and bounded the sides of the work. Usually, we conserve and preserve things that are judged to be beautiful or rare or testaments to creativity and cultivated artistic endeavour. Current conservation tends to valorise artistic value. This suggests that material culture be preserved in a way that protects or restores original stylistic and

formal integrity. Here the value of material heritage is often assumed to be intrinsic—a matter mediated not so much by culture or politics as by aesthetic properties and sensory perception. The efforts for researching the values and other social contexts of conservation highlight the broader resonances of cultural heritage—

which transcend the aesthetic model and reflect the myriad ways in which people invest meaning in and are available to know the buildings, landscapes, places, and objects around them.

ASPECTS OF HERITAGE CONSERVATION

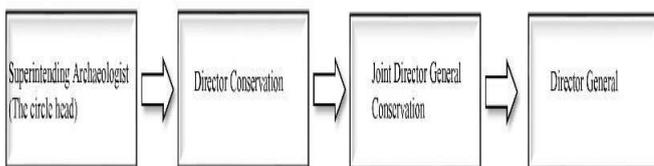
The Archaeological Survey of India follows the Conservation Manual of Sir John Marshall which was published in 1923. The conservation manual by Sir John Marshall provided guidelines for the protection and preservation of the ancient monuments/sites with structural remains unearthed from the excavations. Preservation and conservation of sites have also been addressed in the adopted National Policy on conservation and preservation of monuments/sites. The National Policy for Conservation of the Ancient Monuments, Archaeological Sites and Remains (NPC-AMASR) draws lessons and inspirations from the ASI's rich legacy for conservation and acknowledges the adoption of contemporary approaches to conservation, management, and protection of monuments and archaeological sites, and proposes various principles of interventions within and around them. The Policy also claims available traditional craftsmanship in the country and the use of traditional building materials, practices and skills as an integral part of the conservation process. It deals with topical aspects like the management of tourism and development (within and around a monument), as well as issues of capacity building and building of partnerships

with multi-disciplinary organizations and institutions. The Policy attempts to put a monument in perspective (as a ubiquitous part of its setting) and underpins the role of local communities. It focuses on all Ancient Monuments as it is put into operation by the ASI's Archaeological officers and field staff since 2014, it is subject to periodical reviews as may be decided by ASI. The Superintending Archaeologist (SA) of each circle inspects monuments and sites. Based on the inspection note and a condition assessment

ABSTRACT

note, the nature of the works on the monument is decided. The Superintending Archaeologist analyses fabric based on historicity, Architecture, and requirement of conservation while the Archaeological Engineer prepares the estimates and the work to be executed. The conservation works are carried out by the Conservation Assistant who is also the site in charge. Once the financial and administrative approvals are received from the relevant competent authority, the works undergo the tender process, and the suitable contractor who could provide material and labour is selected and the work is executed under the overall supervision of the superintending archaeologist. Priority is given to works of urgent nature required to preserve or consolidate a monument or special works at World Heritage Monuments. The conservation works are carried out under the Special repair budget (SR) while the regular maintenance of the monuments is done under the Annual Repair budget (AR). Any Conservation proposal drafted by the Superintending Archaeologist goes through this chain of approval.

CASE STUDIES 01. CHANWAR PALKHI WALON-KI-



HAVELI, AMER, RAJASTHAN

The Chanwar Palkhi walon Ki Haveli is in the ancient township of Amber. While India has legislation to protect historic structures, such as the Ancient

and Archaeological Sites and Remains, declared as monuments of national importance under the AMASR Act, and does not, for the time being, include un-protected built heritage. The Policy envisages a dynamic document and, Monuments and Archaeological Sites and Remains Act (1958) and the Ancient Monuments Preservation Act (1904), the ancient haveli and other built heritage in Amber are insufficiently protected by these laws. Until recently, many of the decaying buildings in Amber lacked owners, and few paid attention to ensuring their preservation.

PROJECT IMPACT

As work progressed, it became apparent that the ruins were structurally much stronger than they had appeared to be and that even the most dilapidated-looking buildings can be restored. Also, the project managers realized that most traditional materials were much more durable than contemporary materials and that simple, time-tested methods are often better in the long-term than fashionable innovations. Furthermore, it became clear that traditional craftsmen have a much better understanding

02. NEW PALACE, KOLHAPUR.

The new palace is an ancient building on the Bhavani Mandap-Kasaba Bavda Road. It was constructed during 1877-1884. Being a superb specimen of architecture in black, polished stone, it has been an attraction for tourists. It has extensive premises with a beautiful garden, fountain and wrestling ground. The whole building is eight-angled and features a tower within the middle. The clock on it fixed in 1877. At a separate distance, there are small towers. There are a zoo and a ground lake. Even today, it's the residence of Shreemant Shahu Maharaj. In the late 19th century, several buildings were constructed at Kolhapur in the Indo-Saracenic architectural style which was a fusion of Victorian Gothic architecture with Indian elements. It was developed at Kolhapur by the architect Major Charles Mant under the auspices of the Maharaja. Mant designed the New Palace which took seven years to complete (1877-1884). This building was built in grey stone around a central courtyard and exhibits a lofty tower. The interior was equally lavish, adorned with trophies of game and tiger heads, it contains several beautiful stained-glass windows depicting the lifetime of Shivaji which was the work of an Italian artist.

PROJECT IMPACT

The condition is a bit low maintained. As Kolhapur has a heavy rainfall the wall has become weak. The clock color

has also got a bit old. As the clock is a mechanical thing it has to go under restoration. The window frame is made up of wood. They need to get replaced. The balcony railing has weakened. It has to get replaced with a replacement one. The small dome also needs to go under restoration. The interior also needs to get a look but the part which comes under the

museum is maintained by them and that part cannot come under restoration. The entrance door which is also of wood needs some work. The popularity of the palace has increased the economy in the place. The restoration has created a new look of the palace. This effort has paid off in terms of greater public awareness and support for conservation generally, as well as in gaining continuing assistance for the palace. The project will now be a well-known heritage site in the city. The project will also be successful in helping to demonstrate to government officials the value of the historic neighborhood and the place. The palace will now be a significant example of restoration work. Because of the extent of work carried out on heritage buildings, the conservation project enabled local

help the people in the future for people to restore and maintain the heritage. The local people will get to work with the

expert people in the field and also the expert will get to know about the knowledge of the local people. The restoration project has led to greater community awareness of the value of built heritage and has educated the community about conservation.

The main goal is to increase the number of tourists from the area and make the palace look a bit new. The conservation objective will be to restore the palace and extend the life of it. The time for restoration estimated is about 3 years as the interior also need to get restored. The estimated cost of the restoration for 10 crores approx. The stakeholder is the descendant of Shivaji Maharaj.

CHALLENGES AND THEIR SOLUTIONS

a. POLICY

The National Conservation Policy is well structured by ASI and covers all significant aspects of conservation. However, despite being adopted since 2014, it is not being practiced by ASI itself. The awareness for the policy is lacking where it should be spread and practiced by all State Archaeology Departments. In 2014, it was adopted by the State Archaeology of Rajasthan for its World Heritage Sites though, in practice, Rajasthan State Archaeology is much advanced in practicing a few of National Policy clauses such as engaging local crafts people and drafting region-wise conservation schedule of rates within Rajasthan since 1991. The ASI National Policy needs to strictly adhere to clause-wise for any ASI conservation projects. Conservation works not to be approved unless they conform to all clauses of National Policy—

4.06, 4.07, and others. All Annual Conservation Plans to be peer-reviewed as per policy. By stating the significant elements that need to be preserved at any site inappropriate Conservation works can be avoided. More so, when staff responsible for the site might be from another part of the country and not recognize the cultural

significance of the monuments/site in their care. Significance is a so important later in the interpretation and tourism promotion of

the site.

b. PLANNING

As per policy it is essential that a holistic conservation plan through a multidisciplinary team is prepared following a value-based and scientific approach before undertaking any conservation works. However, in most sites such as plan is missing and works are being carried out on an impromptu basis. Comprehensive Site Management Plans (SMPs) for property and buffer (with conservation, interpretation and rescue, visitor management, environmental management, buffer management, disaster management, etc.) are essential. The policy states that a Conservation Plan is to be prepared in advance of any conservation effort. Also, a 'completion report' should be prepared after each project. No conservation funding to any site should be permitted without the availability of a conservation plan that should include architectural drawings, condition assessment, photographic record, statement of significance, names, and qualifications of those responsible— including external consultants. Conservation Plan should be implemented in phases as per immediate, medium, and long-term actions. The ASI needs to actively seek expertise on a consultancy basis for each conservation effort. The need for partnerships with various institutions and organizations for specialized conservation works is required to fill in the specific expertise gap in ASI. Such expertise could include archaeology, engineering, hydrology, conservation architects, art/urban history, landscape architecture, geology, botany, environmental sciences, hotel/visitor management, horticulture, finance, lighting design, new media design, fund-raising, administration, archival research, exhibition design amongst several others. It is neither possible to employ the number of experts required to ensure the conservation effort is well informed nor cost-effective to employ so many experts when projects are not to scale.

c. IMPLEMENTATION

An updated conservation manual, schedule of rates exclusively for items related to conservation works, specific schedule for monitoring and supervision of work, the involvement of crafts people are essential aspects for undertaking site works as per conservation policy. There is a lack of a multidisciplinary approach to conservation work. Material Specifications, Scheduled Rates and there is no skilled resource pool of specialized masons, artisans, Shapatis, Sompuras, etc. Due to these reasons, conservation work on sites is often ad-hoc and does not conform to ASI's own National Conservation Policy. ASI has not defined any parameters for monitoring its sites and monuments even though this is an essential and critical part of conservation. It only mentions in inspection notes per monument per year which is not sufficient. Detailed Monitoring parameters need to be developed as part of

the conservation plan based on the value and nature of each site, parts, artworks, etc. Monitoring may also be divided into weekly surveys by CA, Subcircle level, and monthly carpentersto gain experience in traditional work. This will

REFERENCES

- i. <https://worldarchitecture.org/architecture-news/ehpm/key-aspects-and-challenges-of-heritage-conservation-in-india.html>
- ii. Nitiayog <https://niti.gov.in/sites/default/files/2020-06/Improving-HeritageManagement-in-India.pdf>
- iii. UNESCO ASIA PACIFIC AWARDS <https://web.archive.unesco.org/20160713072550/http://www.unescobkk.org/index.php?id=2135>
- iv. Archaeological survey of India <https://asi.nic.in/>
- v. <https://www.indiaculture.nic.in/built-heritage>
- vi. Values and Heritage Conservation: Research Report <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.3195&rep=rep1&type=pdf#page=69>

Human Psychology In Spaces of Confinement Context of Prison

Prerana Godambe

V.I.T's Padmabhushan Dr.Vasantdada Patil College of Architecture, Pune

prernagodambe12@gmail.com

Abstract : *The harsh reality of today's prisons in India is that they are redesigned to be a torture chamber than a model of rehabilitation. This paper aims to understand the psychological implications the spaces have on the mind of the prisoners and how this contributes to their post-prison adjustment. The psychological repercussions of the space on a prisoner are analyzed through the evolution of ideology, programs, and drawings of prisons on parameters of the spatial response to rehabilitate. The paper focuses on the interposition between punishment and reformation and its influence on society in terms of societal advancement, opportunities, and cultural growth.*

Keywords: Institutionalization, Post-prison adjustment, Re-socialization, Contemporary prisons, Reformation

I. Introduction

Institutionalization :-

This word has been used often while studying this topic and in other words, this is what led me to this research. This research is focusing on only the prisoners who are awaiting trial, debtors, and prisoners who are in jail for certain years and are going to return to society. What does this word exactly mean?

Being institutionalized is a process of adapting to the harsh reality of the unnatural settings of the prisoner's life in prison. Thus, during the time of incarceration the longer you stay the more chances of your transformation and thus greater the risk of prisoners being institutionalized.

The prisoner's timeline is an important aspect of the study to understand how and when does the term institutionalization starts influencing the prisoner's life.



Figure [1]:- Timeline of the prisoner's life which tells the period of influence during institutionalization To understand the state of prison architecture in current times, it is necessary to know its evolution.

A. EVOLUTION OF PRISON ARCHITECTURE:-

1. Formation of the Prison system:-

- In the 16th century, in Europe started this trend of 'House of correction' where criminals and small offenders were kept in a strict disciplined environment and were forced

to do hard labor as punishment. Though this was a widely accepted corrective measure there were issues related to sanitation, popularly known as "Jail Fever" which led to the emergence of modern prisons in the late 18th century.

2. The Inception of penitentiary:-

- In 19th century in New York, the idea of "Solitary Confinement" emerged and was considered to be the ideal way, as it would give the prisoner solitude wherein he can reflect on himself and would become penitent. This system was known as the 'Separate System' or 'Pennsylvania System'.

- Another model known as 'Silent System' or 'Auburn System' emerged intending to cut the contact between convicts so that there is less influence of them on one another.

- New system known as 'Personal Reform' or 'Mark System' was developed at Norfolk Island in 1840. This system's chief mechanism of reform was through giving the prisoners credits and marks which they would earn through good conduct, hard work, and study. Before the convict returned to the civilian society he had to undergo three stages which included

- a. Isolation
- b. Group work projects
- c. Transfer to intermediate prison (Before 6 months of release)

B. The objective of imprisonment:-

- Approach 1:- Keep criminals away from civilian society.

- Approach 2:-

a. General deterrence:- Aims to deter people who would otherwise commit crime
b. Individual deterrence:- Prisoners serving there should be less likely to commit any further crime.

- Approach 3:- It aims to focus on issuing punishment or obtaining justice from the people who have committed the crime.

- Approach 4:- Personal reformation of those who are convicted of their crime.

The typology of prison has come far away from physical pain, public humiliation to a more reformatory model in contemporary times.

II. Material and Methodology:-

For understanding the topic deeper research in how prisons came into existence and what ideology led to this kind of institution was necessary. Also, how has the ideology and the program of the prison evolved from ancient to contemporary

times is studied. Understanding the history of prison architecture through various research papers and articles helped in understanding the overall progress the prison typology has made so far. For analyzing the intangibles the tangible aspects are studied, thus the spatial program of prisons helped in understanding the psychological impact it might have on the prisoners.

While understanding the evolution it was divided into three parts:-

1. Ancient Times
2. Medieval times
3. Contemporary times

One example from each time was studied thoroughly. The spatial program was studied with the help of parameters like chronology, geographical location, socio-cultural structure, and the architectural style.

Methods adopted for collection of data:-

- Live case study
 - Secondary source case study
 - Photographs and newspaper articles.
 - Documentaries of prisoners
 - Movies that are located in the prison
- (To understand the prison environment through motion pictures)

Indicators of the spatial response to re-socialization:-

The four examples that were selected to demonstrate the evolving trends of the prison architecture and program. Table no. 1 has listed the various indicators of spatial response to re-socialization. The comparison helps in the study of similarities and differences in response to the characteristics in Table No.

2. The selection of the prison was made based on the time period, availability of information, access to the site, and reviews available. The examples studied are as follows:-

- Mamertine Prison, Italy. (690 BC- 616 BC) [Ancient times]
- Aguada Fort Jail, Goa (1612- 2015) [Medieval times]
- Tihar Jail, Delhi (1957 AD) [Modern times]
- Leoben, Austria (2004 AD) [Contemporary times]

Below are listed 20 indicators that are grouped into categories to understand the Evolution of prison architecture. (Fikfak, 2016)

Table No. 1

CATEGORY	INDICATORS
A. Location	1.Prison isolation/Integration with the existing built environment.
	2.Characterstics of the immediate surroundings.
B. Spatial concept and design	3.Prison size / Capacity
	4.Layout characterstics
	5.Form characterstics
	6.Daylight quality
	7.Characterstics of the building materials
	8.Application of colour and artwork
C. Design Aesthetics	9.Co-orelation between surrounding and prison space.
	10. Co-orelation between the vegetation and prison interiors
	11. Existence of bars
	12. Design Aesthetics
D. Accomoda tion cells and blocks	13. Impression about the prison from the inside.
	14. Number persons per cell
	15. Standard size of cell
E. Content and Functiona- lity	16. Cell design, materialization, equipment, and daylight
	17. Adjustment to age, gender, and security
	18. Analogy with day – to – day life outside the walls
	19. Inclusion of the public
	20. Programme diversity

		Mamertime prison (690 BC - 616 BC)	Aguada Fort jail (1612 - 2015)	Tihar Jail (1957)	Leoben, Austria (2004)
A.	1	Location within city boundaries	rather isolated, outside city area	Location within city boundaries	Location in city suburban area
	2	The prison is near the court building and the church	Heavily contoured site with sea on one side and thick forest on the other side	The prison complex is surrounded by urban fabric	The prison is surrounded by urban tissue from three sides; the southern part is in proximity of motorway and woodland
B.	3	10-12 inmates	900 inmates	17,534 inmates	205 inmates
	4	Underground typology	Branched and courtyard layout	Courtyard type layout	Rectangular & Atrium layout
	5	Compact underground dungeons	Linear composition of the barracks with one open courtyard with high wall for security	Branching ways connect the different jails with courtyards for each jail	Jagged composition of compact forms and open space partitions
	6	No daylight inside the dungeon	Scarce daylight in the interiors	Average daylight in the interiors	Abundant daylight in the interiors
	7	Materials - stone	Materials - local stone, brick	Materials - Brick & concrete	Materials - concrete, wood & glass
	8	No art	Wall art inside cells	Information not available	Colorful interior spaces, walls, murals, woodwork, artistic objects
	9	No connection between the prison and the surrounding	Exterior space designed as the continuation of the existing landscape	Prison is cut from its surroundings	Drawing the surroundings near prison space achieved by the position on the hills
	10	No integration of the outside vegetation and the interiors	Visual connection with the vegetation outside	Visual connection with the vegetation outside	Integration of the vegetation and the interior achieved partially, due to lack of tall trees
		Maximize 10-12 inmates in a single cell, minimum 1-2	Solitary cells as well as shared cells. Maximum:-20, Minimum :- 1	Solitary cells as well as shared cells. Maximum:-20, Minimum :- 1	Mostly single cells and twin shared cells
	11	No window	Small windows at higher sill level with bars	Small window at regular sill level with bars	Medium sized windows with bars
C.	12	Ancient & medieval times prison : Dungeon	Medieval times prison : closed isolated	Modern times prison:- Colonial prisons with open jail concept explored in today's time	Contemporary design, light and open
	13	Completely enclosed in a box type situation with no light and only one opening at the top	Rigidity and impression of entrapment from the inside	Rigidity and impression of entrapment from the inside	Dynamic appearance from the inside
D.	14	Maximum 10-12 people in a single cell, minimum 1-2	Single cells as well as shared cells Max 20, Min 1	Single cells as well as shared cells Max 20, Min 1	Mostly single cells
	15	Approximately 12 Sq.m	Shared cell : 25 Sq.m 6 people	Shared cell : 18 Sq.m 6 people	Shared cell : 6 Sq.m 1 person
	16	Cells with no sanitary units	Cells with no sanitary units	Cells with sanitary units	Cells with sanitary units, white walls, contemporary simple wooden furniture, refrigerator
E.	17	No adjustment to age, gender and security	Adjustment to gender	Adjustment to gender	Adjustment to age and security
	18	No analogy as they were sentenced to death	Analogy with "basic living"	Analogy with "basic living"	Analogy with "urban living"
	19	No public involvement	No public involvement	Public work programme	Public included in acceptance and work programmes
	20	No programme as such, just wait for death sentence	Programme includes cooking and dining, washing up, work, education, meditation	Programme includes cooking and dining, washing up, work, education, meditation	Programme includes cooking and dining, washing up, work, education, meditation, outdoor and indoor recreation and healthcare

Results and Tables:[Table no. (2)] :-

Comparative Analysis of Prisons from Ancient times to contemporary times

Four cases were analyzed and compared on certain indicators in different categories.

A] LOCATION While comparing and analyzing the aspects under location it was found that there is no such perfect location that exists and moreover other factors of the built and the program plays a broader and more important role. It was observed that usually, the tendency of the design of prison is such that they want to isolate the prisoners and cut them off from society and the surrounding context.

PATIAL CONCEPT AND DESIGN

Space has undergone an evolution from ancient times to the contemporary one. This was primarily because of the prison reforms that happened over time and the change in the socio-economic status of that time period. The program formulation

has undergone changes in qualitative and quantitative aspects like prison size, characteristics of the layout, formal expression, quality of daylight, building materials, the correlation between surrounding and prison spaces and access to outdoor spaces. The prisons in modern times are better responsive to the local natural setting than the contemporary ones. Structures that are planned around the courtyards bring in more daylight and the surrounding landscape inside the cells, Visually connecting the prisoner with the surrounding. Construction materials have transformed from locally available to modern and universally available materials. Artworks applied with meaning can prove to be effective for prisoners as seen in contemporary prison. The outdoor spaces were earlier adjusted according to the sites and less emphasis was given on the qualitative aspect of it. These outdoor spaces mimic the outside world and constant contact with these spaces can enable the prisoner for better post-prison adjustment.

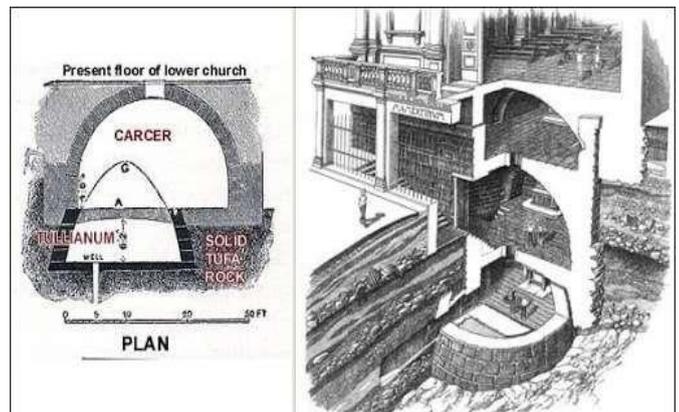


Fig 2. :- Tullianum prison of mamertime in ancient Rome.



Fig 3 & 4 :- Interior of the prison cell in Aguada Fort jail, Goa



Fig 5:- Prison cell of Tihar jail



Fig 6 :- Façade and Courtyard of Leoben prison (Contemporary Times)

B] APPEARANCE OF THE PRISON

From a dungeon to a contemporary prison cell the design aesthetics have come a long way from mere walls, rigid design to a more dynamic yet simple and more pleasing to the eye.

C] ACCOMMODATION OF CELLS AND BLOCKS

Transformations in the prison cell from applications of corrective measures, improvement of hygienic conditions, punishment to rehabilitation. Design of cell has throughout times been minimalistic and in sync with the meaning of minimalism of that time period. Optimum sized groups are found to be giving a sense of neighborhood like the atmosphere which in turn helps in re-socializing once sent back to the society.

D] CONTENT AND FUNCTIONALITY

The medieval prisons do not have any connection with the public, as against the prisons in modern and contemporary time has work programs that has public involvement. This interface can act as a catalyst to help prisoners adjust with the outside world once they are out.

III. Conclusion:-

After critically interpreting the programs and design approaches of the prisons of all periods, one can see the shift of idea from the torture chamber to a rehabilitative one. The ideological shift from prisoner's as an object to be managed to subjects with individual rights and potential is seen. There is a need for emphasizing rehabilitation so that recidivism is reduced. As prison remains an off-the-radar issue, knowing the fact that the resources are depleting and the number of prisoners is increasing this is now a matter of urgency and a paradigm shift is needed. Reconsidering the prisoners as citizens with rights to basic things would be an effective

approach. Program and design of the prison are fundamental as it establishes a correlation between the building and the wider community outside. The prisoners are paying heavily as the designing of prisons is overshadowed by previous ideologies and programs. The research has shown that there are different parameters responsible for the program formulation and is applied in various ways in designing during the different periods. Instead of coming up with a list of spatial parameters or guidelines for the new prison model, the idea of a new approach to the prisons starts with re-socialization as an ultimate aim central to designing. Space-time context is core to architecture and the prison model is one of them.

Appendix

Fig 1. Timeline of Prisoner (Flowchart) Source :- Author

Fig 2. Tullanium prison of mamertime in ancient Rome.

Source :- <http://necrohalfbreed.blogspot.com>

Fig 3 & 4 :- Interior of the prison cell in Aguada Fort jail,

Goa Source :- Author

Fig 5:- Façade and Courtyard of Leoben prison (Contemporary Times) Source :-

<https://www.nytimes.com/2009/06/14/magazine/>

Fig 6 :- Prison cell of Tihar jail

Source :-

<https://timesofindia.indiatimes.com/travel/destinations/>

Table 1. List of Indicators of spatial Response Source :-

(Fikfak, 2016)

Table 2. Comparitive anaylsis of prisons Source:- Author

Acknowledgement

I would like to express my deepest and sincere gratitude towards my research guide Ar. Prerna Shetty for being my mentor and guiding me throughout my research with valuable inputs. I would extend my deepest gratitude to Ar. Narendra Dengale for their valuable guidance. I would like to thank the profession of architecture for giving me this opportunity to write a research paper on a topic of my interest. I am extremely thankful to my family and friends for your constant support, love, and care.

References

- i. Carrabine, E. (2015). *Imagining Prison*. *Prison service journal*, 15-22. Source: https://www.researchgate.net/publication/Imagining_Prison_Culture_Hist_ory_Space
- ii. Darabont, F. (Director). (1994). *The Shawshank Redemption* [Motion Picture]. Source: <https://www.amazon.com/Shawshank-Redemption>
- iii. Häfström, M. (Director). (2013). *Escape Plan* [Motion Picture]. Source: <https://www.amazon.com/Escape-Plan>
- iv. Haney, C. (2002). *The Psychological Impact of*

Incarceration: Implications for Post-Prison Adjustment. From Prison to Home (pp. 77-92). Washington D.C: The Urban Institute.

- vi. *Source:-<https://aspe.hhs.gov/basic-report/psychological-impact-incarceration-implications-post-prison-adjustment>*
- vii. *Kini, A. (2017). A Critique on prisons in India in the light of Re - Inhuman conditions in 1382 prisons. Wiinter Issue , 72-89.*
- viii. *Source: <http://ili.ac.in/pdf/ananth.pdf>*
- ix. *Vessella, L. (2017). Prison & an active component of the contemporary city. The Plan Journal, 63-84.*
Source:[http://www.theplanjournal.com/system/files/articles/T_PJ_V2_I1_vessella.p df](http://www.theplanjournal.com/system/files/articles/T_PJ_V2_I1_vessella.pdf)

Resource Person

- GTDC Chief Engineer :- Mr. Sachin Gore
- Site Engineer :- Nambiranjan

ICONIC ARCHITECTURE – DEFINITION, NEEDS AND IMPACTS

Jain Prithish Anurag

VIT's P.V.P. College of Architecture, Pune
jprithish28@gmail.com

Abstract: There have been examples of very different forms of architecture since man learned a way to build structures for more than just shelter and protection. This has evolved throughout the ages in the form of Ziggurats, Pyramids, Forts, and Castles to modern day Skyscrapers. The reasons that contributed to the construction of these structures have also varied along with time and the economy of the people constructing them. Each of these structures convey a different meaning, statement, symbol which they were intended for. The intent of this research is to study the circumstances that led to the emergence of these structures and understanding what impact they have on the economy, fabric and urban context of the area in which they are built. The methodology adopted for the above study will be qualitative. It will include study of two significant structures throughout history, the political and economic aspects that led to construction of these structures the impact that these Icons had over the city/state/country/world, and also the people. The inferences will be drawn based on which a definition will be deduced which describes Iconic Architecture in a holistic way.

Keywords: Iconic, Image, Imposing, Power, Economy, Culture.

INTRODUCTION

Icon: How do you define icon? When do you describe something as iconic? Well, an icon means an image, something to look up to. And iconic is the nature of being an icon. All in all something which is iconic is an image to look up to or which represents something.

So, if we look throughout the history of architecture, there have been many structures which have been an image of the period in which they were built, the purpose for which they have been built. The study of these structures or large-scale developments will help to understand the impacts they had and the image they represented. This will help in deducing a definition of Iconic Architecture which can describe it holistically. Leslie Sklair in his paper says, "Iconic architecture is defined as buildings and spaces that are (1) famous for professional architects and/or the public at large and (2) have special symbolic/aesthetic significance attached to them." After studying the above, the research also aims at adding to the definition of Iconic Architecture. The limitations here will be that the structures considered for study and analysis will not be visited due to time and location. Iconic Architecture can gain temporary attention by world class architecture; it may only be short term. This is because the buildings commissioned are not of the cultural and traditional fabric of the city or context in

LITERATURE REVIEW

which it is built. The surrounding people and built environment suffer due to this, as after the event or purpose for which the structure is commissioned is over, the structure permanently disturbs the existing fabric of the locality/city. This may result in cities losing their authenticity over time. An example of this is the Guggenheim Museum of Bilbao and the Walt Disney Concert Hall in Los Angeles, both designed by Ar. Frank O Gehry.



Figure 2.1: Guggenheim Museum in Bilbao



Figure 2.2: Walt Disney Music Hall in Los Angeles

The style and materials used for these structures is the same which doesn't respond to the context of these places. Due to this the structures are indistinguishable in their location or function. Thus, Globalisation causes a hierarchy of cities that involve into the global economy. For some cities, for instance, New York, Tokyo and London, they are the nodal points for the coordination of the global economy. Thus the competition amongst cities emerged due to the struggle for better positions and to put themselves in a higher hierarchical position. This is needed for the city to boost economy

and capital. For this purpose, there is a need to build good urban infrastructure. Urban infrastructure helps in creating spaces for urban economic activities.

All in all this is an authoritative step towards symbolising the capability of the city to develop at a faster rate. In our time in the west, as the adage has it, “when people stop believing in God, they don’t believe in nothing- they believe in anything”. (Jencks, 2006) For instance, the World Trade Center never was famous as a piece of architecture before it was brought down, repeatedly, on TV. At that point, the media gave the ruins and the previous image an enduring religious presence. (Jencks, 2006)

Lincoln Cathedral, Nikolaus Pevsner had pronounced, is architecture, while a bicycle shed is a building. Architecture versus mere building, everyone carries around such a distinction because it is historic, economic, ornamental and social. So, what happens when this difference is eroded, or even reversed; when a bicycle shed becomes not only architecture can be believed. (Jencks, 2006) The example of the Guggenheim Museum or Ronchamp Chapel; These structures have made a difference only because of their Architecture. They could have been similar to any other structures in their categories, but they had a purpose to fulfil.

There are also the other kind of Iconic buildings, which fail in their purpose. One such example is of the Walkie-Talkie Centre. It is an award winning office block in the center of London. Its concave design has been hailed as an architectural triumph but it also leads to some serious health and safety issues. Not long after its completion complaints began to roll in regarding its focusing of sunlight onto local streets. One notable instance even blamed the design of the building for damaging parked cars and generally make pedestrians pretty uncomfortable. (McFadden, 2017)

RESEARCH METHODS

The data for the paper is study of secondary data, research papers, articles related to Iconic Architecture. The peer reviewed papers will be studied to gather information which will be further analyzed based on the needs which led to their emergence i.e., political & tourism-based needs. The analysis will prove the needs and impacts of Iconic Architecture and will help define them.

The methodology adopted is qualitative approach. The research problem here is to find out the needs and impacts of Iconic Architecture. This research method was adopted as it was practically difficult to visit the Iconic structures considered to study in the research.

For the comparison, two structures are considered from a list of famous buildings located in various countries. They will be discussed on the points of their emergence, their impacts in their respective period of construction and their impacts today. This will further strengthen the two points stated above i.e., political power and tourism-oriented approach.

A series of structures were considered after which two structures were shortlisted viz. the Qutub Minar, Delhi

and the Burj Khalifa, Dubai. They were shortlisted on the basis of building type. The fact is that both are towers or skyscrapers of their respective time periods. One structure is ancient, one structure is modern.

INFERENCES

The Qutub Minar was built by the first ruler of the Delhi Sultanate, Qutubuddin Aibak. The minar was built to signify the power of the Slave dynasty i.e., the Mamluk Dynasty. As the rulers from slave dynasty planned their buildings, they were short of raw material. By demolishing the majestic temples, they served another very important purpose. To ensure stronghold, it was important that the backbone of religion prevailing in conquered land is crushed. Destroying temples meant that the new Islamic Invaders had no respect for the religion being practiced by locals. They were in such hurry of completing the job, that they were not able to deface the statues properly. Even today, the remains of temples can be seen within the Qutb Complex. This minar helped impose the power of the Dynasty on the people. Thus, it helps prove the point of political and power-oriented approach.

Dubai initially was an important town for trade due to its geographical location and proximity to Iran. Despite a lack of oil, Dubai’s ruler used revenue from trading activities to build infrastructure. After years of exploration, oil was eventually discovered in territorial waters in Dubai, albeit in small quantities. This led to acceleration in infrastructure and development plans and a construction boom. In recent years, the government decided to diversify from an oil-based economy to one that is service and tourism oriented. Hence, the decision was made to build Burj Khalifa which was designed to be the centerpiece of a large-scale, mixed-use development. It was necessary for such projects to be built to garner more international recognition and hence investment. The concept of profitability derived from building high density developments and malls around the landmark have proven successful. Its surrounding malls, hotels and condominiums in Downtown Dubai have generated the most revenue from the project as a whole, while the Burj Khalifa made little or no profit. (Construction Week, 2011)

ANALYSIS & RESULTS

The factors that led to the emergence of Iconic Architecture have seen a trend which has continued over time other than some exceptions. In the olden times, for the conquerors and Emperors to show their power, to the medieval times for industrial advancements in construction, to the economic and capital agendas of cities, states or countries to gain importance and become a landmark on the world map.

The study boils down to two major factors for the need of Iconic architecture; one being political/power-oriented approach and the second being a tourism/economic/financial growth. Iconic structures have always been built to show dominance, power and authority. The rulers/emperors wanted to show off the prowess & wealth of their kingdom, a landmark to be known in their honor; for instance, the Qutub Minar. Though it was built in stages, it signified that the Slave dynasty had a lot of power. Rather it was a strong one, the one that was the first to rule the Delhi Sultanate.

There has always been a competition among various countries/states to build the highest skyscrapers since advancement in construction technology of high-rise structures. It reinforces the economic state of the city/state/country and marks the development of the country.

The second approach of tourism/economic growth. This approach is more of a recent trend where Tourism has started generating revenue for countries and have become a major part of their economic growths. For instance, countries like Dubai, India, which have rich cultural heritage or high technological advancement in construction and are developing rapidly. Dubai is expanding rapidly and is a major hub for experimenting construction technology advancements due to its climate. Hence, the structures built here are of tremendous importance for the tourism industry. And this tourism industry is a major part of their economy.

The impacts of Iconic structures are somewhat direct and indirect. For instance, the Burj Khalifa, Dubai. The residents of Dubai, be it nearby the structure or in the city limits. The residents have noticed an increase in the number of foreigners visiting the city after completion and inauguration of the structure. There is increase in density of people in the city, increase in incomes of businesses catering to the Tourism industry – a direct impact. People in cities over the world come to know about this new structure through media such as news, social media, travel companies etc. This creates an urge to travel to the city to visit the structure, to experience the structure. Also, it creates curiosity among students, and various other professionals to study the structures with regard to architecture, construction, economics, management, hospitality etc. This is an indirect impact that the structure has created. Hence, the goal of the government was accomplished, of diversifying into an economy that is based on service and tourism, rather than only on oil. All the above impacts are by-products of this goal.

DISCUSSION & CONCLUSION

In his paper, Leslie Sklair says, “Iconic architecture is defined as buildings and spaces that are (1) famous for professional architects and/or the public at large and (2) have special symbolic/aesthetic significance attached to them.” After studying about Iconic architecture in terms of the needs and impacts, there is need for an addition/amendment to the definition by Sklair, which is put forth hereby as, “(3) A structure which is made out of need for political importance or economic growth (4) A structure which remains immortal in the peoples’ memories.”

The second part is concluded as all of these Iconic structures try to live for decades. Even after they have been demolished or damaged, they remain in peoples’ memories. For instance, the Twin Towers in New York. Hence, after studying the past and the present, the common link between all Iconic structures is Immortality of the structure and the space it creates. The experience it creates for generations to come. Apart from political importance and economic growth as factors for emergence of Iconic architecture, what the futuristic approach will add to these factors and build upon it is a question put forth for further discussion.

ACKNOWLEDGEMENT

I would like to thank my Guide, Ar. Purna Shetty for her support, for believing in me and pushing me to explore my ability to think and ways to communicate my thoughts.

I would also thank my fellow classmate Atharvi Netragaonkar for her support in guiding me to think rationally and from different perspectives.



Figure 2.1: Guggenheim Museum in Bilbao

Source : Riza, M. (2015). Culture and City Branding: Mega-Events and Iconic Buildings as Fragile Means to Brand the City. Open Journal of Social Sciences, 269-274.



Figure 2.2: Walt Disney Music Hall in Los Angeles

Source : Riza, M. (2015). Culture and City Branding: Mega-Events and Iconic Buildings as Fragile Means to Brand the City. Open Journal of Social Sciences, 269-274

RESOURCE PERSONS

No first-hand data was collected. Hence, no resource person is mentioned.

Disclaimer: Written consent of resource persons must be procured before publishing the research paper in any conference or journal or magazine or any other publication house besides PVP COA

APPENDIX

a. List of Figures

REFERENCES

- i. *Construction Week. (2011, August 13). Retrieved from <https://www.constructionweekonline.com/article-13535-the-kingdom-beckons>*
- ii. *Jencks, C. (2006, April). The iconic building is here to stay. City, 10.*
- iii. *Lai, S.-Y. (2004). Urban Infrastructure and the Making of City Image in the Age of. Shanghai towards Internationalization–Fostering City Image and City Spirit.*
- iv. *McFadden, C. (2017, May 22). 25 Extremely Embarrassing Architectural Failures. Retrieved from Interesting Engineering: <https://interestingengineering.com/25-extremely-embarrassing-architectural-failures>*
- v. *Riza, M. (2015). Culture and City Branding: Mega-Events and Iconic Buildings as Fragile Means to Brand the City. Open Journal of Social Sciences, 269-274.*

Need And Feasibility Of Adaptive Reuse of Industrial Sheds.

Author 1: Priyanka Dharmadhikari

Fifth Year student, Dr. B. N. College of Architecture, Pune, India
Email id: dharmadhikari.priyanka@gmail.com

Author 2: Vaishali Anagal

Associate Professor, Dr. B. N. College of Architecture, Pune, India
Email id: vaishali.anagal@bnca.ac.in

Abstract: Due to updates in technological requirements of the industry, methods of production and sometimes due to production shifting to a new location, industrial sheds are often left redundant or are sometimes completely abandoned. These long span structures occupy huge building footprints and are commonly situated in prime locations within the city. Demolishment of these structures results in the wastage of material and their embodied energy. A demand is created for new materials for building new structures. This paper aims to promote subjecting the existing industrial structures to adaptive reuse. Due to the rapid growth of cities, there is scarcity of large plots of vacant land for projects which would benefit from being located within the city. Adaptive reuse of these redundant structures would change the function of a dysfunctional space by including new program requirements.

Introduction:

Adaptive reuse is the process of providing an abandoned structure with a new function. It is defined as a “process by which structurally sound older buildings are developed for economically viable new uses.” (Cantell, 2005). (1) Use of dysfunctional sites located in prominent parts of the city, supports sustainability. By providing a new function to these abandoned sites, urban sprawl is reduced.(2)Adaptive Reuse prolongs building’s life. (Haifa, 2016) These sites offer opportunities to reuse established resources like road access and connectivity to the site, grown vegetation in and around the site, connection of service lines, etc. By using the existing structural skeleton, the cost of material and construction is exponentially reduced. These buildings also carry heritage value and their demolition destroys the intangible aspects of the space, such as its heritage value, and the associative value that people attach to the build form. Industrial structures are often designed as long span structures which provide obstruction free spaces with large height which facilitate adequate amount of natural light flowing in. These structures are designed considering heavy loads of machinery which offers flexibility while accommodating new function. Industrial structures have large building footprints and also have a strong structural system. Considering all these aspects, industrial sheds have a huge potential for its function being transformed to accommodate a wide variety of new functions into the existing framework. This paper aims to study methods and strategies employed in adaptive reuse of abandoned industrial sheds along with justifying its need. It also aims to provide a guideline for approaching adaptive reuse projects, especially abandoned industrial factories.

For this purpose, four adaptive reuse projects are identified and analysed for understanding the processes implemented for transforming dysfunctional industrial factories. Along with this, a 9.7 acre site is identified as a case study for analysing the scope and strategies employed in approaching adaptive reuse of abandoned industrial structures.

Comparative Analysis of existing Adaptive reuse projects:

Project	Area	Location	Original use	New use	Year of construction	Year of Adaptive Reuse	Age of structure when Adaptive Reuse was carried out
Imagine Studio- At the Trees.	1,000 Sq.M	Godrej Group Industry Vikhroli, Mumbai	Power Co-Generation plant and Boiler plant for Godrej industry	Marketing Studio, Workshop, Meeting room, Restaurant, Work place, Cafe.	1945	2015	70
Xi'an Dahua Textile Mill	84,790 Sq.M	Xi'an, China.	Textile Mill	Cultural park which includes Exhibition space, Art display, Office area, Restaurant.	1935	2014	79
Tate Modern	34,500 Sq.M	London	Power station	Art Gallery	1963	2000	37
Empire Stores	31,000 Sq.M	Brooklyn, New York	Coffee industry and warehouse	Mixed use development which includes Co-Working space, Community hub, Exhibition space.	1901	2017	116

Table 1: Analysis of possibilities of Adaptive reuse of industrial projects.

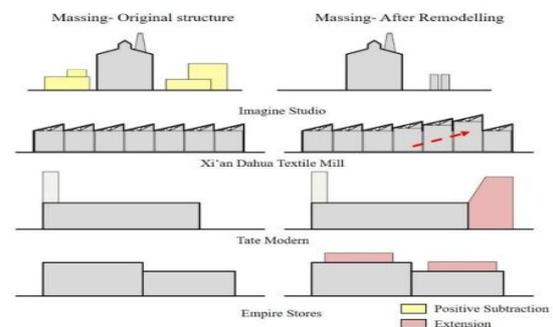


Figure 1: Schematic representation of Massing before and after remodeling of Adaptive reuse project.

Adaptive Reuse Strategies:

- I. Imagine Studio- At the Trees: Retaining existing Industrial character by maintaining Chimney for enhancing the profile. Three cylindrical Silos represent the legacy of Godrej group (3)
- II. Xi'an Dahua Textile Mill: Positive subtraction strategy is used for creating Plazas and court in between the high (4) density fabric structure Hierarchy is created in the monotonous form.
- III. Tate Modern: Existing Structural skeleton is retained as it is including the underground Oil tanks. Extension building includes Glass and brick for its façade.
- IV. Empire Stores: Existing built forms exterior is retained as it is. The form is divided into two parts by introducing a courtyard. Extension is proposed on the top floor of the structure.

Case Study of proposed project:

While analysing the adaptive reuse potential of case study industrial sites following steps were followed:

1. Structural Analysis:

These sheds are designed for heavy machinery, hence are capable of sustaining heavy loads. The structural skeleton, which is made of steel, is found to be in good, un-damaged condition. The roofing made of aluminum sheets and fiberglass has also been found to be in good condition. But, some elements, such as chajjas and grills are rusted and would need to be replaced. Other damages found in the structure include some walls which now only cover half its height, the flooring is deteriorated at some parts and broken glass from some windows needs to be replaced, Moreover, the structures would need a new coat of internal plastering and rusted external pipes would need to be removed. One of the factories consists of a gantry girder which is currently not in use. This gantry girder can be removed in order to reduce the existing load imposed on the structure.

2. Understanding Site context and surrounding:

The case study considered for analysis is an industrial site is surrounded by an ammunition factory and the College of Military Engineering, Pune. The selected site has proximity to Mula River. It is situated in the cantonment region of Pune which houses many military establishments. This region consists of residential areas of both military and civilian population. The site is connected to the old Mumbai-Pune highway and a metro station is proposed in its close vicinity. This industrial campus consists of factories which were built in the year 1960. They functioned as a testing plant, a bearing plant



Figure 2: Site Plan

3. Figure Ground Analysis:

Existing fabric of the industrial campus is dense. These factories are monotonous and have a fat footprint. Currently there is no open space present within the boundaries of the factory. The roads connecting these factories are narrow. Due to the large scale of the factories with respect to its height as well as span, these structures are overwhelming. The present condition of the factories does not have foreground. Currently there is no connection established between the landscape pockets and existing open space.

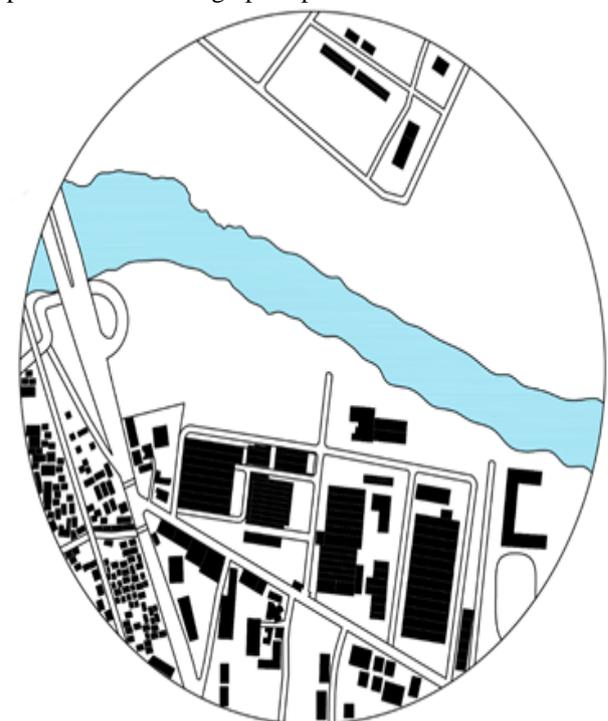


Figure 3: Figure Ground analysis (Ratio of built and unbuilt)

4. Form analysis:

This industrial site occupies a huge building footprint and is a bulky mass. It consists of two big factories having a profile of

FORM ANALYSIS				
	FACTORY 1	FACTORY 2	FACTORY 3	FACTORY 4
AREA	30Mx65M=1950sq.M	38Mx30M=1075sq.M	72Mx60M=4320sq.M	89Mx97M=8600sq.M
USABLE HEIGHT	14M	16M	7.5M	7.5M
FEATURES	North Light Truss, Verandah facing River side. Trees near front side	Sloping Roof, Gantry Girder Verandah facing River side. Segregated Testing Rooms. Toilet Block, Fibre Glass roof lights.	North Light Truss, Fibre Glass roof lights, Toilet Block, Mezzanine Floor, Staircase Block, Viewing Gallery (G+3)	North Light Truss, Verandah on 3 sides, Fibre Glass roof lights. Glazing above Verandah, Toilet Block.
CONNECTIVITY	Connected with area with Cooling tower, Cylinders	Connected with area with Cooling tower, Cylinders	Landscape Pocket, Open space	Landscape Pocket, Open space
VIEW	River Side, Dense Vegetation view	River Side, Dense Vegetation view	Road side Elevation, Landscape pocket	Landscape Pockets on 2 sides
FAÇADE FEATURES	Exposed Brick Façade with Circular Punctures, Blue Doors, Windows	Corrugated aluminum sheet, Stone cladding till sill level. Small Rectangular openings Exposed Pipes	Corrugated aluminum sheet, Red Plastering till Lintel level	Corrugated aluminum sheet, Stone cladding till Lintel level
EARLIER PURPOSE	Heat Treatment Plant	Engine Testing Plant	Bearing Plant	Production Plant
PHOTOS				

Table 2: Comparative Form Analysis of existing Factories

5. Material and Fenestration Analysis:

The existing structures each have unique facades. The heat treatment plant has an exposed facade with brick walls and concrete structural members. The doors and windows are of bright blue colour, and it has circular punctures on the top floor. On the other hand, the engine testing plant has stone cladding till sill level with the rest of the structure covered with corrugated aluminum sheets. It has small rectangular slits as openings. The pumping is exposed.

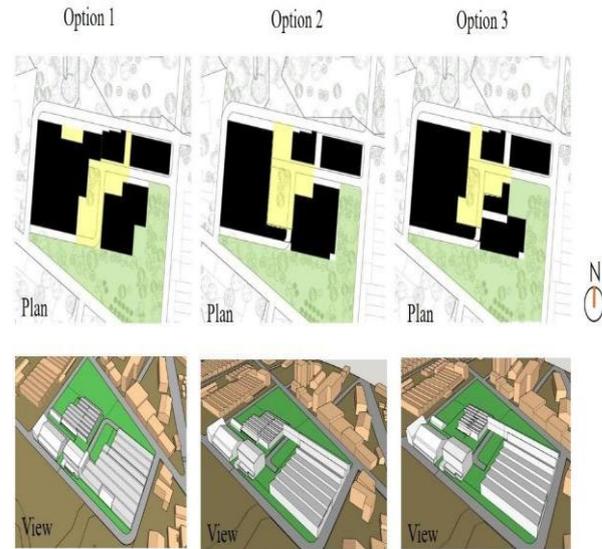
The bearing plant's walls are plastered and painted red till the lintel level with the rest of it being covered in corrugated aluminum sheets, while the production plant is stone cladded till sill level with the rest of it being covered with corrugated aluminum sheets too.

These facade treatments are utilitarian and chosen with parameters such as speed of installation and safe working environment in mind. and lower heat gain. Interesting facade options with variations

Inference from Analysis:

By following these steps of analysis, new function in the existing industrial campus can be proposed by considering the site context and surroundings. In this case, a proposal related to cantonment region like an aviation or army museum can be proposed. Fig no. 4 represents possible intervention options which can create interesting spaces between structures which would lead to creating a central plaza. By creating a central plaza, Focal point can be established and hence the industrial character of the campus can be converted into a public space. After using positive subtraction strategy, foreground can be created in front of the existing factories. Further development in facades should happen with regard to the new use of the space.

north light truss and two factories having huge height and gable sloping roofs along with



For the new project, which would require ably take into consideration the comfort level of its users, newer facade options can be explored which provide greater sustainability

Figure 4: Possibilities of intervention based on figure ground analysis and Form modulation

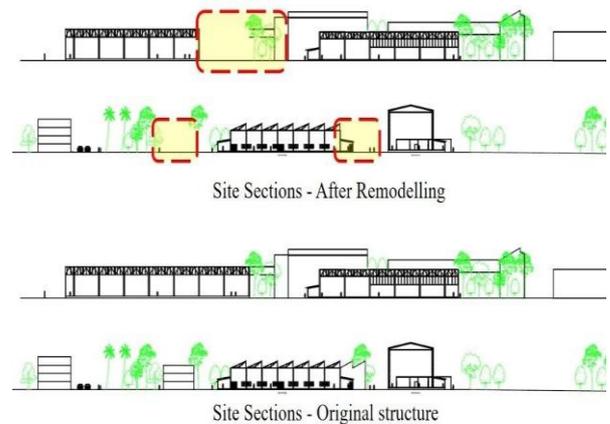


Figure 5: Possibilities of intervention based on Site Sections

IV. Conclusions:

This paper offers a guideline in which an adaptive reuse project can be approached. It offers steps to be followed for remodeling the existing structure. By studying the following case study and examples of adaptive reuse, I would like to conclude that dysfunctional industrial sheds have a lot of potential to be converted into a new project. It is today's need for using these abandoned factories located within the cities which would reduce urban sprawl.

V. Bibliography

- i. Cantell, S. F. (2005, January). The Adaptive Reuse of Historic Industrial Buildings: Regulation Barriers, Best Practices and Case Studies. <https://www.researchgate.net/publication/237125402> The Adaptive Reuse of Historic Industrial Buildings Regulation Barriers Best Practices and Case Studies
- ii. Haifa. (2016). Adaptive Reuse Architecture Documentation and Analysis. Journal of Architectural Engineering Technology.
- iii. https://www.archdaily.com/916722/imagine-studio-at-the-trees-studio-lotus-plus-gpl-design-studio?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user
- iv. https://www.archdaily.com/889760/renovation-of-xian-dahua-textile-mill-china-architecture-design-group-land-based-rationalism-drc?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-
- v. https://www.archdaily.com/895040/empire-stores-s9-architecture?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user

Virtual creation – A Science Interacting with the Real World without Altering Reality

Rachit Rupesh Joshi, Prof. Ar. Pushpagandha Shukla

CTES College of Architecture, Chembur, Mumbai

Email: rachitj77@gmail.com

Abstract: *The world as we know is surrounded by the constant need for virtual immersion. It can be either in form of digital media like movies, or be in the form of augmented reality for daily and commercial use or entertainment (Virtual Reality). Indian organizations face a significant void of a coherent representative medium that is an amalgamation of all such sub-divisions under a single banner. This research paper aims to formulate a compound environment that helps in gathering all such diverse sub-groups into a single-umbrella facility on a nation-wide scale.*

Key Words- Virtual immersion, coherent, representative medium, compound environment, void, single banner



Figure-1 Evolution of Man

INTRODUCTION

“Technology is the application of scientific knowledge to the practical aims of human life”, or to change and manipulation of the human environment. The use of such technology to create various means of countless inventions that immerse our everyday lives and make them easier in terms of productivity. Moreover, the part of the technology that is coming to light and becoming a major shareholder in the innovation sector is Virtual and Augmented Reality platforms.

Virtual Reality (VR) in the field of using machine learning, mechanical data, and technology to create a simulated environment that mimics or realizes reality. It is a medium that puts you inside of the media. When VR is done well, the brain is going to treat that as if it were a real experience. It feels like a person is doing something. Humans are known to be visual creatures, and display technology is supposedly the biggest differentiator between Immersive V.R. systems and traditional U.I (user interfaces.) Today, Virtual reality technology is applied to advance professional fields of, engineering, architecture, education, medicine, design, training, and entertainment. The technology has been integrated in multiple ways across the design project like,

giving visually immersive spaces for people to experience the entirety of the facility without actually traversing. Also help them to visualize the different technological mediums the tech is used in like Omedical, engineering, building construction etc.

Augmented reality (AR) is an interactive experience that takes place in the real-world setting where the objects that reside in the real world are enhanced by computer-generated perceptual overlays, sometimes across multiple sensory inputs, including visual, haptic, auditory, somatosensory, and olfactory. Augmented reality (AR) is a blend of elements of the virtual environment with the user’s environment in the real-time AR can be defined as an operating system that fulfils three basic features: a combination of real and virtual realities, real-time interaction interface, and accurate 3D integration of virtual and real objects. The intention behind adding this digital information is to provide an engaging and dynamic user experience that is allowed with the input received from the users of various hardware items like smart glass, smart lenses, smart phones etc. The entirety of the field is focused on these three categories to help envelope the entire segment with the people, first is the real-time digital world, then is the immersion, and the last being real-time interaction between the people and technology.

These two technologies together can help push multiple boundaries and therefore need a global institution that’s capable enough to handle operations in all of India, as all the current sectors are minute and scattered all across India.

PHILOSOPHY

The Design Philosophy follows the lines of how technology will become a predominant driving factor led by Virtual and Augmented Reality.

The overall premise focuses on the different aspects of virtual creation and individually expands them for a clear understanding. The Design Concept of a project revolves around the aspect that the overall design will focus its base on, and follow the parameters set by the designer. Here, the concept is Computational and Parametric Design, where it’s the application of the above strategies to the design process. While designers traditionally rely on intuition and experience to solve design problems, computational & parametric design aims to enhance that process by encoding design decisions using a computer language.

This revolves around the main core of the project that entwines itself into the design, and that is the implementation of artificial intelligence. A.I., being the next step in a future that is governed to work on the systematic approach of all the

workings within the society, implements itself here and gives the project the watchword that it uses to further define the work and portray itself.

The word is “efficiency”, which is derived from the core of the research.

Efficiency is the overall ratio of the useful work performed by a machine or in a process of the total energy released or used or heat energy taken in. Thereby using this thought process to design, innovate and facilitate the overall workings of the institute, as well as the business is what this project aims to achieve. May it be in terms of energy-efficiency, or efficient working, the overall proceedings should be carried out in a way with minimal wastage of power and maximum value to be outputted.

MATERIAL

The Philosophy of the thesis assisted in bringing together the key components of the V.R. space, i.e. the concept of Computational and Parametric Design, the core of the project being artificial intelligence, and the key aspect being efficiency. But to further dive into the workings and the ideology of the project, four case studies are taken into consideration.

These four case studies help to identify:

1. To understand and visualize the informative aspects that are related to the project.
2. To deduce the unique architectural aspects as well as the characteristics that help us to better understand the workings of each of the projects in their section of work.

CASE STUDIES	INFORMATIVE ASPECTS	ARCHITECTURAL ASPECTS
BIG Designs : AI CITY	All the energy and water required for the facility, is generated within the facility using the natural elements and solar for water and electricity collection.	The use of nature and technology as one main aspect to integrate the facility into a more advanced and living space for residing.
PRISM : Housing Project	It also helps in deciding the various design elements other than structural like for residential, the number of different bhk blocks to be configured	The use of software with computational and parametric data for directly designing a project using software.
LXG Gaming Centre	It also shows us the various working of the events, and all the other services that a E-Sports hub provides other than just gaming services like, streaming etc.	The workings and program of a live e-sports centre in India with an arena, events as well as a LAN centre.
Gwynne Pugh Urban Studio	It helps us to understand the various services and programs for the entire facility as well as its nature and scale that it requires.	How circulation plays an important role in the user experience and also how site materials can make a huge difference in connecting the site to the structure.

Table-1 Correlative Matrix of case studies relating to V.R. Industry

Out of the four case studies, two of the case studies are based on foreign institutions, one is of an Indian institute and one is based on software exploring the core concept of the project being parametric and computational design.

For understanding the workings and vision for work in relation to this project, many literature reviews were taken into consideration, the key ones are mentioned below:

1. Provide the foundation of knowledge on the topic.

2. Identify inconstances: gaps in research, conflicts in previous studies, open questions left from another research.
3. Identify the need for additional research (justifying your research).
4. Identify the relationship of works in the context of their contribution to the topic and other works.

LITERATURE REVIEWS	INFORMATIVE ASPECTS	ARCHITECTURAL ASPECTS
As E-Sports Grow, so do their homes ARTICLE BY- Newzoo, Global Reporters	The overall focus to the revenue making aspect of the business and how they achieve it. Their take of proving future credibility of the brand for continued business. The major advantage of sponsorships and ads for getting the brand out and also generate income.	The space management and allocations that allowed all such events to take place. The correlation of the entire structure to the main purpose of esports and how it was being integrated within.
Technology Parks and their valid counterparts ARTICLE BY- Percento Technologies	The brief of how tech hubs help in Growing the economy of a country. The abundant scope of future credibility, growth and business development and also the overall upliftment of the company with the latest tech at their disposal.	Proper use of technology being incorporated in the infrastructure to maximize output. Large eye-catching facilities with huge aims and the necessary equipment to back it up.
Application of V.R. in Architectural building construction ARTICLE BY- Ahmad K.Bashabsheh	The brief of how there are various developments, not only in the field of architecture but also in other professional fields like, medical, Military, entertainment, etc.	Use of this technology to test the way the building will be made on site and test the feasibility of the building being actually able to withstand its design.

Table-2 Correlative Matrix of literature reviews

METHODOLOGY

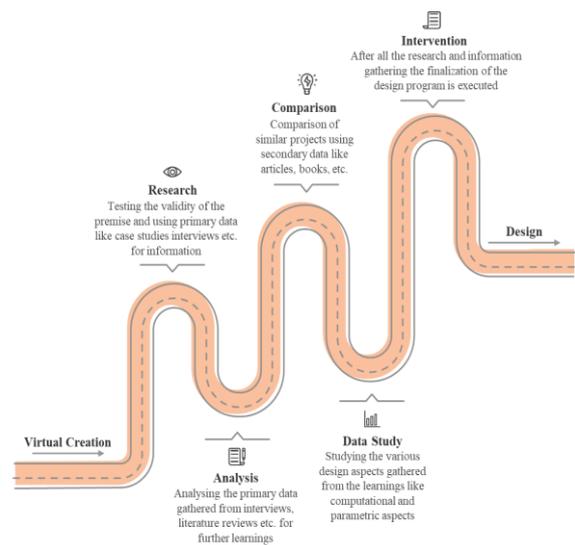


Figure-2 Methodology Road Map

The research would focus on the background of different fields following under virtual reality from the origin to their development and current scenario. The motive is to understand the spaces and functions of a technology centre through collecting information as per the requirements. Then through case studies, by reading about the existing centres and their functions and then coming to a design program and architectural intervention.

The Methodology follows a road map that briefly checks all the criteria to start, from the name of the topic to the final

design. The following are the pointers that were worked upon to move forward

1. **Topic-** The title of the research paper is what starts the overall wheel towards the working of the paper. A name relevant to the study as well as describing what it's all about is crucial for a well described and easy to understand study.
2. **Research-** To test the validity of the premise by studying, gathering information in the form of primary data and with the use of data like case studies, interviews etc.
3. **Analysis-** Inspecting the primary data that was gathered from the various data sources like literature reviews, case studies, interviews, etc. and cumulating all the learnings to further work on the prospect.
4. **Comparison-** Comparing similar projects that are built or in concept with the use of secondary data sources like books, articles, forums, etc.
5. **Data Study-** Studying the various design aspects gathered from the learnings like computation and parametric aspects as a form of design philosophy, to help carry forward the study, and at the end, the design.
6. **Intervention-** After all the research and information gathering, the finalization of the design program and also the design concept is executed.

SITE SELECTION

A site was required that would act as a national hub for the overall operations in the field of VR. and its subcategories. This led to the decision of choosing one of the two main I.T. hubs of India as that would make the utmost sense for such a facility to reside in. the two cities were Mumbai and Pune.

After comparing both their merits, Mumbai was chosen as the City Location, Bandra Kurla Complex was the one that was the most optimum area under the Suburban District.

B.K.C is fast becoming the country's most happening business-cum-leisure hub, the Mumbai Metropolitan Region Development Authority (MMRDA) is rolling out a Rs 1,000-crore road project to ensure cars moving in and out of the area aren't caught up in traffic jams.

The site was a commercial marked site by the 2014 DP plan as well as the plan provided by Adani Group of Builders in 2016.

The site was exactly what was required in terms of area required.

The site is located at 19.067N, 72.861E in terms of co-ordinates. the address of the site is Kolivery Village, University of Mumbai, Vidya Nagari, Kalina, Bandra East, B.K.C. road, Mumbai-400098

The site is the apt choice for the requirement of the design theory for it being a rather simple shape of a plot, the accessibility is great as it is located on the side of the road on multiple sides.

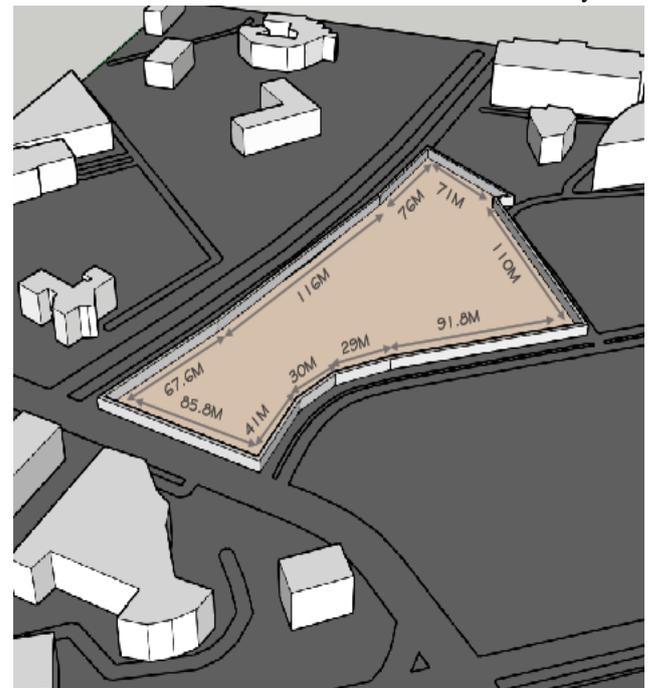


Figure-3 Site at B.K.C.

DESIGN CONTEMPLATIONS

The Research helped in deducing the factors that would play an important role in the further execution of the institute and the realization of the facility.

The interventions were Space, Philosophy, Interaction and Circulation.

1. Space-

Spatial experience is dynamic, and not only relies on what's constructed but also on what is not. Space is about ensuring one to focus on the right medium.

As an architect one is not sculpting building materials, as the primary medium is space itself. Perception is what the individual distinguishes on a rare and subjective basis.

Experiencing surroundings is a subtle act of the human body and mind.

We use our eyes to visualize a space, making thousands of subconscious computations every second. We scope it out using our senses and create an artificial mimic in our head.

Wayfinding, orientation, direction, etc. all come from visual clues.

Augmented Reality is where the virtual space combines both the realities and makes the static space in front of the users, useful.

2.Philosophy-

Philosophical analysis that uses definitive keywords to portray what the designer wants to accomplish, here using Computational and Parametric design as elements to push the design theory forward.

It's the main ideology that is studied, analysed, and followed while designing.

Computational design is the application of computational strategies to the design process.

While designers usually rely on intuition and experience, the computational design aims to enhance that thinking by solving the design decisions using a computer language.

Parametric design is an avant-garde, computer-aided style of architecture and urban planning in which the usage of spaces is considered parametrically variable (dynamic) rather than it being static.

In the Parametric stage of design, the foremost state of information is the configuration. This translates to, everything that is known about the designed object except its exact dimensions. at times it may be in some cases that the exact material choice is also unknown, though the basic class of material will mostly be included in the configuration information.

3.Interaction-

While architecture and interaction design have dealt with ontologically differently-the physical vs. the digital-this distinction is now being challenged. Ubiquitous computing, embedded systems, and the Internet of Things (IoT) are examples of how interactive technologies can be integrated into our physical surroundings.

Interaction and Architecture is about the design of engaging systems that takes an architectural understanding of interactive technologies as its main point of departure, and how such technologies act as architectural elements in the creation of engaging experiences as another point of departure.

Dynamic interaction is the implementation of design elements that create zones or meet-points within workspaces to remove the static environment.

4.Circulation-

Circulation is the area that is most accessible to the user. In this guise, circulation is often overlapped with other functions, such as a lobby, atrium, or gallery, etc. Circulation space is sometimes seen as a connecting space, adding a transition to the main areas. As a result, the word efficiency often goes hand in hand with circulation.

Elements such as elevators, escalators, and staircases are often referred to as circulation elements, as they are arranged and designed to optimize the flow of crowd through a building, sometimes using a core.

Circulation being the space before the highlight area, can be designed in a way that hints the upcoming space and create curiosity for reveal.

CONCLUSION

The study overall solves the first question asked, by giving brief introductions and use cases of all the subdivisions of V.R. It dives deep within the various aspects, describing the benefits and solutions for the issues all the said partitions are facing currently in India.

The study helps in giving a broad perspective and a brief towards all the facilities that come under Virtual Creation. It also helps in understanding its affiliations with almost all the fields in the near future and how it is important to embrace its workings and integration how the rest of the world has already implemented.

The study also helps in justifying the need of a landmark brand that would help to secure the future of said industries, like their counterparts in foreign countries have already established.

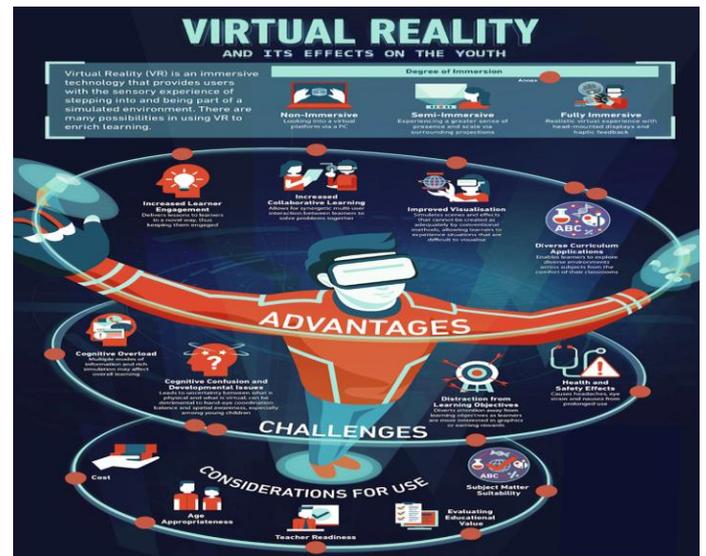


Figure-4: VR. Infographic: Source- Author

ACKNOWLEDGEMENT

I would like to thank my parents and my brother for encouraging me, giving me their support, and having trust in me. I would also like to thank my mentor, Prof Pushpagandha Shukla, for guiding me through my research and encouraging me to pursue my topic.

I would also like to thank Ar. Sailesh Pathwardhan Sir for guiding me in my path where I needed help in the thesis and providing me with the materials that he could offer me.



Figure-5: Dissertation Posters: Source- Author

REFERENCES

- i. <https://www.britannica.com/technology/technology>
- ii. <https://studyboss.com/essays/what-is-virtual-reality-2.html>
- iii. [https://www.accedo.tv/understanding-virtual-reality/#:~:text=Virtual%20Reality%20\(VR\)%20is%20the,t%20interact%20with%203D%20worlds.](https://www.accedo.tv/understanding-virtual-reality/#:~:text=Virtual%20Reality%20(VR)%20is%20the,t%20interact%20with%203D%20worlds.)
- iv. <https://www.imbibe.info/digital-realities/what-is-vr/#:~:text=What%20is%20VR%3F,or%20gloves%20fitted%20with%20sensors.%E2%80%9D>
- v. <https://in.linkedin.com/company/esfindia>
- vi. <https://blog.ipleaders.in/esports-in-india/thevrara.com>
- vii. <https://vizworld.com/2018/09/computational-design-bridging-design-thinking-ai-and-traditional-design-infographic/>
- ix. <https://www.debbieflevotomou.com/>
- x. <https://createralabs.medium.com/relation-between-interaction-design-user-experiences-human-computer-interaction-f3916a5d150c>

Analysis of ‘Climate Responsive Strategies’– Ingenious Way to Energy Efficient And Sustainable Architecture

Miss. Rashi Agrawal, Bachelor Of Architecture, Vth Year,
SMM College of Architecture, Seminary Hills, Nagpur-06
Email- rashi0401@rediffmail.com

Abstract: Energy is one of the most important stimulant in revenue generation, economic growth and social development in all countries. High performance architecture meets both “Comfort and Energy” issues to a maximum level. The application of climate responsive architecture is a strategy that can meet both issues. According to World’s Watch Institute data, buildings are responsible for annual consumption of 40% of World’s Energy. Energy conservation and Environmental quality have been widely acknowledged as important parameters of building designs. It describes broadly a few important components and its emerging trends to achieve Climate Responsive Design parameters influenced the Energy Efficiency of Buildings. This leads to reduction in the use of conventional energy by desirable utilizing day lighting and using appropriate thermal designs of building for space conditioning. Thus, this paper will be focusing on the Climate Responsive Strategies and various Design Parameters which aids in making the energy efficient buildings ultimately contributing to the sustainable architecture.

Key words- Climate Responsive Architecture, Sustainability, Energy Efficiency

1. INTRODUCTION

Climate change is one of the greatest challenges faced by human society in the 21st century. Architecture has an inherent role to play in this climatic crisis. Buildings, as they are designed and used today, contribute to serious environmental problems because of excessive consumption of energy and other natural resources. The close connection between energy use in buildings and environmental damage arises because energy intensive solutions sought to construct a building & meet its demands for heating, cooling, ventilation & lighting cause severe depletion of invaluable environmental resource.

Buildings contribute close to half of the energy use in the Country. Since energy is the number one contributor to global warming, an obvious way to mitigate climate change is to design low or no energy use buildings.

Climate change triggered by global warming is expected to have widespread consequences and subsequent usage and over loading of conventional energy resources. These effects will have major impacts on ecosystems, health and water resources. As such it is clear that architecture tribute to the climate change that has to be viewed and reviewed critically to work out mitigating methods.

Buildings consume energy at different levels in every stage of life cycle. Approximately half of all non-renewable resources

(water, energy, and raw materials) mankind consumes are used in construction. Contemporary human civilization depends on buildings and what they contain for its continued existence, and yet our planet can’t support the current level of resource consumption associated with them. To tackle climate change, carbon dioxide emissions can be reduced by changing the way buildings are designed, constructed, managed and used. The climate responsive architecture aims to design the optimized building according to the specific characteristics of that particular site, to minimize extreme energy use and have a reduced impact on the natural environment. The application of climate responsive building elements in building design practice is still limited. Barriers are their innovative character and the lack of dedicated knowledge on the synthesis of design, building performance and implementation in the design process. They can be overcome by means of design strategies to assist designers during design process.

2. IMPORTANCE OF CLIMATE RESPONSIVE DESIGN

In today’s context, designers are increasingly focused on how to create structures that have less impact on the natural environment. Climate-responsive architecture is a design practice centered on creating buildings that function in lockstep with the local climate. It is simple in concept but more complex in execution. While every project is unique, especially when it comes to the site-specific environmental conditions, there are several practices to follow for designing a climate responsive building.

The goal of climate-responsive architecture is to create a comfortable interior while reducing the building’s reliance on artificial energy. The climate responsive building design reflects the weather conditions in the precise area where the building is constructed (Figure 1). Climate responsive design utilizes data on the region’s weather patterns and accounts for factors like seasonality, intensity of the sun, wind, rainfall and humidity

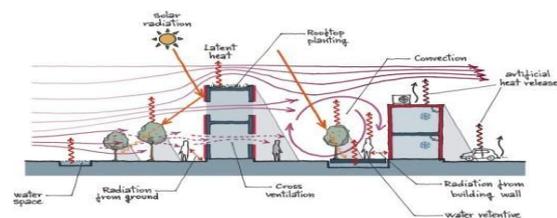


Figure 1. The change of climatic conditions surrounding the building depending on the location of the building

Clothes hold much more meaning to us than the need for thermal protection, starting simple, but how many original functionality features are lost to the concept of fashion. Buildings, too, means more than the need for a comfortable place to live. Like fashion it now often represents a status symbol. As that symbol, it must adapt to the established standards of status like convenience and leisure and sometimes ignoring basic functionalities like the environment. Thus, Bioclimatic architecture deals exclusively with building design and materials to achieve energy efficiency.

The climate-responsive strategies implemented in vernacular architecture from different regions have the potential for being further developed and could be adapted in answer to contemporary needs. Therefore, based on the need of designing buildings adapted to a specific climate and territory, it is pertinent to study vernacular buildings in order to develop and integrate their design strategies in the up-to-date construction context, contributing to its sustainability.

3. ACHIEVING ENERGY EFFICIENCY THROUGH VARIOUS PARAMETERS

With an approach from a genuinely sustainable perspective to create buildings that respond directly to their unique place, the process begins with climatic data rather than just architectural sketches. By addressing the questions such as “determining the sun’s position in the sky at a given time and season?”, “How much rain falls on the site each season?” and “What effect will the wind have on the building keeping in mind the occupant’s comfort?”. The building should be adaptive to changing environmental conditions to meet its functional requirement and to provide comfort. To do so means going back to the basics and looking how the design of a building is optimized to the particular features of a specific site to minimize the potential of extreme energy use.

3.1 CLIMATE RESPONSIVE AND ENERGY EFFICIENT CONSIDERATIONS IN BUILDINGS-

The design parameters influencing the energy consumption of the building are as follows-

- 1. Sustainable site development:** - Generating less waste, using less resources and less impact on landscape.
- 2. Water savings:** - Rain water harvesting, soft paving’s and recharging water table.
- 3. Material Selection:** - Minimize cost and meeting performance goals.
- 4. Energy efficiency:** - Less energy use, eliminating energy waste and lowering cost on

households.

5. Indoor environmental quality: - Provide comfortable living by humidity control and temperature control.

3.2 STEPS INVOLVED IN ACHIEVING CLIMATE RESPONSIVE DESIGNS AREAS FOLLOWS-

3.2.1 SITE POTENTIALS

An architectural site analysis will look at issues such as site location, size, topography, zoning, traffic conditions and climate. The analysis also needs to consider any future developments, or changes to the sites surroundings, such as a change of roads designations, changing cultural patterns, or other significant building developments within the area. Understanding the context of a site is a key to enabling the designer to weave the new design in with the existing fabric of the site. It allows us to understand the existing opportunities, or problems in a site, and make informed decisions on how to respond to our findings. This response could be that the designed building reflects the surrounding context and also to understand the ramifications of the buildings through site analysis.

3.2.2 SUN PATH

The building should be placed considering the cardinal directions. The goal is to maximize the amount of sun that heats space in the winter as well as decreasing the amount of sun in the summer to reduce the less reliance on mechanical energy for cooling and heating.

3.2.3 ORIENTATION OF WINDOW

Buildings with façades facing the south should use a window area appropriate to their orientation, and glazing should use a double or triple-panelled Low-E-coated glass. In the hottest months, it minimizes the amount of heat transmitted into space while keeping heat inside during the cooler winter months.

3.2.4 BUILDING FOOTPRINT

Building should have minimum footprint and to achieve this, architects should design the buildings to be multi-functional. The building will have fewer excavation costs and more wall areas, that can benefit from the sun’s warming effects along with an increase in natural day lighting.

3.2.5 ACHIEVING COMFORT THROUGH VENTILATION (NATURAL)

Natural ventilation plays a significant role in providing optimum indoor air quality and maintaining acceptable thermal comfort without the aid of mechanical systems, building can be cooled by designing for stack ventilation to draw cooler air from low building openings to protect from

warm air rises while carrying heat away through openings at the top of the space. The rate at which the air moves is a function of the vertical distance between the inlets and outlets, their size, and the temperature difference over the room height.

3.2.6 ACHIEVING COMFORT

By adapting the above parameters, it can be achieved naturally. With climate responsive design, the amount of energy used to cool and heat the building is reduced by dependence on using natural systems, the sun, and the wind.

4. ANALYSING THROUGH A CASE STUDY

India is a home to a variety of climatic regions and has its own share of energy-efficient and climate responsive designs. The climate of India can be segregated into 6 climatic zones: Hot and Dry, Warm and Humid, Moderate, Cold and Sunny, Cold and Cloudy Composite. Based on the climatic zones, architecture and design elements have gone through various modifications to create comfortable spaces.

Here is an example of climate responsive architecture Located in Leh, in upper Himalayas, Designed by Arvind Kishan & Kunal Jain. The building required to be heated almost throughout the year. It has a long winter from October to April (Figure 2).



4.1 Degree College and Hill Council Complex, Leh by Ar. Arvind & Kunal Jain (Cold and Sunny)

Figure 2. View of a college amidst Himalayas

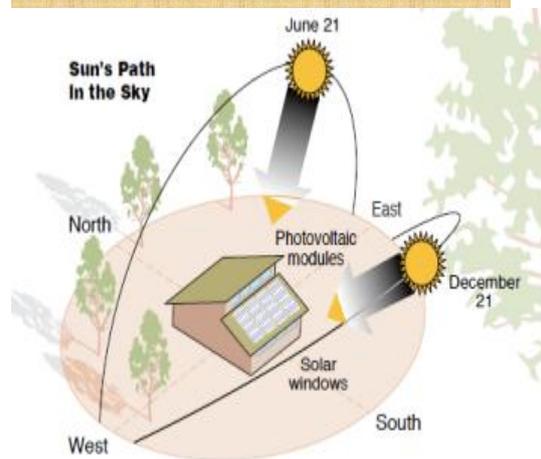
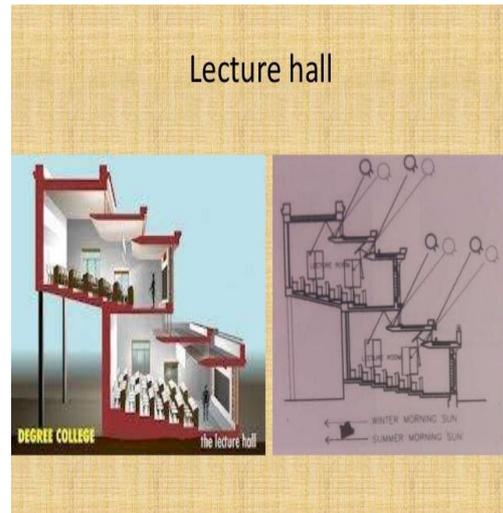
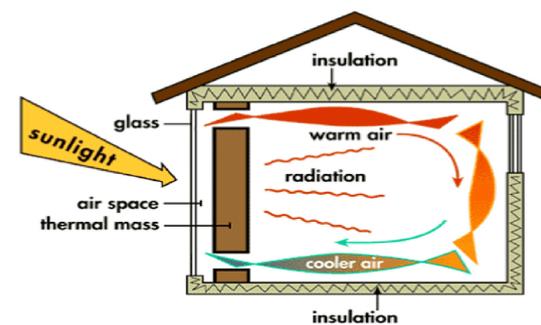


Figure 3. In cold climate, heat gain is desirable, hence , building is located on the south slope of the hill for the better access to solar radiation.



The institution is built on a rectangular site that is along the north-south direction and is surrounded by snow-capped ranges on all sides. The individual structures are oriented in various directions and treated specifically based on their orientations. However, the buildings on the north side of the complex have thick walls to minimize heat loss and those on the south side maximize heating and daylight distribution (Figure 4).

Trap maximum heat from sun

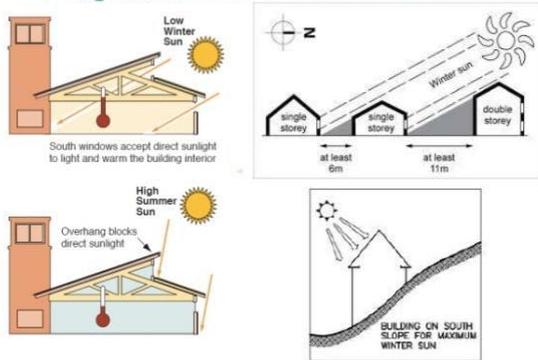


Figure 4.South facing glazed windows admits direct sunlight to light and warm the building interior.

The openings have been maximized to tap into natural light sources and the double glazing helps control loss of heat without condensation. Ventilation is achieved through a connective loop activated by buoyancy and it is also coupled with cross ventilation through the eastern-western fenestration. The usage of Trombe walls, glass, and insulation on the roof allows the building to attain internal thermal comfort based on the conditions outside.

The street should be wide enough to ensure that building on side should not shade those on the other side. The street orientation should be east-west to allow for maximum south sun to enter the building.

Figure 5: Slabs are at different levels to get maximum intake of sunlight.

Figure 6: Section explain trombe wall, roof insulation for cold climate

CONCLUSIONS

“Every time we design is a response to the specific climate and culture of a particular place.”—by Norman Foster.

The goal of climate responsive designs should be to design buildings that use proper strategies to create Buildings have a significant and less share in total energy consumption as they have a profound impact on environment. Impacts of various design strategies have been explored. It describes broadly the few more important components and its emerging trends to achieve energy efficiency in buildings. Besides ,it also throws light on day lighting, ventilation, sun path, effective materials and micro climatic changes for comfort conditions and for

conserving the energy. Steps like above should be taken to achieve reduction in emissions in the most cost effective manner. When passive design principles are established correctly the need for lighting, cooling and heating is reduced which allows the use of smaller and more efficient building systems and technologies.

ACKNOWLEDGEMENT

I am highly thankful to our learned faculty **Ar. Seema Burele** for her active guidance throughout the completion of research paper.

Last but not the least, I would also want to extend my appreciation to those who could not be mentioned here but have well played their role to inspire me behind the certain.

REFERENCES

- i. Looman, remco (2017), *climate responsive designs, Tu delft*
- ii. Krishan, Arvind, (2001), *climate responsive architecture, Tata Mcgraw*
- iii. <https://sustainabledevelopment.un.org/>
- iv. <https://www.remeha.co.uk/Legislation-support/Energy-efficiency/Why-is-energy-efficiency-important>
- v. <https://www.rockwoolgroup.com/our-thinking/blog/the-benefits-of-energy-efficient-buildings/>
- vi. <https://www.re-thinkingthefuture.com/fresh-perspectives/a1060-what-architects-must-know-about-climate-responsive-architecture/>
- vii. <https://cdn.intechopen.com/pdfs/53557.pdf>
- viii. www.re-thinkingthefuture.com
- ix. www.yumpu.com

Optimal Healing Environment – Accelerating Patient Recovery by Changing The Built Environment

Revati Dass

Fifth year Student, Dr. D Y Patil College of Architecture, Akurdi Pune

Ar. Mihir Vakharia

Assistant Professor, Symbiosis Skills and Professional University, Pune

revati.sd09@gmail.com, mihir.va@gmail.com

Abstract

This paper is an assessment of structured scientific evidence and findings into the healthcare environment and its impact on the patients' health. Research into Evidence Based Design (EBD) visibly demonstrates the significance of built environment in a healthcare setting. As such, an intensive study of EBD attempts to understand the fundamentals of an optimal healthcare setting, and this paper seeks to prompt detectable biological changes in the patients' body via environmental triggers to accelerate their recovery. While there is limited scientific research confirming design solutions for the configuration of healing spaces, this paper strives to reveal relationships between the body and the confining built form.

Keywords: Evidence Based Design, healing architecture, optimal environment, biological component, recovery

Introduction

The World Health Organization (WHO) has estimated in a report that thirteen million deaths annually are attributed to preventable environmental causes [i]. The report also estimates that 24% of the global disease burden (healthy life years lost) and 23% of all deaths (premature mortality) can be attributed to environmental factors, with the environmental burden of diseases being 15 times higher in developing countries than in developed countries, due to difference in exposure to environmental risks and limited access to health care.

The physical environment affects people's behaviour and wellbeing. The effects could be noticed by the untrained eye, but some effects required close and keen observation. Some effects can negatively influence wellbeing, decision-making, mental and physical health; although many alterations can also be positive. People may be unaware of the real triggers for changes in behaviour, mood, and wellbeing; as most of these alterations are not generally associated with physical space.

Fuelled by the trend of evidence-based design (EBD), research on healthcare facilities has steadily increased over the last 20 years. The research in this specific area is sparse, even though legal precedents have spoken to the

need for quality environments for many years. Even though environmental psychology has been studied, detailed research to understand the impacts of architecture on the brain using neuroscience is limited. However, from this limited study of the interaction between human health and the environment, environmental risks have been proven to significantly impact human health, from direct or indirect exposure to harmful agents which can affect human life or subtly change life sustaining ecosystems.

Acknowledging the scale of impact sensitive architecture can have on healthcare is an important beginning to laying out the guidelines that support the objectives in the design of health care structures. One of the ways this can be done is by studying the biochemical reactions that support and accelerate healing in our body and learning to trigger them externally, by moulding the environment. Through comprehensive study, a directive can be formed that is specifically calibrated for a healthcare environment.

The environment, which has become the causation of disease and bad health, can in fact be nurtured to be an active participant in healing the human body, mentally and physically.

Literature Review

Article	Study Design	Light type	Study population	Length of stay (in days)	Significance
Bemachemin & Hays (1996)	Naturalistic observation	Daylight	174 admissions	Dim : 19.5 Bright : 16.9	Significant difference of 2.6 days
Benedetti et al. (2001)	Naturalistic observation	Daylight	602 unipolar and bipolar depressed inpatients	Dim: 23.5 Bright: 19.8	Significant difference of 3.7 days
Choi et al (2012)	Observational	Daylight	1167 patient data sets	Shorter in bright rooms with 16-31%	Significant shorter stay in bright rooms
Jourder & Price (2013)	Observational experiment	Daylight	263 patients	Increase of 100 lux, reduction of 7.3 hours	Significant reduction by increasing lux
Gbyl et al (2016)	Preliminary study	Daylight	29 patients	Dim : 58.8 Bright: 29.2	Significant difference of 29.6 days
Vercelles-Ruiz et al (2014)	Observational study	Daylight	3344 patients	Dim : 13.3 Bright: 13.0	No significant difference



(Table 1: Included studies with length of stay with the main characteristics)

Certain light experiments were carried out on the roof of The State Hospital in Copenhagen in the period 2011 - 2013. Here, approx. 70 m above the ground, there is an unobstructed view of the horizons. A prototype light station is installed and mounted, consisting of 8 rooms which are single-bed wards and serve as light laboratories in the experiments. On the whole, it seems as if this strict EW-orientation is based at equinox, and overlooks our northern latitudes and the specific variations that exist here, overlooking the importance of the northern winter sun. Instead, this study suggests that the orientation which utilizes the winter sun, with facades facing the winter east, better balance and distribute the morning sun and the evening sun throughout the year. Finally, the experiments show that the asymmetrical planning of building form, light openings and facades, can help balance large variations in the morning and the evening light better, throughout the year.

Methodology

In method, this paper can be a comparative case study, in retrospect. The research strategy is based on mixed method research with source material being quantitative descriptions, based on historical data and literature. Existing literature has been thoroughly reviewed and the relevant data has been retained to write literature reviews, thereby forming the basis of this paper. Interviews with surgeons, doctors and healthcare workers were conducted, and their insight has been used to formulate the contents of this paper accurately and realistically.

The promotion of release of healing chemicals in the body was prioritized; hence, these particular chemicals were identified. Once the chemicals were narrowed down upon, research was conducted on how to trigger these chemicals via environmental factors. The ascertained environmental factors have been outlined in this paper and their role in healthcare settings has been highlighted sufficiently.

Main Body

An individual is constantly in a involved tandem with the multiple environments surrounding them. For instance, a warm room can cause people to sweat, feel uncomfortable, and unable to concentrate. A dark room can make people feel afraid, stay alert, and unable to relax whereas a classroom well lit with natural light can help students be attentive in class.

The environment always affects the individuals who occupy it, at some level or the other. This interrelation can be named as an architecture-individual relation. people and spaces are in a symbiotic relationship, and can change each other. this relationship is called 'architecture-individual' or individual-architecture' depending on which variable is affecting the other more. Therefore, this relation is a two-way path. This intricate relationship is similar to a cell-environment chemical one. Cells are

dynamic, with their configuration adjusting to the environment around them. The same thing happens to all living being, since we are essentially made of cells. "The evolutionary success of an organism is a testament to its inherent capacity to keep pace with environmental conditions that change over short and long periods" (Brooks et al. 2010).

Virtually, any characteristic of the environment can have a supportive or detrimental effect on human (psychological or physical) performance and hence, on patient safety in healthcare. For example, if we consider lighting; a recent study correlated the relationship of medication errors to lighting levels. As lighting intensity approaches 1,500 lux, [ii] the incidence of medication errors dramatically decreases. Poor lighting and the lack of daylight are linked to depression, increased need for pain medication, medication errors [iii] Health care-acquired infections are related to air quality, ventilation rates, the presence of handwashing stations, the number of room occupants, and finishes. [iv] Landscape design has direct application to many health care environments. Even something as minor as the form of a pathway, be it straight, crooked or convoluted can affect the time and the safety of the staff. Exposing nurses to nature vs. non-nature views decreases their stress levels and enhances their awareness to errors. [v]

Fundamental shifts are taking place in the way we evaluate architecture in relation to health. The emergence of a more holistic definition of health and 'disease' acknowledges that causes of ill health are not simply physical and that wider environmental issues are at play. In architecture, a more sophisticated understanding of the interaction of people and space has given rise to the development of theories which include the importance of the individual and their feelings and emotions.

According to the WHO, four major diseases are currently threatening the modern world today; cardiovascular diseases [vi], cancer [vii], obesity and depression. All of these diseases are affected by light and can be treated with light. For both, cardiovascular diseases and cancer, there seems to be a striking correlation between latitude and dissemination. The further away we move from the equator, and the UV light of the sun, the more the cholesterol levels increase, also increasing the mortality from cardiovascular disease and several types of cancer. Sunlight seems to play a role – albeit an uncharted and equivocal one- in the development of these diseases.

1. Vitamin D

The vitamin D is, in actuality, not a vitamin at all. It is originally misclassified as a vitamin and is a steroid hormone, that is, a substance which the body – unlike

vitamins – can synthesize by itself. The UV-light of the sun converts 7-dehydrocholesterol in the human skin to an inactive "Vitamin D", which in turn, via the liver and the kidneys, is converted to the active Vitamin D3. The formation of Vitamin D3 is therefore not the result of the sun alone, or for that matter a result of the body alone, but the result of a complex collaboration between the body and the environment.

2. Melatonin

Melatonin is secreted by pineal gland and defines what is called the 'biological night'. Light inhibits the production of melatonin, thereby exhibiting a higher level of activity in the pineal gland during the daytime. As diurnal creatures, this enables us to utilize the daylight, being more alert, both physically and mentally. Conversely, the lack of light during the day results in higher melatonin levels and lower levels of activity, which in turn may result in low recovery rate and impaired sleep, increasing the risk of diseases. Various observations [viii] with subjects show that the bodily circadian rhythm is approximately 24.5 hours by nature. Light acts as a cue – a signal – for the body to wake up; synchronizing the circadian rhythm to the physical world, shortening the rhythm to correspond to the rotation of the earth around its axis.

3. Serotonin

Serotonin [ix] can be termed as a happiness-hormone, and as such, it helps to regulate mood, appetite, pleasure and memory. Serotonin is an important hormone for our general well-being and for our health, and can help in the treatment of both Seasonal-Affective-Disorder (SAD) that usually begins from November to spring, and depression. In the low light during the winter, serotonin is transformed into melatonin. Serotonins being a precursor to melatonin, the levels of serotonin in the body are lower. The lack of serotonin results in mental discouragement, just like the presence of melatonin causes fatigue. The result is a depression like state, which ceases once the natural light levels in the environment start increasing. This in turn increases the levels of serotonin, which again increases the overall well-being

Inferences

After conducting several interviews with doctors, healthcare workers and patients to gather data, experiential reviews suggest that exposure to the right environmental attributes, such as natural light and visual access to greenery help boost patient morale as well as trigger recovery. While this theory has always been subconsciously working on our minds, the study of various literature materials establishes the relationship between the natural healing capacity of the body and the environment, especially the presence of daylight.

Conclusion

The brain and body are constantly adapting to the external stimuli from the environment to improve chances of survival for an individual. Architecture, as a field that provides for the essential requirements of humans, now needs to adapt to the environment as well, in order to create sensitive spaces, contributing to the better health of the human race. Combining different fields like architecture and neuroscience could result in innovative healthcare spaces that may contribute passively to fighting healthcare disorders.

Acknowledgements

In preparation of my research paper, I received much needed help and guidance from some esteemed people, for which I am deeply grateful. I would like to thank my colleague, Mugdha Phalak for her support and peer review and Dr. Aaditi Gokhale (PT) for her valuable insights and constant guidance. I would also like to extend my appreciation to the institution of Dr. D. Y. Patil College of Architecture, Akurdi, Pune for the opportunity to conduct research and write this paper.

References

- i. World Health Organization. *Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease.* WHO | Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks
- ii. Buchanan TL, Barker KN, Gibson JT, et al. *Illumination and errors in dispensing.* *Am J Hosp Pharm* 1991; 48 2137-45. *Illumination and errors in dispensing - PubMed (nih.gov)*
- iii. Benedetti F, Colombo C, Barbini B, et al. *Morning sunlight reduces length of hospitalization in bipolar depression.* *J Affect Disord* 2001; 62: 221-223. *Morning sunlight reduces length of hospitalization in bipolar depression - PubMed (nih.gov)*
- iv. Noskin GA, Peterson LR *Engineering infection control through facility design.* *Emerg Infect Dis* 2003; 3: 18-26. *Engineering infection control through facility design. (nih.gov)*
- v. Debajyoti P, Harvey T, Barach P. *The impact of exterior views on nurse stress: An Exploratory Study.* *Health Environments Research and Design Journal* 2008;2:27-38. *Relationships between exterior views and nurse stress: an exploratory examination - PubMed (nih.gov)*
- vi. Wang TJ, Pencina MJ, Booth SL, Jacques PF, Ingelsson E, Lanier K, Benjamin EJ, D'Agostino RB, Wolf M, Vasan RS. *Vitamin D Deficiency and Risk of Cardiovascular Disease.* *American Heart Association, 2008.*



*Vitamin D Deficiency and Risk for Cardiovascular Disease
(nih.gov)*

- vii. *Giovannucci E, et al. The epidemiology of vitamin D and cancer incidence and mortality: A review (United States). Springer 2005
The epidemiology of vitamin D and cancer incidence and mortality: a review (United States) - PubMed (nih.gov)*
- viii. *Sack RL, Brandes RW, Kendall AR, Lewy AJ. Entrainment of Free-Running Circadian Rhythms by Melatonin in Blind People. The New England Journal of Medicine, 2000.
Entrainment of free-running circadian rhythms by melatonin in blind people - PubMed (nih.gov)*
- ix. *Berger, Miles et al. The expanded biology of serotonin. Annual review of medicine vol. 60 (2009): 355-66.
The Expanded Biology of Serotonin (nih.gov)*

Container Housing : Study Of The Economic Feasibility of Container Housing In Pune.

Ar. Ramiya Gopalakrishnan, Dr Vaidehi Lavand
SMEF'S Brick School of Architecture, Pune
Email: riddhig31@gmail.com

Abstract:

The prospect of container housing remains unexplored in India. In countries like Russia, container housing has provided homes to thousands of people. This research paper aims to determine if any kind of container housing scheme would be feasible in an urban context of Pune with a vast palette of user groups. The methodology adopted is surveying the urban population and case studies of the existing container housing to analyze how and if they are viable. This research will prove beneficial in expanding knowledge about the various housing schemes and might be a useful tool in the transition from traditional low-cost housing to container Housing.

Key words – Container Housing, Affordable, Mass housing, Feasibility, Vast user palette, Container housing schemes

INTRODUCTION

A shipping container is a reusable transport and storage unit made primarily out of corten steel. It carries several materials like chemicals and fuel across locations and countries by road, rail, and sea. These containers are used in industries like construction, mining, logging, farming, etc. “There are more than 20 million containers around the world, and the world container fleet is growing by 3.9% every year” [1]. This means that almost 65,000 shipping containers are produced in the world every month. “Of those 17 million containers, however, only six million are being used for transport or any other practical usage. That means approximately 11 million shipping containers are unused and are just sitting stagnant all over the place.”[2]. The cost of transporting these containers back to the port exceeds the manufacturing cost due to which these containers are abandoned and auctioned off. As shipping containers are built to withstand heavy loads, their cheap and easy acquirement makes them a desirable alternative to traditional construction material.

Shipping containers usually come in two sizes - 20x8 ft and 40x8 ft. Even with the size restrictions, several container housing technologies have come up, opening this field to innovation and discoveries.

In India, the lack of awareness about container housing keeps us from exploring a probable solution to the majority of affordable housing problems. In an urban context like that of Pune, finding a decent and affordable residence might be difficult. The misconceptions about the aesthetic appeal, comfort, and life quality in a container house hinder people's

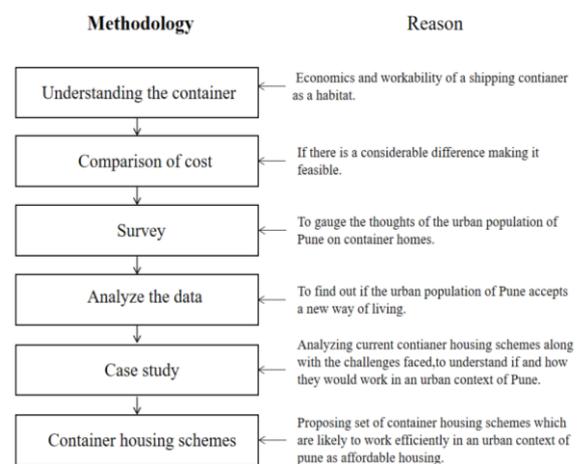
thought processes preventing them from making an informed decision. One way to overcome this problem is to demonstrate the advantages of container housing over traditional brick and mortar.

There is previous evidence of studies done on the usage of containers as affordable housing; however, the Working of a Container housing scheme in an urban context of India has not been studied directly.

This research aims to study the feasibility of container housing schemes for different user groups in Pune. The research is conducted through a case study of the existing container housing to understand their working. The cost of living in traditional houses is assessed by taking interviews and compared with that of container housing. After analyzing the cost of such various housing schemes, the feasibility of container housing in Pune will be determined.

METHODOLOGY

Previous research papers have been studied to understand the costs related to container housing .A survey is conducted among the urban population of Pune to gauge their take on the viability container housing.



Flowchart 1 : Methodology used For the research and its significance

I Comparative analysis between traditional and container housing

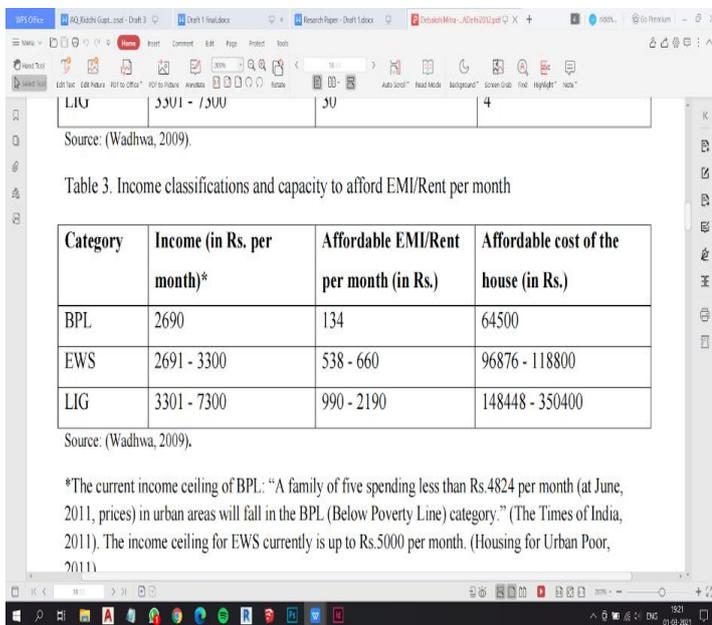
Various cost incurred	Container house (400 sq ft)	Traditional house (400 sq ft - 1BHK)
Cost of transportation	Rs 15,000	N/A
Cost of buying the property	Rs 1.5 Lakh	Rs 30 Lakh
Cost of Interior works	Rs 5 Lakh	Rs 10 Lakh
Cost of utilities	Rs 500 /Month	Rs 500 /Month
Cost of maintenance	Rs 800/Month	Rs 1500/Month
Any extra cost incurred(Workmanship, Transportation etc.)	Rs 20,000	Rs 20,000

Factor	Shipping container home	Traditional house of same area
Cost incurred	One time - Rs 7,00,000 Recurring - Rs 1300 / Month	One time - Rs 40,00,000 Recurring - Rs 2000/Month
Structural stability	Structurally durable if stipulated amount of openings are provided and load is calculated properly in case of vertical stacks.	High structural stability due to rigid nature of construction technique used.
Life span	35 Years	50 years
Usage if space	Constricted due to form of house.	Space seems to be larger as the form allows for multipurpose activities.
Security	Comparatively less secure as these homes are most likely standalone structures .	More secure as such homes are part of a larger community
Thermal comfort	Moderate - The interiors of a shipping container are coated with a protective lacquer varnish and an epoxy resin base. These provide insulation essential for thermal comfort .Less flexibility to install thermal devices.	High - Excessive flexibility to cater to temperature variations naturally or installation of thermal devices.
Ease of maintenance	Due to lack of architectural features and projections,maintaining exterior surfaces is easier.	Maintenance is slightly tedious.
Lighting conditions	Moderately lit interiors due to restriction on amount of openings.	Well lit interiors as there is no restriction on opening size (In a framed structure)
Scope for future expansion	The modular construction makes it easy for the user to add more sections to increase the space later if so desired.	It is difficult to expand in future due to structural constraints

Table 2 - Comparison of cost incurred between Container house and traditional house of same area.Source - Data collected through survey.

Table 4 - Comparison between Container house and traditional house of same area on various parameters.

Source: Data collected through survey.



Source: (Wadhwa, 2009).

Table 3. Income classifications and capacity to afford EMI/Rent per month

Category	Income (in Rs. per month)*	Affordable EMI/Rent per month (in Rs.)	Affordable cost of the house (in Rs.)
BPL	2690	134	64500
EWS	2691 - 3300	538 - 660	96876 - 118800
LIG	3301 - 7300	990 - 2190	148448 - 350400

Source: (Wadhwa, 2009).

*The current income ceiling of BPL: "A family of five spending less than Rs.4824 per month (at June, 2011, prices) in urban areas will fall in the BPL (Below Poverty Line) category." (The Times of India, 2011). The income ceiling for EWS currently is up to Rs.5000 per month. (Housing for Urban Poor, 2011)

Table 3 - Income classifications and capacity to afford EMI/Rent per month. Source: Data collected through survey.

- Contrary to popular assumption, shipping container houses can be modified according to the user requirement and planned to be larger in floor plate. The standard size of a container makes it easier to repeat the module horizontally as well as vertically.
- Large container housing communities from the government could be a beneficial scheme for affordable housing. The discarded containers are available at a minor cost which can be transformed quickly into a livable space after proper cleaning and sanitation.

II CASE STUDIES

To understand if container housing can provide substantially affordable housing solutions for all user groups,case studies of different kinds of container housing schemes have been conducted.

Project type: Private residence
User group - LIG/MIG Single Family Owner of house
Size: 1050 sq ft

A. SEA CONTAINER HOUSING , DC



Image showing the Sea container housing project.Source:[5]

Project name - Sea container housing,DC
Architect - Travis price architects
Location - Washington DC
Project typology - Student dormitory
User group - Students who need a cheap temporary housing

B. DRIVELINE STUDIOS



Image showing the Drive line studios project.Source:[6]

Project name - Drive line studios
Architect - LOT-EK
Location: Maboneng, Johannesburg,South Africa
Project Type: Residential and Retail building
User group - LIG section of the society
Size: 75,000 Sq Ft

C. CONTAINERS OF HOPE



Image showing the Contianers of hope.Source:[7]

Project name - Containers of hope
Architect - Benjamin Garcia Saxe Architecture
Location: San Jose, Costa Rica

S.no	Case study	Type of container housing scheme	Advantages of a similar scheme in The context of pune
1	Sea container house,DC	Small scale temporary affordable housing.	In parts of pune which are educational and business hubs,finding a affordable space to stay is difficult.Due to this,travelling long distances has become a necessity,Providing such affordable housing schemes win such areas will reduce the traffic load and reduce urban sprawl
2	Driveline studios	Mass housing for Low income group of the society.	This type of contianer schemes will reduce the development of slums in city areas and provide a better living community for the EWS of the society.
3	Containers of hope	MIG and HIG single owner/family residence.	This type of contianer housing scheme will help in providing comparatively larger homes for people in contextual locations where the traditional homes and constructions cost are high.

Table 5 - Summary of case studies showing advantages of similar scheme in context of Pune.

Source: Data collected through survey.

III DATA COLLECTED THROUGH SURVEYS

The aim of the survey was to determine the awareness about container housing among people and their perception about it.

- According to the survey, more than 70% of the Urban population of Pune lives in apartments.The usual area of apartments for the MIG and HIG ranges from 700 Sq ft - 5000 Sq ft.

III-A Awareness about container housing among the urban population of Pune.

- According to the survey conducted, 62 % of urban population of Pune is not aware of the concept of a container house.
- Almost 85 % of the population prefers to live in a container house as a holiday getaway and only 11% would want to explore this option as a home in the city. This could be a result of the fact that Container housing in India is introduced not as a housing module but as a space for small setups like ticket office, public washroom, construction site office etc.

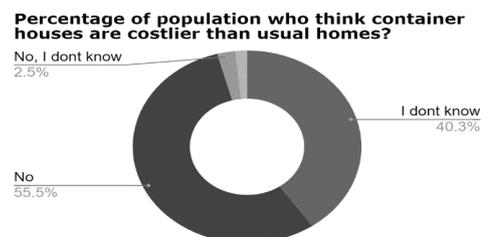


Figure 1:Chart showing percentage of population who think container houses are costlier than usual homes.

III-B Choice of Living in a container home

Preference of living in a cheaper container house over traditional house in densely populated area.

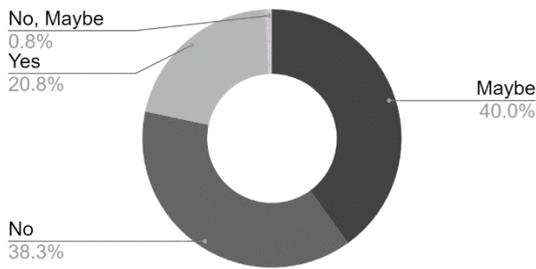


Figure 2: Chart showing preference of people to live in a cheaper container house.

This result reflects on the way people perceive living in a container house. In most sections of the society the need to reinvent the lifestyle is not felt, and when it is, these new ideas are shunned by the society.

Choice of different age groups to live in a container house

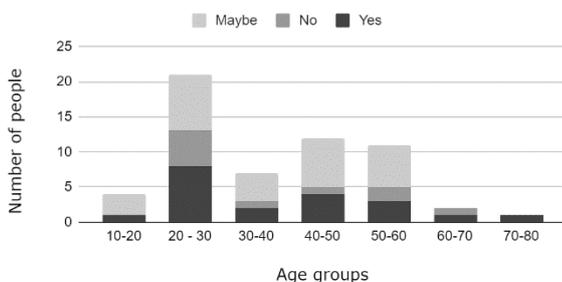


Figure 3 :Chart showing choice of different age groups in a container house

Figure 3 shows that the population between the age group of 20-30 years is most likely to make the shift to container house more comfortably. The likeliness of living in a container house keeps decreasing with the age group which is majorly due to the fact that people are set in their ways of living and are skeptical about changing them.

III-C Perception of container housing among urban population

Reason of Unpopularity of container homes among MIG and HIG of people in India.

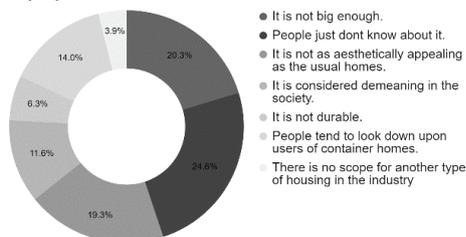


Figure 4 :Chart showing reason of unpopularity of container housing among MIG and HIG

- Even though a shipping container is available in standard sizes, they are often combined to form large homes for single family residence as well.

Reason of the unpopularity of container homes among people of the EWS of the society.

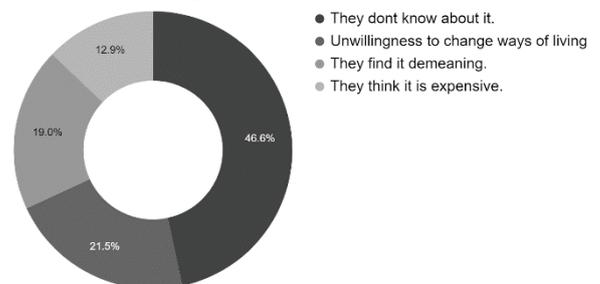


Figure 5: Chart showing Reason of unpopularity of container housing among EWS.

- Almost 20% of the population also believes that this section of our society is unwilling to shift to a new habitat. Another large part of the reason is that the people find living in such a house demeaning in the society.

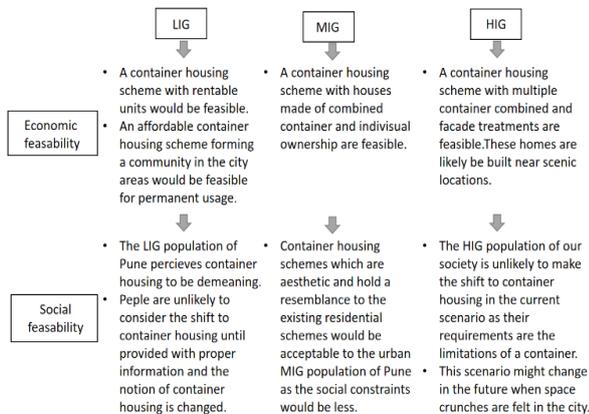
ANALYSIS

“On October 16, 2017, the Government of Odisha, a state located in eastern India, ordained “The Odisha Land Rights to Slum Dwellers Act, 2017”, a landmark and historic legislation, which aims to grant in situ land rights to 250000 households living in about 2500 slums in the state”[8]. Within a few months of implementation, the government saw vast changes in the sanitation and cleanliness scenario.

- This is one among the many examples showing that the people in India feel a sense of belonging to a place when they do not have the fear of relocation.
- According to table 3, affordable EMI/month ranges between Rs 500 - 2000. The average rent of a traditional House of 320 Sq ft in Pune is Rs 6000/month. This means that to create an affordable container housing community for the EWS and LIG, the rent/month should be less than Rs 2000.
- The average cost of setting up a container house in a community - Rs 4 Lakh
- Rent collected in a year by charging Rs 1500/month - Rs 18,000
- Time in which the government could get back the invested money - 22 Years(Which is much less than the container life span)

This proves that a long term mass container housing scheme with rent-able units would be efficient and affordable in Pune.

CONCLUSION



Flowchart 2 : Economic and social feasibility for Various user groups of Pune.

The case studies and the survey conducted show that the container housing scheme is a viable affordable solution to the increasing prices of real estate in Pune. The survey also proves that awareness among the people of Pune about container housing is of utmost importance without which the shift to container housing will be drastically gradual.

ACKNOWLEDGMENT

I would like to express gratitude from the bottom of my heart to my guides, Dr. Vaidehi Lavand and Ar. Ramiya G, for their valuable guidance, inspiration and encouragement. Their keen indulgence in this work helped me reach an irreproachable destination.

REFERENCES

- i. S. (2021, February 15). *Biggest Container Manufacturers of the World*. Container XChange. <https://container-xchange.com/blog/container-manufacturers-new-built-and-used-containers/>
- ii. A. (2017, September 1). *Don't Let Those Millions of Shipping Containers Go Unused*. Shipping Container Sales & Modifications. <http://integratedequipmentsales.com/dont-let-millions-shipping-containers-go-unused/>
- iii. adhaan. (2016, July 4). *The Pros and Cons of Building with Shipping Containers*. WWW.Aadhan.Org. <http://www.aadhan.org/blog/2016/7/2/pro-and-cons-container-architecture>

- iv. Zhang, G., Setunge, S., & van Elmpt, S. (2017, September). *Using shipping containers to provide temporary housing in post disaster recovery: Social case studies*. 4th International Conference on Building Resilience, Salford Quays, United Kingdom. https://www.researchgate.net/profile/Guomin_Zhang/publication/275541322_Using_Shipping_Containers_to_Provide_Temporary_Housing_in_Post_disaster_Recovery_Social_Case_Studies/links/5552ec9c08ae6fd2d81d60eb/Using-Shipping-Containers-to-Provide-Temporary-Housing-in-Post-disaster-Recovery-Social-Case-Studies.pdf.
- v. Club, T. C. (2018, May 14). *SEA CONTAINER HOUSING DC*. THE CASA CLUB. <https://thecasaclub.com/sea-container-housing-dc/>
- vi. *Gallery of Drivelines Studios / LOT-EK - 1*. (n.d.). ArchDaily. <https://www.archdaily.com/905460/drivelines-studios-lot-ek/5be335c108a5e5f7ac0007cf-drivelines-studios-lot-ek-photo>.
- vii. Rosenberg, A. (2019, October 24). *Containers of Hope / Benjamin Garcia Saxe Architecture*. ArchDaily. <https://www.archdaily.com/143332/containers-of-hope-benjamin-garcia-saxe-architecture>
- viii. "The Odisha Land Rights to Slum Dwellers Act, 2017, aka Mission Jaga" -- A Conversation with Mr. G. Mathi Vathanan, Principal Secretary, Department of Housing and Urban Development, Government of Odisha, India | University of Chicago Law School. (2019, April 3). Uchicago. <https://www.law.uchicago.edu/events/odisha-land-rights-slum-dwellers-act-2017-aka-mission-jaga-conversation-mr-g-mathivathanan>

Impact of Organic Architecture on Human Psychology

Chaudhary, R.

(rinkalchaudhary12@gmail.com)

D. Y. Patil School of Architecture, Lohegaon. (2020-21).

Abstract:

People love to be in nature and Organic architecture is a philosophy or a style that attempts to integrate a harmony between human habitation and surrounding environment. Humans have long intuited that being in nature is good for mind and body and access to nature and green environments yields better cognitive functioning and has a positive impact on human psychology.

The interaction between the architectural design and human emotions and psychology is significant, yet it remains largely unnoticed or even sometimes ignored. As 'nature' has been an inspiration of architecture since ancient times, and organic architecture being a style which is truly inspired by nature, this paper endeavors to create an understanding of how organic architecture impacts human emotions, feeling and psychology.

Since we spend 80 to 90 % of our time in a built environment, the building themselves play a major role in shaping our mental health. As being surrounded by nature or staying close to nature has a very positive impact on human psychology. Thus, this paper focuses to study if organic architecture has any cognitive benefit on people.

It does so by first understanding the concept and characteristics of organic architecture as it has been manifested in different ways by different architects. As each person receives, perceives and responds in a different way in a same space, the research approaches a method of primary survey which will help in studying and analyzing the impression of different characteristics of organic architecture on human psyche, emotions and feelings.

Keywords: organic architecture, human psychology, patterns, nature, human emotion

Introduction:

Organic architecture is a philosophy that is used to form a unified and symbiotic relationship of nature and architecture. Understanding and interpretation of this definition varies from people to people. Today, many views exist on the nature and qualities of organic architecture. For some, it is an architecture rooted in nature's forms and principles; for others, the focus is on the connection from interior to exterior. Some see it in the use of natural materials such as wood and stone, juxtaposed with modern materials like concrete. Others see it in Ar. Frank Lloyd wright's interpenetrating volumes and contrasts- light and dark, compressing and releasing to take the occupants of a building on a journey as if through nature. Organic architecture is at once all of these things.

Human psychology refers to an individual's experience of physical environment and the impact of such experience on their psychological wellbeing.

Since we spend 80 to 90% of our time indoors, even if we are out we are still surrounded by the built environment. People often find themselves physically and emotionally comfortable in specific spaces. Whether someone s reading a book on the terrace of a coffee shop, or painting sitting in a courtyard, or waiting for train at a train station, some spaces tend to initiate a feeling identical to being in their own home.

'We shape our buildings and afterwards our buildings shape us,' said Winston Churchill in 1943. It has proved that the building in which we spend most of our time affects people both physically and mentally. In today's world, with so much of urbanization happening, it is very important to create the architecture that will positively stimulate the human senses, their cognitive and emotional and behavioral domains. For example, an office building could be designed in a way that it would promote creativity and productivity amongst the employees. School buildings should arouse curiosity, joy and excitement in students and hospitals could be designed in a way that would radiate piece and help in healing process of patients, etc.

There is a deep relationship between human and the nature. It is often found out that people love spending time in nature. Various studies shows the positive effect of staying connected and close to nature, which has benefits like reducing stress, improving memory, shaping our mental and physical health, etc. 'breathing in nature gives us wholesome sensory awareness. When we spend time outdoors, we are mindful of what we see, what we hear, what we smell, and what we feel.' (Chowdhury, 2020)

The connection of nature and human can be well understood by studying the theory of 'Biophilia hypothesis.' 'It is believed that humans are genetically predisposed to be attracted to nature. It states that all the humans inherently love the natural world.' (Rogers,2019). Thus, with this understanding in mind and the idea that humans have an innate love and a deep need of nature, this research paper tries to find out if organic architecture has a same positive effect on humans as being in nature itself.

Aim objective and methodology:

This research paper focuses to study if organic architecture, a style which is well integrated with its site and surroundings (nature), has any positive impact on human emotions and psychology.

To achieve this aim firstly, the paper requires studying the human emotions, feelings and psychology, later study the

philosophy of organic architecture its interpretation. Further, it is also essential to consider various characteristics and features of organic architecture and its impact on the individuals.

Thus the study approaches a method of primary data collection through a mode of questionnaire. This method includes pictures of various characteristics of organic architecture and other architecture styles, which will be helpful in understanding if organic architecture is liked by people followed by that they also elaborate on the emotion and feelings they are having when they look at the pictures. This method is generally based on a cognitive analysis, where it concerns the way individual takes in the information from the pictures, and its effect on them. In this survey, a sample of 30 people was selected including people who love to travel, educated and people who are fascinated about different spaces and architecture.

As the feeling and emotions of different people can vary in a same space, people will have different experience while looking at the pictures. It will culminate in a different mental representation and thus different emotions and feelings. This way it will be helpful in understanding the impact of organic architecture on different people and the emotion it evokes.

Primary survey:

The primary data collection survey generally consisted of pictures based on seven principles of organic architecture which are simplicity, blending of interiors, building and site, exposed building materials, bringing outdoors inside the building, grammar, light and ventilation.

Organic architecture is simple because its scheme and design are clear. Simple forms are easy on eyes. It has very few distractions and thus the attention is automatically drawn towards the most important building elements. So, the first picture was inspired by simplicity of organic architecture. The second picture along with it was also based on the simplicity following different architectural style. Among both these pictures, 24 out of 30 people liked organic architecture and they listed their emotion as comfortable, and refreshing.

Humans spend most of their time indoors, thus the interiors such as shapes, forms, colors, textures, materials etc. also have a direct influence on the human behavior and emotions. Hence the second picture was showing the interiors of falling water designed by Ar. Frank Lloyd wright and other picture was of a contemporary home designed by Kaplan architects. Mostly people liked interiors of falling water in which flooring was of natural and locally available stone and furniture was made up of wood. People linked it with a feeling of warm and welcoming, peace and calmness. 'Wood has psychological and positive effect on emotional state of people. Environments with wooden furniture gives a homely feeling of warmth and comfort.' (Zaidi, 2020). The wooden textures

can be used to create aromatic space that welcomes you and relaxes you as the day goes by. Today also in many residential or commercial building mostly furniture are given a look of wooden finish. Environments with wooden structure cause a drop in blood pressure and pulse and have a calming effect.

Building and site; these two have a very special relationship in organic architecture. The site should be enhanced by the building, and the building derives its form partially from the nature of the site. The building grows with the site and these two shall not be treated as an independent entity nor should they have dominance over each other. Thus the third picture represented the characteristics of building and site, in which 19 people liked organic style which evokes the emotion of happiness and peace or calmness in people.

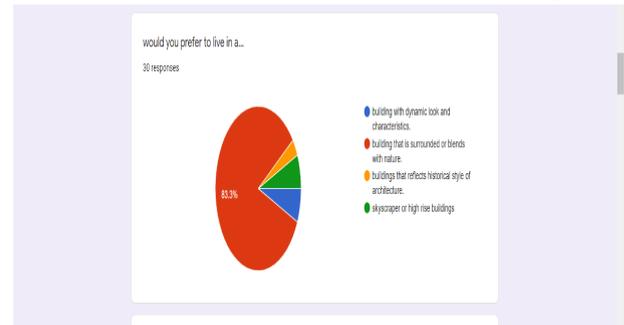
In a style of organic architecture, materials are used in a way that enhances their innate character and optimize their individual color, texture and strength. One material is not disguised as another. In this style, only a few materials are used both inside and outside with their true texture and color exposed. Under this characteristic, pictures in which the building shown the materials in its true form was chosen by 23 people. People said that it gives more natural feeling and it gave an emotion of contentment and comfort. The nature of the material from which a building is constructed shall be expressed freely. Wooden finish gives a warm feeling in a same way brick or stone gives a raw, natural and confident feel to the occupants while bringing the outdoors to indoor. The materials that make up our building can also improve our connection with nature. Construction material such as brick, stone, concrete can create a natural- feeling living environment that establishes a more comfortable setting.

Organic building designs have to look like they grow from their environment. One of the key characteristics for this is to bring the transparency between the outdoors and indoors and let it flow inside the building. This is generally done by planning a courtyard, giving a course of many windows for an unchecked flow from inside to outside, or by creating cantilevered terraces and balconies. The result for this characteristics came as 21 people liking the organic architecture design as it evokes the emotion of peace and calmness, it is refreshing and provide serene environment. 'Being in nature or even viewing scenes of nature reduces anger, fear and stress and increases pleasant feelings. Exposure to nature not only makes you feel better emotionally, it contributes to your physical wellbeing'. (Delagran, 2014).

Each building has its own grammar, its vocabulary of pattern and form. In organic architecture all forms of the building from the smallest detail to the overall form thus speaks the same language. The grammar may be completely different for two buildings although both are designed on the philosophy of organic architecture (the Johnson wax building verses Taliesin west). Two buildings were displayed in the survey. One picture was of Taliesin west and the other was of London aquatic center, both following a different grammar throughout the structure. 22 people liked Taliesin west.

The last principle was of natural light and ventilation where two pictures were shown of different style with ample amount

of light entering in space. People gave more positive response to picture of Taliesin west. Daylight also introduces a part of nature into a building. Sunlight can improve our mood and bring more natural and comfortable feeling to the interior of a building. Fresh air is also an important aspect of introducing nature architecture. It can stimulate our senses and provide pleasant breezes that just make us feel in tune with our natural environment.



The above picture is a response from people, when they were asked what building they would prefer to live in. 25 out of 30 people said they would love to stay in a building that is surrounded or blends with nature.

Sight: As eyes see the material used, the space which has an advantage on the sense of sight is explained majorly throughout the paper.

Hearing: The same way, hearing sense is also very important. Sound reflect in a space, and that way it gives us an impression of its form and material. Hearing or viewing aspects of nature such as water can also improve our mood and overall health. Whether it means including a water feature within a building or providing openings to listen to or view natural features outside. Any type of natural sound can have a positive effect on our senses.

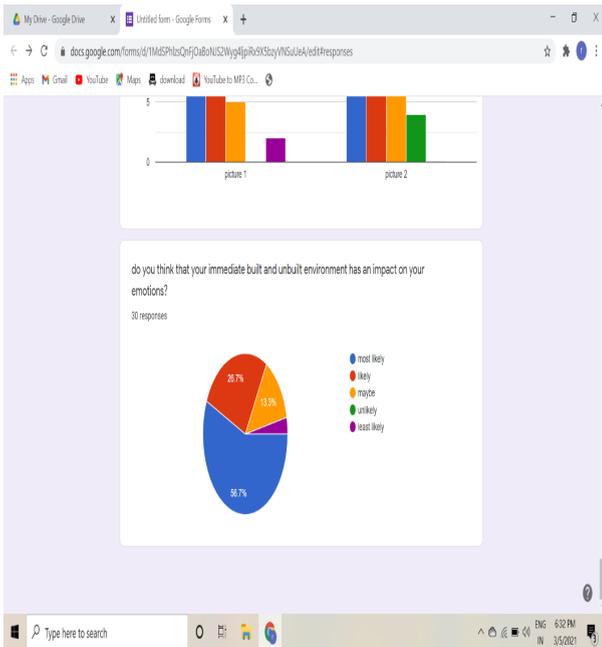
Smell: a particular space makes us unknowingly re-enter the space. When it rains, an earthy smell known as Petrichor permeate the air. This smell actually comes from the moistening of the ground and people tend to like this smell as it is very refreshing and pleasant. Why does people like this earthy smell and anything that connects us to nature can be well understood by studying the term 'Biophilia hypothesis' and 'Environmental psychology.'

As mentioned earlier, Biophilia hypothesis is a belief that humans possess an innate tendency to seek connections with nature and other forms of life, thus inspired from this theory came an another architectural design style known as Biophilic design. This style is concept used within the building industry to increase occupant connectivity to the natural environment through the things like natural lighting and ventilation, natural landscape features and other elements for creating a more productive and healthy built environment for people. Environmental psychology, on the other hand is an

interdisciplinary field that focuses on the interplay between individuals and their surroundings.

Literature review:

To find out why humans like anything that makes them closer to nature, the answer has its basis in human evolution. 'Buildings that provides us with the sense of pleasure are those that incorporate the architectural elements that our brain



In the survey, it was found out that maximum people think that their immediate built and unbuilt environment effect their emotions. Therefore, they had different emotion while looking at different pictures.

Human senses:

Our senses are the result of our perception with the senses we experience by what we see, what we hear, smell taste and touch. In architecture all senses are important but the sense of sight is very dominant. The other senses are generally not much considered while designing any space. All five senses of human shall be given equal attention while designing as the combined perception of all the senses gives us our total experience of a space

as having similar characteristics to those locations that helped our human ancestors to survive.’ (Ricci, 2018) This paper further explains the architectural success of some historic buildings. Many of the most critically acclaimed buildings throughout the time have been those that mimic the natural environment from which we came.

The building examples given are La Sagrada Familia, designed by Ar. Antoni Gaudi based on organic architecture style is still liked by people because its inspiration was forest. One is greeted by 28 foot tall pillars that branches off the canopies. It also explained that the Taj Mahal still a perfect example of beauty, because the carving mimics the pattern of leaves and flowers and other natural patterns. We perceive these buildings as beautiful because our brain possess the sensory information and correlates it with pattern that had previously proven to be evolutionary beneficial in nature. Yet, because this pattern recognition happens at a subconscious level, most viewers are unaware behind their perception of this sense of beauty.

Conclusion:

The natural environment is considered the main source of different emotions and also it can be said that what a person does, the thoughts and the feelings are all linked to their surrounding environment. This research paper provides with the result that organic architecture is more liked by people as it evokes the same sense of emotion and feeling among the users as that of nature. Hence, it proves that organic architecture does have a positive impact on human psychology. Being visually connected to nature or having certain features in a building that connects us to nature has a same positive effect as being in nature itself.

Acknowledgement:

I would like to thank Professor Sunaynee Banerjee to give me a direction and for providing me with valuable guidance throughout this research paper.

References:

- i. Chowdhury, M. (2020). *The positive effect of nature on your mental well-being*. Retrieved from <https://positivepsychology.com/positive-effects-of-nature/>
- ii. Delagran, L. (2014). *How does nature impact our wellbeing*. Retrieved from <https://www.takingcharge.csh.umn.edu/how-does-nature-i mpact-our-wellbeing>
- iii. Ricci, N. (2018). *The psychological impact of architectural design*. Retrieved from https://scholarship.claremont.edu/cgi/viewcontent.cgi?article=2850&context=cmc_theses
- iv. Rogers, K. (2019). *Biophilia hypothesis*. Retrieved from <https://www.britannica.com/science/biophilia-hypothesis>
- v. Zaidi, S. (2020). *How do materials affect human psychology*. Retrieved from <https://www.rethinkingthefuture.com/fresh-perspectives/a1275-how-do-materials-affect-humanpsychology/#:~:text=A>

Tiny Houses: A Future to Better Living Spaces In Pune

Roshni Shethia, Ar Vaidehi Lavand, Ar Ramiya Gopalakrishnan, Ar Girija Indulkar

SMEF's BRICK School of Architecture, Pune, Maharashtra

Email ID: roshni.shethia20@gmail.com

ABSTRACT

Tiny housing, a fairly new concept in India, is yet to be recognized to its full potential. A Tiny house is a dwelling unit block, about 120-300 square feet, containing all spaces, but much more compacted. Due to the ever-increasing population, cities are getting overpopulated and congested, unable to cater to its citizens. Therefore, this paper aims to address and solve the problem of over-consumption by down-sizing to smaller houses without loss in quality of life. Pune is chosen as a context for conducting research. The research was conducted through the means of case studies, surveys, interviews and activity mapping.

Keywords: Tiny house communities, Urban cities, Down-sizing, Economics of tiny housing, User-Friendly, Adaptive Use

INTRODUCTION

Tiny houses are primarily full-fledged dwelling units on a much smaller scale. They have been considered as a suitable housing solution due to their low carbon footprint, flexibility, adaptiveness, low construction cost and minimal maintenance. Over the years, one can do nothing but notice the contrasting sizes of houses within a city, with one family of four having large penthouses and another having to live in a '4x4' chawl. The primary reason for this anti-thesis lies in the current economic gap that has eloped the society.

A solution for the ever growing population

With the increasing population, India is leading towards becoming the most populous country in the world, with its population set to reach 1.7 billion by 2050. Currently, India accounts for more than 18% of the world population but occupies only 2.4% of the total land surface. This has caused India's 'land to person' ratio to go down to 0.0024 (while that of the world stands at 0.011). Continuation of this trend will result in crucial problems like over consumption and lead India towards scarcity of land to use. In addition, increasing land value has caused a reduction in the size of dwelling units, by almost 17%. Therefore, tiny housing could prove to be a practical solution, as it accommodates all the basic functions in a compact, yet functional way.

A pocket friendly solution for the future

According to experts, a typical tiny house in India costs Rs 1500/square feet. Due to its compact size, majority of the spaces fit in about 300 square feet, bringing the average cost of building a tiny house to roughly 5-6

lakhs. On the contrary, an average studio apartment, with a minimum carpet area of 600 square feet, costs Rs.3000/square feet, bringing the total to a minimum of 15-18 lakhs, costing almost triple to that of a tiny house. In addition Tiny Houses can also be transported to different locations, thereby providing its users an economical solution to the woes of buying/renting when moving to a new city.

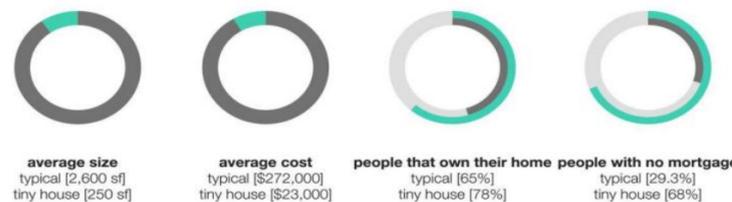


Figure 1 : showing cost to mortgage ratio for a tiny house and a typical house

A solution for all economic sections

The distinctive property of tiny housing being completely customizable and made according to the user and their needs make them different from other dwellings. It makes them not only flexible but also very user-friendly.

From Military Troop barracks to Temporary Houses and Slums, tiny housing has been used by various people for various dwelling purposes over the years.

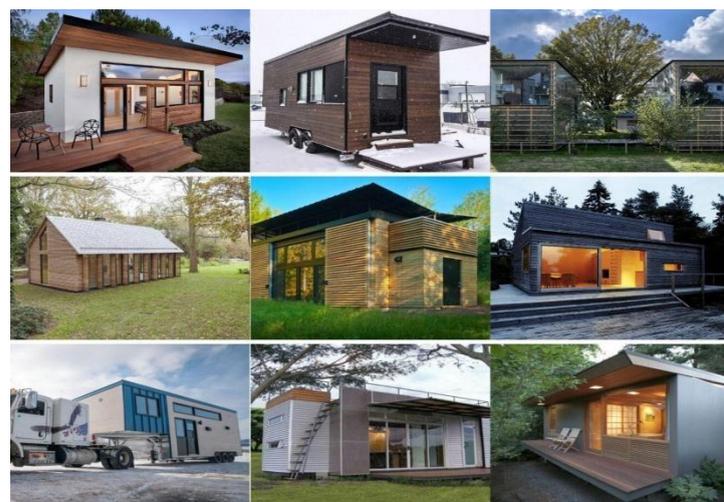


Figure 2 : showing different uses and types of tiny house

Pune as a model project for Tiny Housing

Pune, known as the ‘Oxford of East’ and ‘Home for retirees’, houses people of diverse age groups, broadening its reach for tiny housing. With the IT Sector boost, Pune has developed into one of the most prominent urban agglomerates in India. It has rapidly grown into a contemporary industrial hub and is identified today as a growing metropolis with tremendous potential. However, along with all this Urbanisation, it will also soon face issues of land scarcity just like Mumbai, with the exception that Pune will not have any land to ‘reclaimate’. Hence tiny housing could be the solution for accommodating more people without compromising on health, lifestyle and standard of living.

METHODOLOGY

The research was conducted by the means of the following methodologies as listed below:



Flow chart 1: showing the methodology used to conduct the survey

1. Case studies

A few examples of tiny houses and tiny houses committees were studied to understand its economical importance and significance. The table below highlights the case studies and my inferences from it.

Srno	Case study 1	Case study 2
		
Name of the architect	Brian Levy	MBCI
Total area	210 sqft	250 sqft
Total cost	\$30,000	\$30,000
Capacity	2 ppl	3 ppl
Location	Nil	Fresno CA
Purpose	Travel house	Travel house
Inferences	content of life is not related to the size of the dwelling	Customization of each unit according to the users needs
	convinient living with minimum use of renewable energy	Light weight material used with wind load consideration
	seamless difference between the bedroom and living room	

Table 1 : showing the inferences from the case studies

0. Surveys

In order to find the idea and perspective of people on tiny housing, various surveys were conducted. The following stakeholders were identified.

The questions asked were divided into 3 categories:

- **GENERAL QUESTIONS:** *Are you aware of tiny houses and would you prefer staying in one?*
- **AFFORDABILITY:** *Would you like to own a tiny house or rent it and how much would you pay for it?*

- **PERSONALISATION :** *Where would you like your tiny house, the city or outskirts and would you like to customize it?*

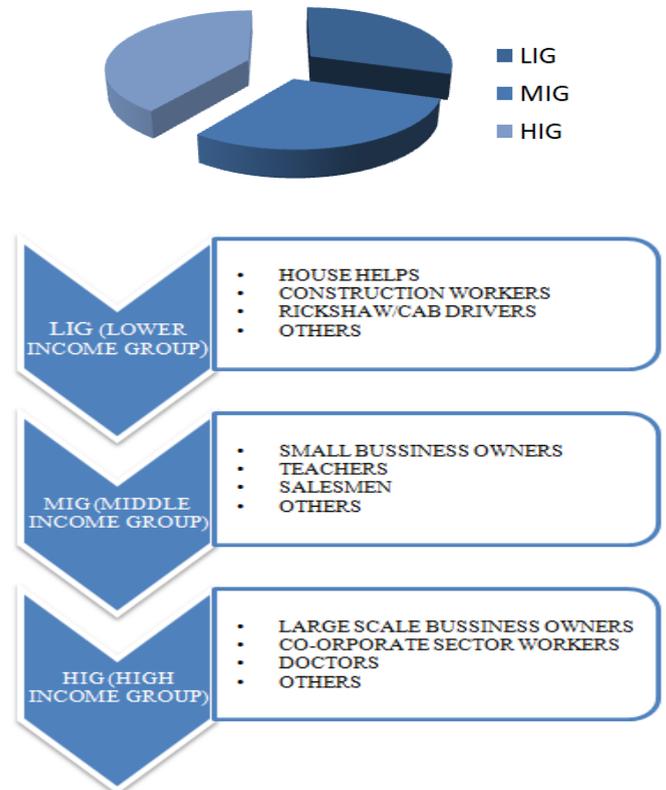


Figure 3 indicating the stakeholders surveyed

400 such stakeholders were surveyed and asked questions related to tiny housing and their responses were recorded.

0. Interviews

Along with Surveys, Architects and Interior Designers, who are versed with the concept of tiny housing, were interviewed and their perspectives were understood.

Ar Gaurav Kandelwal, a practicing Architect from Indore, was one of the experts who was interviewed. He has done various tiny housing projects and owns a prototype of a foldable tiny house module.

On asking him about his views on tiny housing and the idea of it being an economical solution, his response was: "Tiny houses

are an effective solution for the rising overpopulation. It's about time that tiny houses are normalised as people will want to

downsize due to the excessive land prices and the feeling of content with fewer things. It is surely an economical solution since the houses are transportable and can be relocated to different cities. The initial process of downsizing is definitely going to be difficult for a few economical sections but everyone will eventually get used to it."

Table 2 indicating the no of hours spent by each category in the different living spaces in a house

0. Activity mapping

To understand the spaces used by the stakeholders listed above, their activities were mapped throughout the day and analyzed. The activity mapping was conducted on the basis of the areas most used in a house with the number of hours spent in that space.

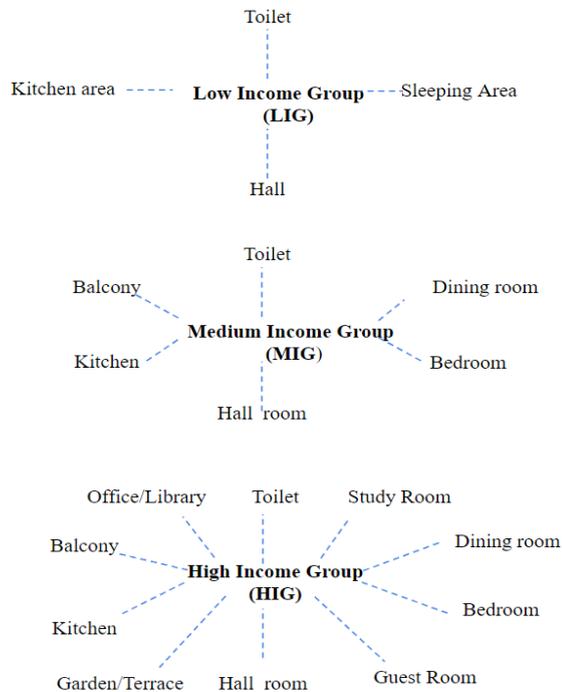


Figure 4 indicating the spaces used by different categories of stakeholders

Living spaces in a house	Category		
	LIG	MIG	HIG
 Living room	9	7	1
Dining room	0	1	2
Bedroom	8	10	12
Kitchen	3	3	2
Toilet	1	1	1
Study room	0	0	1
Office	0	0	1
Guest room	0	0	1
Balcony / Open spaces	3	2	1
Garden	0	0	3
Ratio of built to unbuilt	7:01	11:01	5:01

DATA COLLECTION

The result of the surveys conducted on different stakeholders is given below.

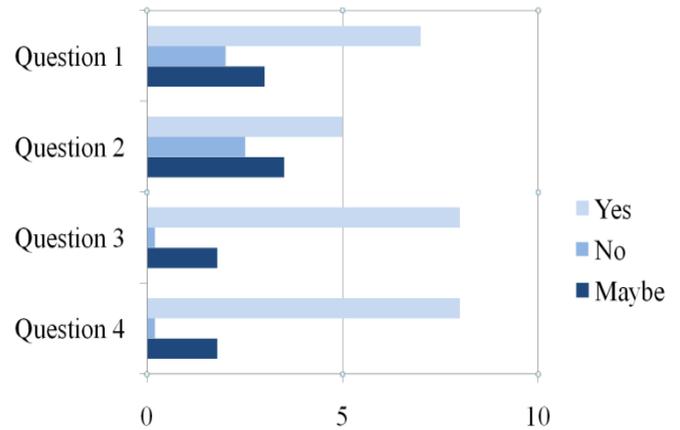


Figure 5 showing the results of the questions . Question 1: Do you know what a Tiny House is?. Question 2: Would you like to stay in a Tiny House? Question 3: Do you think it's economical? Question 4: Do you think they are a good investment?

The remaining questions were asked under the categories of tangible and intangible aspects of affordability , requirements etc

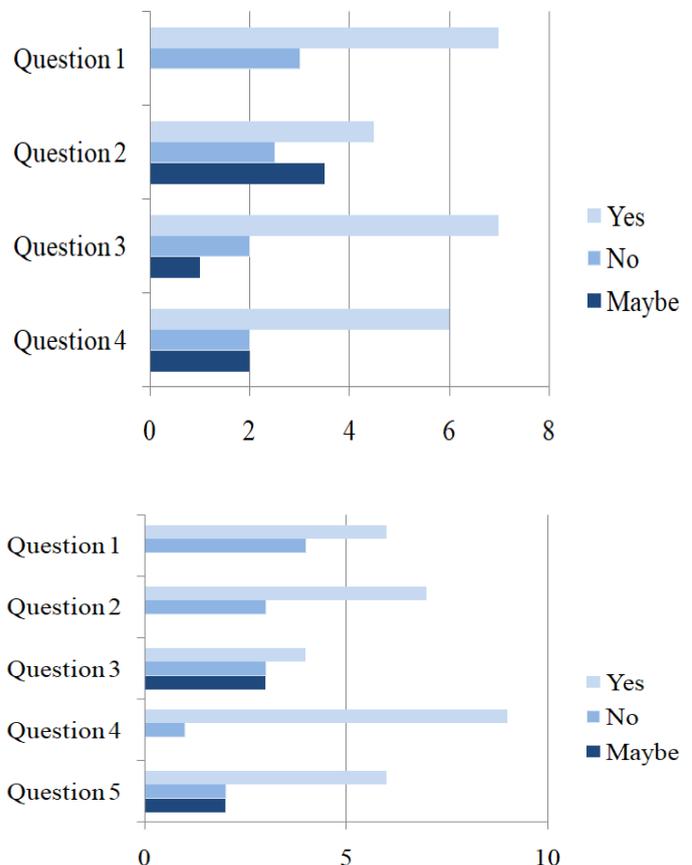


Figure 6 shows the result of the questions. related to ownership

Would you like to own a Tiny House? Question 2: Would you pay less than 6000 rs as rent? Question 3: Would you like to stay for more than 3 years? Question 4: Would you consider living tiny as a permanent solution?

Answers related to requirements : Question 1: Would you prefer your tiny house to be transportable? Question 2: Would you like to live in fringe areas of the city? Question 3: would you like to stay with your family? Question 4: Would you like to get your house customized? Question 5: Would you like more indoor spaces than outdoor?

DATA ANALYSIS

After the survey was conducted, the results were analysed and the following conclusions were made:

- The concept of Tiny Houses is not the primary dwelling option due to lack of awareness.
- Due to its considerably lower costs, people are inclined towards buying the unit rather than renting.
- 60% of the people prefer to live in a tiny house community if given a chance.
- HIG preferred having more outdoor luxury spaces, followed by LIG who use these spaces to cater to their daily chores.
- HIG needs more private spaces than MIG and LIG.
- The hours spent in private spaces is higher for HIG than for LIG and MIG.
- Customization of interior spaces will help cater to all economic sections.

From the following analysis, a module was designed, catering to all the economic sections and their needs. After analysing the total area utilized by each economic section, a typical module size of 3x8m was designed. a multipurpose area is designed near the living room which can cater to different functions at different times and different users.

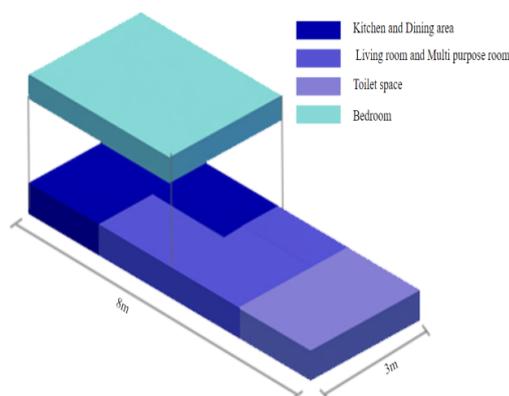


Figure 7 showing the zoning module

CONCLUSIONS

In conclusion the paper helps in understanding how tiny houses can accommodate different economic groups in the same carpet area, not just as a forced economical solution but as an informed

choice. The paper explores how tiny housing communities are a potential socio-economic solution to ever growing problems of overpopulation and habitable space limitation.

ACKNOWLEDGEMENT

I would like to extend my gratitude to my faculties, Ar Vaidehi Lavand, Ar Ramiya Gopal and my guide Ar Girija Indulkar for their valuable inputs and necessary comments.

I would also like to acknowledge my friends for supporting me and motivating me throughout the course of writing this paper.

Finally, I'd like to thank D.Y Patil College for giving me this opportunity and allowing me to share my paper on such a large platform.

REFERENCES

- Housing, H. (2021, January 05). The scope of the 'TINY House Movement' in India and its possible repercussions on the industry. Retrieved March 08, 2021, from <https://www.herohousingfinance.com/blog/knowledge-series-of-experts/trend-watch-the-scope-of-the-tiny-house-movement-in-india-and-its-possible-repercussions-on-the-industry/>*
- Pandit, A., & Aishwaryapandit0, A. (n.d.). Dissertation - the tiny house movement and its adaption in Indian context. Retrieved March 08, 2021, from https://issuu.com/aishwaryapandit0/docs/dissertation-the_tiny_house_movemen*
- M, N. (2021, January 20). The impact of small houses In India. Retrieved March 08, 2021, from <https://connect.buildnext.in/building-smaller-houses-in-india-heres-how-you-can-save-money-the-environment/>*
- Gupta, A., & Aasthagupta19, A. (n.d.). Tiny house dissertation. Retrieved March 08, 2021, from https://issuu.com/aasthagupta19/docs/tiny_house_dessertation*
- Small House, Big Impact: The Effect of Tiny Houses on Community and Environment, Charlie Kilman Carleton College(https://d31kydh6nr5j5.cloudfront.net/uploads/sites/11/2019/07/charlie_kilman_tinyhouses__4_.pdf)*
- MODERN PORTABLE TINY HOUSE TECHNIQUE, Tushar Bharat Patil1 , Akash Vitthal Bhoje2 1,2Department of Civil Engineering,Sandip Institute of Engineering & Management, Nashik(<file:///D:/college/SEM%207/RESEARCH/research%20paper%203.pdf>)*
- Tackling Homelessness with Tiny Houses: An Inventory of Tiny House Villages in the United States, Krista Evans(<file:///D:/college/SEM%207/RESEARCH/research%20paper%205.pdf>)*
- FUTURE OF TINY HOUSING IN INDIA USING SUSTAINABLE MATERIAL, Harshneet Kaur1 Department of Interior and Furniture Design, Lovely Professional University.(<https://www.sciencedirect.com/science/article/pii/S0970389615000336>)*

Study of Architectural Factors Affecting The Community Spirit of The Neighborhoods In Pune

Rucha Pimplapure* (author) and Prof. Mahesh Bangad (co-author)**

Fourth year Student, Dr. B .N. College of Architecture, Pune, India

** Assistant Professor, Dr. B .N. College of Architecture, Pune, India

*pimplapure.rucha@gmail.com ** mahesh.bangad@bnca.ac.in

Abstract: The spirit of a community is a fundamental intangible factor in sustaining the community which is enhanced by the social interaction between people. The current residential neighborhoods occupy less common spaces where people can interact which further accelerates the failure of the notion of community living. Hence, there is a requirement to understand the spatial characteristics which will help social interaction. This research paper will focus on studying the architectural and humane factors that promote social interaction between people in the residential neighborhoods of Pune city. The study will further examine the role of Indian festivals in transforming the neighborhoods for social engagement and how social interaction affects the wellbeing of residents.

Keywords: Social interaction, community spirit, residential neighborhoods, urban spaces, architectural psychology

INTRODUCTION:

Community living is an important part of our Indian culture and social engagement between people plays an important role in this. However, this aspect is slowly fading due to evolving lifestyles of people. The emotional connection to the community people live in is getting lost in the current scenario of housing development due to rapid urbanization. Moreover, with the development of the city and significant demand for housing, the current housing models in residential neighborhoods occupy more private dwelling and have less or no common spaces where people can interact with each other which further acts like a barrier for people to interact. It has been observed that the modernization of current societies today had an essential role in reducing the communication of people in their societies. Architectural design can act as a tool and bridge this social gap in the community. It can help to bring the community together and promote social interaction in the residential neighborhoods. There are various factors associated with this research that facilitate community engagement. Architectural and spatial factors, urban design elements, the psychology of the users and the context of the surrounding environment are the factors to be studied.

This research paper aims to study the architectural factors that facilitate community interaction in neighborhoods. To create new alternatives and present services which address the issue, it is necessary to know about society and the people, their needs and preferences. Residential neighborhoods are the area of study in this

research paper because there is a need for residential models that promote sensitive social and behavioral needs of the residential users. Residential models with quality common spaces which promote interaction, engagements and celebrations among the residents will promote a user-friendly interactive design and eventually promote quality life for the users.

LITERATURE REVIEW:

Several papers were studied under literature review that looked at the aspect of social interaction in residential neighborhoods. The common conclusion from the paper was that various architectural factors influence the selection of the location for community engagement in the neighborhoods.

Following research papers were studied :

- i.) Impact of social interaction on Residential satisfaction in gated Communities in an indian context : Preetha Jacob [1], Dr. Sheeba Chander [2]
- ii.) Social interactions at the neighborhood-level As a function of external space enclosure : Majd Al-Homoud [1], Louis G. Tassinary[2]
- iii.) Designing for Improving Social Relationship with Interaction Design Approach : Nasser Koleini Mamaghani [1], Azadeh Parvandar Asadollahi [2]
- iv) Legibility of neighborhood parks and its impact on social interaction in a planned residential area: Amine Moulay[1], Norsidah Ujang [2]

MATERIAL AND METHODOLOGY:

The research shall be carried out with interviews, a questionnaire survey and observations of the community patterns in the neighborhood. The findings of the study will contribute to the benefit of the society considering the greater demand for community spaces in cities and help in establishing more community-friendly spaces in the residential localities. This investigation aims to conclude a

possible hypothesis that spaces with aesthetic and comfortable surroundings with appropriate architectural characteristics are preferred by the users and these spaces help to liven the community spirit of residential neighborhoods. Further research leads to the understanding of the design considerations in incorporating community spirit in residential areas.

Sampling frame:

The study population was comprised of the residents and non-residents of the residential neighborhood in Bhusari Colony, Kothrud, Pune. Seven groups of sample based on age group were selected:

1. Teenage 13-19 years
2. Young adults 20-30 years
3. Adults 31-40 years
4. Adults: 41-50 years
5. Middle-age adults: 51-60 years
6. Senior citizens : 60+ years.

A total of twenty-six responses were determined including all the people sorts during this survey. This survey was conducted face-to-face within the neighborhoods of Bhusari Colony, Kothrud and therefore, the responses were noted on the Google kind. Participation was voluntary. The participants enclosed households of various ages and genders.

Sample Characteristics:

Different variables were thought of as factors to conduct the study. Identity of the users: The age, gender associated occupation of the users were surveyed to induce an analysis of that people, gender and background prefers that activities and areas. Comfort, safety and different close factors: The users were surveyed to understand the comfort level and safety of the users. The users were interviewed to understand, however, they understand the noise levels, comfort levels, lighting within the area. Selection of area for community interaction: Experience and activities within the area: The expertise of the users and their most popular activity within the area were asked to understand their preference of space. They additionally mentioned what quite additions they would like within the area.

Passive Observations:

The area of study i.e. residential neighborhood of Bhusari Colony, Kothrud, Pune was selected. The neighborhood area that are used as common interaction areas and activities during this neighborhood were known and passive observations were conducted by actual visits to those areas. Variables like common interaction spots, the comfort of users, and occupancy of users, discipline factors facilitating social interaction, seating's and customary activities were determined. Apparatus Media: written communication was wont to collect information for characteristic numerous variables vital to the analysis study.

The survey was conducted through the Google form and responses were conducted consequently. Format. The form was designed to collect information concerning their social interactions, area enclosure, privacy management, discipline characteristics, characteristics influencing interaction and private characteristics. Face-to-face interviews were conducted within the common areas of interaction. Notes were taken throughout and once the interviews

RESULTS AND TABLES

Area of study:

Residential neighborhood in Bhusari Colony, Kothrud, Pune was taken because the space of study.



i.) Figure no. 01. : Area of study map

The areas that are used by the residents of the specified neighborhood were studied according to the variables that promoted social interaction in these areas. The areas are :

1. Pandit Bhimsen Joshi Udyan
2. Veer Savarkar ground
3. Open space used as cricket ground
4. Corners with benches in the neighborhood



Figure 02: Benches at Pandit Bhimsen Joshi Udyan.

These seats areas are placed at the doorway of the garden ahead of the field. Picture source: self



Figure 03: Weekly market at Veer Savarkar ground; image source: self



Figure 04: Seatings ahead of a temple and playground facilitate social interaction; Image source: self

Passive observations were conducted within the space of study and in keeping with these observations, the subsequent analysis was noted:

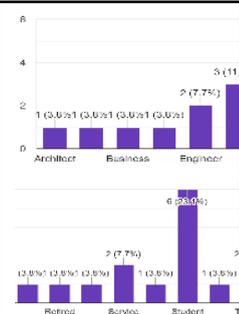
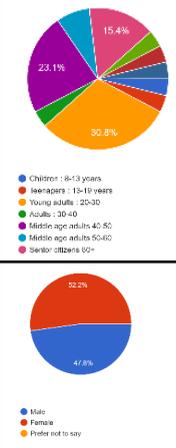
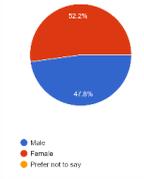
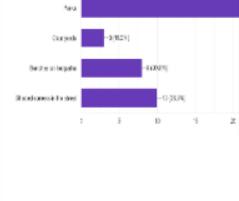
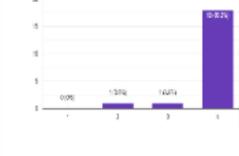
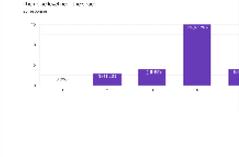
i) Table no. 01: Passive observations of the realm of study

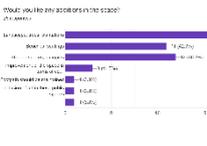
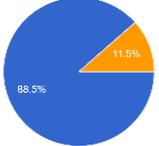
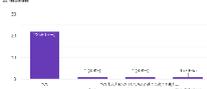
A Google form survey was conducted to understand the preferences of the users concerning their choice of area for community engagement within the residential neighborhood. The survey received total twenty-six responses and following analysis was noted. Following observations were determined

S. N	Area	No.of users per day	Observation	Analysis
1	Bhimsen Joshi Park	50-80	The field garden is well maintained and has ample opportunities in terms of activities and discipline style for folks to socially act.	The park has its own identity that is outlined by the sculptures, mural etc that is devoted to Late Pandit Bhimsen Joshi. The park is simple and properly planned for enough social interaction. The seatings, open gym, lawn, play space square measure the look parts that promote interaction during this park.
2.	Veer Savarkar ground	40- 300, Depends on the occasion	Depending on the occasion This area provides ample opportunities for interaction as the area has numerous activities going down. The condition of the benches and edifice is improved	The market provides a chance for interaction however because of lack of correct seatings, this chance isn't absolutely used. The events and celebrations that happen on this ground bring ample chance for interaction.
3.	Large open space	20-100, depending on the occasion	A Ganpati temple, seatings th at face each other and an open ground utilized by kids.	The seating, the playground and the festival celebrations promote social interaction.
4.	Corners in the neighbourhoods	5-15	There are benches, seatings provided	These spaces act like pause points in the neighbourhood and provide social interaction opportunity.

i) Table no. 01: Passive observations of the realm of study

A Google form survey was conducted to understand the preferences of the users concerning their choice of area for community engagement within the residential neighbourhood. The survey received total twenty-six responses and following analysis was noted. Following observations were determined :

S. no.	Question	Response	Analysis
1	Occupation		People from different professions were identified in the sampling frame to get a perspective on the preferences of people from different backgrounds.
2	Age		People from different age groups right from teenagers to senior citizens were surveyed. The pie-chart shows the number of responses from every person.
3	Gender		The male and feminine gender, both population undergo the survey.
4	Which spaces are used by you for social interaction/relaxation in the neighbourhood areas?		Parks are the most visited space for social interaction. Shaded corners on street, benches on the footpath, courtyards are the second, third and fourth choice according to the responses.
5	What kind of lighting is used there? How is the light quality there?	<p>Street lights, pole lighting. I think some decorative lights can be used.</p> <p>Streetlights on footpath. They are well lit</p> <p>Lights are good but trees dim them out</p> <p>Natural light during day time; street lights at night</p>	Mostly street lights/pole lights are used and there is a mixed response regarding the quality of lighting.
6	How do you feel about the space in terms of safety and comfort?		1-not safe, 5-very safe. Thus, 69% of users have chosen option 4 i.e. the space is safe.
7	The noise level near the space		1-noisy, 5- peaceful 57% of users think that the social interaction space used by them is quite peaceful.

8	Would you like any additions to the space?		73% of users think space needs landscaping additions. Other suggestions are benches, shaded canopies, improvement of the space, including art in these spaces and proper footpaths.
9	Does the apartment building/ housing society have any spaces where you have common interaction?		73% of users responded 'Yes' and others responded 'No'. The latter would primarily need social interaction spaces in their residential neighbourhoods.
11	Does a surrounding with a different architectural style matter to you?		88% of users feel different architectural style matters and others responded 'maybe'.
12	What kind of architecture spaces do you like to be in when you are interacting with the community at the neighborhood level?	<p>Spaces which allow various activities to take place.</p> <ul style="list-style-type: none"> Gardens, shaded gazebos, small ponds Garden, small corners Open yet shaded spaces, Steps/seating for everyone to sit Anything that is well designed for human activity and comfort Open spaces, usually with roof for sun or rain 	Open landscape spaces, with a comfortable and aesthetic environment, is preferred by the users.
13	Do you feel spaces that promote social interaction in humans are an important part of the residential community and promote residential satisfaction?		The users responded that the spaces that promote social interaction are important and promote residential satisfaction. Hence, it plays an important part in people's well being.
14	Do you feel festivals play an important role in enhancing the community spirit?	<p>No. If they occupy main thoroughfares, they are a problem. If they are internal private use for celebrations in the building, they are a problem. If they are internal private use for celebrations in the building, they are a problem. If they are internal private use for celebrations in the building, they are a problem.</p> <p>Yes. It is important to have street celebrations for social interaction.</p> <p>If the residents of the neighborhood celebrate festivals in their neighborhood in a way that others find it a celebration. If other people who do not reside in the neighborhood or who are not invited to the celebration, it creates privacy hindrance to the residents.</p> <p>Yes they do. Especially Ganesh festival.</p> <p>Yes, they play an important part in our interaction. But they should be celebrated in a place that is not a main thoroughfare.</p>	Community celebrations play an important role in enhancing social interaction of the community.

ii.)Table no. 02 : Questionnaire Survey

CONCLUSION:

The study concludes that social interaction plays an important role in people's lives and promotes residential satisfaction of users. Architectural and spatial characteristics affect the users for selecting their location for interaction and festivals promote community engagement. Further research may lead to the understanding of the design considerations in incorporating community spirit in residential areas.

ACKNOWLEDGEMENT:

I would like to express my sincere gratitude to my mentor, Prof. Mahesh Bangad, for his invaluable guidance. I am thankful to my college Dr, B.N. College of Architecture for providing me with a platform to explore my talents. I am grateful to Principal Dr. Anurag Kashyap for providing me with this opportunity.

REFERENCES:

- i. *Published research paper: Social interactions at the neighborhood-level as a function of external space enclosure*
https://www.researchgate.net/publication/232489228_Social_interactions_at_the_neighborhood-level_as_a_function_of_external_space_enclosure.
- ii. *Published research paper: Designing for Improving Social Relationship with Interaction Design Approach*
<https://www.sciencedirect.com/science/article/pii/S1877042815048387>
- iii. *Empowering Public Spaces as Catalysers of Social Interactions in Urban Communities*
https://www.researchgate.net/publication/269367342_Empowering_Public_Spaces_as_Catalysers_of_Social_Interactions_in_Urban_Communities
- iv. *Impact of social interaction on residential satisfaction in gated communities in an Indian context.*
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3551989

Institutional Landscape Design : Impact assessment of tangible and intangible aspects of designed open spaces in Architecture Institute

Authors:1. Rujuta Killedar, Ar. Shraddha Manjrekar, Ar.Vaidehi Lavand , Ar.Ramiya Gopalakrishnan
SMEF'S Brick School of Architecture, Pune
Email: rjutakilledar@gmail.com

Abstract: *Landscaped areas play an important role in connecting places on campus. Campuses designed for architectural education need to have open areas as they are the mediums to connect nature and offer an atmosphere for learning. This research paper focuses on the tangible and intangible aspects of landscape design in architectural campuses. This study is based on a questionnaire survey that was circulated among the students and faculty of architecture, where they were asked about their preferred open area for various functions. This study gives an overview in understanding the preferences and psychological impact of landscape on students and faculty. This will help architects to design the open spaces in campuses adjacent to classrooms and common areas.*

Key words – Designed landscape areas, tangible elements, intangible elements, open spaces, user satisfaction, architectural college

Introduction

The landscape plays a key role in connecting people to open spaces and one another. The aesthetic character and spatial design of the campus are the most important factors for young aspirants to choose the university. The open spaces are not only visually important but have a functional role and psychologically connect as well. **The three important factors influencing the preferences of the users are visual, psychological, and functional roles.**

The appearance and activities happening in various spaces characterize the building and make an image of the institute. As the spaces clubbed with people and activities reflect the life and culture of the institute. Such images help parents and young aspirants in choosing the right institution for their future education. Designed open spaces in the campus of the institute offer various spaces that help students take a break from the routine academic activities and perform independently. Students spend most of their time in the studios working on different assignments which tends to create a block in their heads hence affecting the creative process. Designed open spaces tend to free the minds and open up creativity. Many creative and innovative ideas occur in outdoor environments, away from formal classes and discussions. Architecture students can use the designed open space for formal as well as informal discussions. Open spaces act like connecting spaces in the campus, providing a sense of direction. It is done by integrating and organizing different places and elements. Open spaces in the campus also can provide an aesthetic sense by involving attractive surroundings and creating visual surprises. The connection

with nature and a relaxing atmosphere in designed open spaces encourages meetings and discussions and provide fresh air for stressed students and faculty ([Payne, 2009](#)). Fresh air and openness aids one's creative thinking process and creates a relaxed working environment.

Designed open spaces vary from small to larger scales. These spaces accommodate many spatial functions and serve various user's activities. These spaces create experiences that remain in the memories of the users forever. The physical environment of a college campus provides the context for learning and social interactions. The students develop a meaningful connection with their peers through interactions in these outdoor spaces. Such spaces provide enthusiastic campus interaction and vibrant social life. Various studies show that students prefer open spaces with various landscape elements to change their moods when they are stressed, confused, etc. ([Lau and Yang, 2009](#)). Visual connection with the open spaces can lure one into the open spaces which will result in keeping the open spaces active

Most of the colleges have open spaces some of them are supplemented by, water bodies, amphitheaters, courtyards, lawn spaces, seating areas, and paved walkways. The water bodies and the courtyard, apart from their aesthetic appeal also act as passive design strategies. Other spaces apart from these are playground, alley spaces, bridges connecting various levels, roofs (SMEF's Brick School of Architecture). Architecture colleges have various inter-college sports competitions; hence a playground plays an active role for after-college practice. The sloping roof of SMEF's Brick School of Architecture has steps where students can sit and work on their laptops or have informal discussions. The materials used for various elements in the designed open spaces are common for the three colleges. The amphitheaters and kund are made of concrete; the courtyard has a tree and has tiles or concrete finish, paved walkways, and seating areas made of concrete or stone. The unfinished surface is shaded with trees and some parts covered with grass for the lawn area. 60 interviews had been taken. According to the survey, 82% prefer semi-open and 14% prefer completely open spaces and 4% prefer completely covered spaces for various activities like playing, discussions, and working. Even though most of the discussions happen in the studio, semi-covered and open spaces are preferred as they open up the minds and give scope for creativity and enhance learning. Brick school of architecture and S.B. Patil

college has about 20-40% open areas as compared to the enclosed spaces, whereas Aayojan School of Architecture

NAM E OF THE OPEN SPAC E	DESCR IPTION	TYPE	MATERI ALS FOR SURFACE S	IMAGE
Courty ard	Designe d open space which is enclose d by built structur e on two or more sides	Open to sky /semi covered/ partially covered from sides	Concrete, grass, mud	 <i>Source:flickr.co m</i>
Kund (Stepp ed courty ard)	Seating or interacti on space with seatings at different levels	open	Concrete/b rick/stone	 <i>Source:brick.ed u.in</i>
Amphi theatre	An open space surroun ded with seating like that of an auditori um	open	Concrete/s tone	 <i>Source: quickr.com</i>
Lawn(soft paved areas)	Area of land having green cover usually used for relaxati on,	open	Soft paved surfaces with grass or any ground cover	 <i>Source:justdial. com</i>

	events,e tc.			
Inform al Seatin g areas in outdoo r	Formal or informal seating areas for discussi ons and working areas.	open/se mi covered/ covered	Concrete, timber, brick, metal	 <i>Source: Pinterest</i>
Places with open areas with Water bodies	Apart from aestheti c appeara nce,it helps users in a soothing way by visual, auditory and thermal comforti ng.	open/se mi covered	Concrete/s tone/brick	 <i>Source:indiana rt</i>
Paved walkw ays	Walkw ays which are highligh ted by using a various paving material s. This can be in active or inactive circulati on areas.	open/ semi covered	Tiles, stones, mud	

Semi covered spaces	Semi covered spaces like pergola covered spaces act like walkways or seating spaces(how is it different than pathways)	Semi covered	Wood, steel	
				Source:Pinterest

of the three colleges. From the multiple selected elements, the majority

Data analysis:

has about 40-60% of open space. The following figures show the preferences of the elements of the open spaces used by both the user groups for various activities.

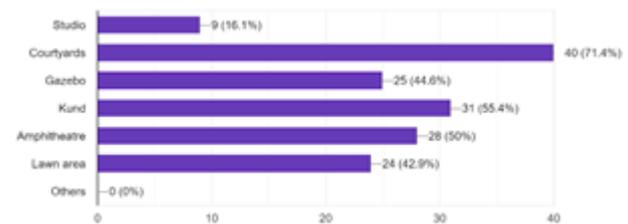


Fig 1.1: Spaces preferred for informal discussions

Methodology:

The research was conducted through questionnaires circulated through both the user groups of three colleges. The result was then analysed and studied.

The following methodology was used for the research:

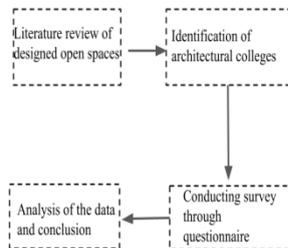


Figure 1.1 of the people have courtyards as their preference, whereas the studio is the least preferred. This chart indicates that open spaces are preferred and they help in peer-to-peer interaction and student to faculty interaction.

Which space do you use for college events?
56 responses

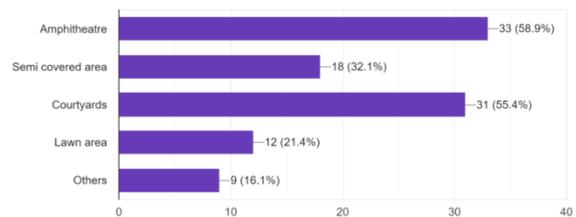


Fig 1.2: Spaces for college events

The space that is used the most for college events is the amphitheater, courtyard, semi-covered area, lawn areas. Though some prefer celebrating it indoors in multi-functional halls and auditorium, most of them prefer it outdoors.

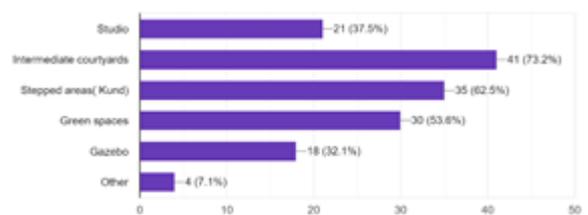


Fig 1.3: Spaces preferred for working

The courtyards are the most preferred spaces which are used for working, followed by the kund, green spaces, and the studios. The courtyards provide a huge space for students to gather and work together. Some students can focus in a closed space like studios, while some prefer the undulated surface of

the kund. It also depends on the kind of work as students prefer workshops in studios while lectures or studio work in semi-covered or completely open spaces.

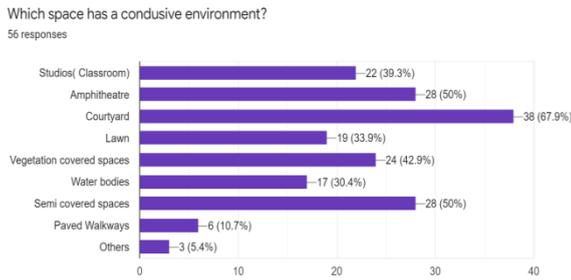


Fig 1.4: Spaces giving a sense of comfort

The most comfortable space according to the survey is the courtyard, followed by the amphitheater and the semi-covered spaces, then the vegetation-covered spaces. The large area of courtyard and amphitheater help in creating a comfortable environment as most of the students might feel claustrophobic in a small space. The vegetation-covered areas will give shade and hence a cool environment protecting from the harsh summers

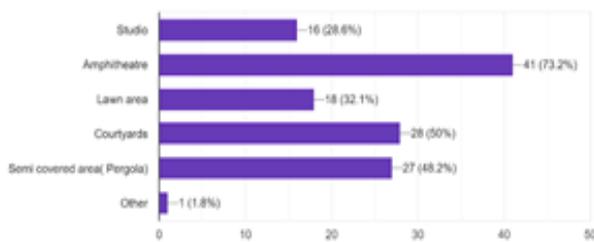


Fig 1.5: Spaces for attending or taking lecture

The spaces for attending or taking a lecture are an amphitheater, courtyard, and semi-covered spaces. The courtyard is the only common space that the user groups prefer for both working and attending lectures. The reason for users choosing the landscape element is the scale, material, and the setting of the natural space. SMEF's Brick School of Architecture has sloping accessible roofs and hence both the faculty and the students also preferred that space for attending or taking lectures.

The survey shows that the favorite space for the students and the faculty is kund followed by the amphitheater and then courtyard spaces and then the lawn areas and playgrounds. This shows that the user groups fell refreshed in the open spaces as compared to the enclosed space of studios or staff rooms.

Findings and discussions:

Design open spaces in an architecture institute not only promotes social interaction but gives an open area for students to work. Students and faculty of architecture spend most of their day on the campus hence the design of the

spaces needs to be interactive, cheerful, and inviting. Designed open spaces help is speeding up the creativity process compared to an enclosed space. Open spaces create a

positive and cheerful atmosphere due to continuous flow of fresh air as compared to the studio spaces.

From the results and analysis, the user groups prefer kund the most as it has multiple planes, creates a playful and cheerful environment, and gives the freedom to be interactive. Visible open spaces are used the most, compared to the ones located at the back. Designed open spaces when connected with an interactive pathway and pause points, attract the users and increase the usability of the space.

Acknowledgment:

I would like to extend my gratitude to my faculties, Ar Vaidehi Lavand, Ar Ramiya Gopalakrishnan, and my guide Ar Shraddha Manjrekar for guiding and helping me throughout the process. I would also like to thank my friends and family for supporting me and motivating me throughout the course. I would like to thank D.Y Patil College for allowing me to share my paper on such a large platform.

References:

- i. Pranay. K (2016 Oct 2) *Landscape design elements in an institutional campus* Retrieved from: <https://www.slideshare.net/pranavkumartode1/landscape-and-design-elements-in-an-institutional-campus-66648485>
- ii. Jon. B (2019 Sept 26) *5 essential roles for landscape in campus design* Retrieved from <https://www.hdrinc.com/insights/5-essential-roles-landscape-campus-design>
- iii. Lusheng.L and Ya.D (2017 Dec 16) *A Study on the Campus Landscape Design of the National University of Singapore* Retrieved from <https://iopscience.iop.org/article/10.1088/1757-899X/301/1/012152>
- iv. Ozgur .Y, Aysu.E, Seda N.D, Haldun.M, Kivanc AK (2017) *Landscape design: Duzce University rectorship building* Retrieved from https://www.academia.edu/31197982/An_example_for_landscapes_design_in_public_buildings_Duzce_university_rectorship_building
- v. Terry.C (2011 Nov) *Landscape Design and Landscape Experience* Retrieved from https://www.researchgate.net/publication/254954494_Spectrum_Matrix_Landscape_Design_and_Landscape_Experience
- vi. Emad.A.F (2019 July) *Integration Of Indoor Environmental Analysis In Architectural Landscape Design* Retrieved from https://www.researchgate.net/publication/334657606_INTEGRATION_OF_INDOOR_ENVIRONMENTAL_ANALYSIS_IN_ARCHITECTURAL_LANDSCAPE_DESIGN
- vii. Sada.N.J (2019 Feb) *Study of college landscape design* Retrieved from https://www.researchgate.net/publication/330887576_paper19812

Diversifying Space Planning Against Exterior Dominance

1-Saloni Jain | 2-Ar. Manjusha Gokhale | 3-Ar. Bijal Vakharia

1- Architecture Student | E-mail: jainsaloni171@gmail.com

2- Faculty: Sinhgad College of Architecture, Pune | E-mail: manjushagokhale@sinhgad.edu

3- Faculty: Sinhgad College of Architecture, Pune | E-mail: bijal.vakharia.scoa@sinhgad.edu

Abstract: *The creation of floor plan layouts is the key to architecture. But the stumbling block is considering the exterior façade, where the planning gets compacted and space is forced to get into the shape of the building. Presently, the dominance of shape of the building is making clients and users to adjust the comfort and functioning of the space. “Form follows Function” this is just a bookish quote, but the shape of the building or structure should take place according to its function or its purpose.*

Keywords: - Stumbling block, Dominance, Functioning, Exterior façade, Compacted, Comfort.

Introduction

Which came first – the chicken or the egg? Everyone knows the correct answer is the egg ... and by “egg” I mean “floor plans”. Architecture is the art and science of designing buildings, In the era where architecture came into being the design was done according to the need of the user and for the user where the functionalism was the first preference then the look of the building. The course of action followed for the design is by and always will be from base planning. A floor-plan consists of a drawing that shows the location of the different areas and rooms required by the client, as well as the sizes, names, walls and floor limits of each of them. However, the building as an “object that contains rooms and spaces” is, and it has always been, the trend in architecture. An elevational treatment is the process where the openings and frontage are given with the reference to plan and also with a basic consideration of vastu.

Steps for Architectural Design: -

1. Site Plan and Analysis
2. Planning
3. Elevations
4. Sections

Above given are the root steps for designing, but in this day and age whole process is changed and is followed alternately, the form and shape of the building (elevation) is taken first and then the planning is done accordingly, need level for comfort is decreasing and the need for aesthetics is increasing, where all the areas and rooms of the building are fitted inside an iceberg-like sculpture. One can see, how the different areas are located, following complex functional requirements and constraints; however, they always fit the exterior form.

Also examining the situation in rural areas, most of the projects are done and carried out only by either contractor or a civil engineer where they do not involve the role of architect in there and the lack of functioning and comfort zones is observed where only the elevational treatment of facades is the catch of the sight.

Research Question:

What do we design first?

Do I design the floor plans first, or the elevations? The correct answer is that the floor plans get developed first, but there is still a lot of give and take when it comes time to develop the exterior elevations. We generally have something in mind when I am putting together the plans on how we want the elevations to look – but the plans are the first piece of the puzzle.

Limitations:

The study was done with the main objective of diversifying and enlarging the study of space planning process rather than focusing on the exterior facades, forms and shape of the building, studying the characteristics of planning and applying them with respect to human ratio, human comfort, and human psychology.

Hypothesis:

- Architects have to fit a wide space program (clients’ needs) into a shape (building’s envelope).
- Architects must consider many variables when designing floor-plan layouts.
- Contractors and engineers in rural area should consult or hire Architect to design the building to enjoy the proper planning and elevations

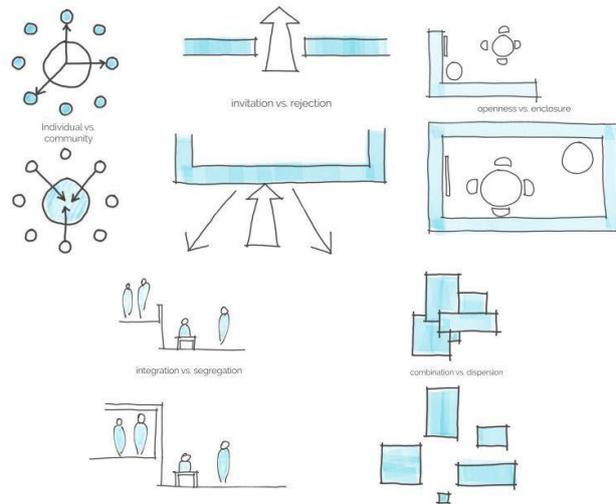
Methodology:

Good design is paramount in planning, says Joe Riddon. There are various examples of architectural planning failure worldwide now a days. Owing to the fact that changing technologies is leading to new techniques which leads to show off the building aesthetics more than the need of the user

The complexity of this process can be observed in this example by OMA Architects) of the China Central Television Headquarters building in Beijing.



Fig.1 CCTV Headquarter building in Beijing



Step 3: - Considering space with space: - Linking the spaces with each common space and interlocking them with each other with the types basic consideration of organising the spaces

Step 4: - Deriving the quick fix – After the above steps are followed, the process is driven out from thinking to sketching the diagrams which leads to the connection of the spaces through bubble diagram or zoning

Step 5: - Revise and Analyse - Once some solutions have been sketched out it is then possible to review these solutions and look for areas that require improvement.

Result:

Failures and defects are common phenomena in Architectural Field. Architects begin space planning by gathering information. They need to know several things before they can draft a space plan. Keeping in mind that these steps need to be considered for all spaces in a building, including how those spaces connect.

First, the purpose of the structure is understood then the study of brief is done in detail after the elevation treatment the form and shape of the building is designed and carried out

Some famous examples which prove that the planning was compromised over the elevation and shapes:

1. **Infosys Building, Pune by Hafeez Contractor:** The requirement of the client who wanted a desired shape of the office building led to the compromised planning.



St. George Orthodox Church, Kerala by Ar. Vinu Daniel: The church was designed in such a way that it failed to follow the traditional planning of a church in order to enhance the elevation of

CCTV Headquarters - OMA

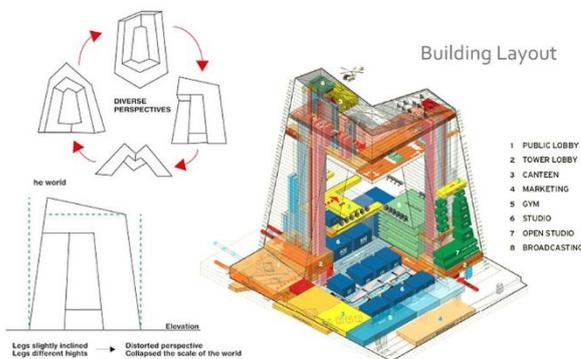


Fig.2 Planning of CCTV Headquarter showing the compact spaces forced to get into the shape of the building

The design of a building or space will have numerous requirements from the client or end user. It is important in the very early stages of design to carry out in depth search and consider as many aspects of the use of the spaces as possible.

Process followed for proper Space planning with proper functionalism: -

There are various self-asked questions and procedures followed by an architect while designing and creating an venerate space planning

Step 1: - Collect information – Basic of planning is to collect the proper content and study the space we are about to design. Some considerations can include:

- Do the spaces have specific functions or need to be particular shapes or forms?
- Do the spaces need to be flexible?
- Is it possible to create a sequence of spaces?
- What relationships must each space have with one another, and the external environment?

Step 2: - Throw light on requirement -Build the brief –The study of brief leads to detail study of human psychology with the interacting environment

the structure. This led to controversies and in process hurt the sentiments of the community.



Conclusion:

Big efforts have been made for solving this problem using approaches from several disciplines; however, half of the approaches come from Engineering and the other half come from Architecture, and both works simultaneously in the process. Therefore, we conclude that this process is still a black box: the result appears suddenly, like magic.

Acknowledgements:

I would like to express my special thanks of gratitude to my professors Dr. Manjusha Gokhale and Ar. Bijal Vakharia as well as our principal Dr. Banani Banerjee who pushed me towards this wonderful opportunity and helped me throughout the entire process of researching.

References:

- i. CHING, F. 1979. *Architecture: Form, Space and Order*. New York, Van Nostrand Reinhold.
<https://www.bluentcad.com/blog/significance-of-architectural-plans-and-elevations>
<https://www.google.com/search?q=2.%09St.+George+Orthodox+Church%2C+Kerala+by+Ar.+Vinu+Daniel&tbm=isch&ved=2ahUKEwiG6OmSrqbvAhVMDysKHTAyCJcQ2-cCegQIABAA&oq=2.%09St.+George+>
- ii. *Proportions in Architecture*, Le Corbusier foundation,
<https://www.google.co.in/#q=proportion+in+architecture+%2B+le+corbusier+foundation>
<https://in.pinterest.com/>
- iii. NEUFERT, E. 1935. *Architects' Data*. London, Blackwell Science, 638 p.
- iv. IGLESIAS, J.; MARTÍNEZ, J. 2007a. *A comparison of floorplan design strategies in architecture and engineering*. *Automation in Construction*, 16:559-568.
<https://www.pbctoday.co.uk/news/planning-construction-news/design-planning-process/67191/>
www.archdaily.com
- v. HSU, Y.C. 2000. *Constraint Based Space Planning: A Case Study*. *ACADIA Quarterly*

Analysing Different Types of Lateral Opening for a Display Area of Painting Galleries.

Samruddhi Dubal^[1] | Dr. Manjusha Gokhale^[2] | Ar. Bijal Vakharia
Sinhgad College Of Architecture, Vadgaon.

Email: samruddhid21@gmail.com^[1] | manjushagokhale@sinhgad.edu^[2] | bijal.vakharia.scoa@sinhgad.edu^[3]

Abstract:

With the increase in green design concepts the daylight designing has powerfully created awareness in designing public spaces. Moreover, naturally lit room tends to have a striking impression on human mind rather than an artificially lit room. The designing of daylight in a paintings display area is very significant as it affects the colour rendering of the paintings and affects the visitor's experience. When considering paintings display area the room should be uniformly lit, while maintaining desirable temperature in the room, so as enhancing the room and the paintings while preventing any possible defacing of the paintings.

Keywords – Natural lighting, sustainable designing, lateral light openings, daylight factor

I. Introduction

Display areas are the rooms where the artists showcase their pieces. While designing such rooms lighting plays an important role and we as an environmentally aware community should focus on providing good lighting via sustainable methods. What is more green than natural daylighting. Studies show that almost 60% of electrical consumption is lighting and daylight harvesting is normally an untapped method of cutting down on a major chunk of electricity consumption. The characteristics of a highly competent artificial lighting never replace the allure of a minimal natural lighting provision. Human beings have a natural attraction and need for daylight. It has a direct impact on well-being and overall satisfaction of the consumers. The designing of daylight in a painting gallery not only affects the visitor's experience but also creates a proper light environment that enables higher colour rendering of the paintings. So to sum up daylighting has environmental and monetary benefits and it also enhances the visitors satisfaction rate.

Unsuitable lighting design, absence of effective daylighting control may cause excessive or insufficient illuminance and poor luminance uniformity. Providing huge opening may lead to higher indoor temperatures which may need mechanical systems for cooling, which does not contribute to our aim of a sustainable design. So it is essential to design the daylight opening considering the thermal discomfort and luminance uniformity.

The paper studies the various typologies of lateral natural light openings, in terms of daylight factor and daylight factor uniformity which is very crucial when the appearance of paintings is considered, thermal comfort and UDI (Useful Daylight Illuminance is a metric that penalizes the area having direct sunlight falling into it, on the theory that people will find this area glary and distracting). All these metrics will be

calculated using the software having a high accuracy in predicting those factors, such as Ladybug and Honeybee plug-ins for Grasshopper. The purpose of the paper is to suggest a lateral opening such as it achieves perfect indoor lighting environment while reducing the cooling energy demands.

The area finalised for conducting the analysis is Pune, Maharashtra as the purpose of this analysis to choose a type of opening for the display of the painting gallery which is a part of my thesis project. The climatic zone that Pune city comes under is Moderate climatic Zone, having the average annual temperature 24°C and average daylight hours 11 hrs.

II. Material and Methodology

The simulation of daylighting environment in the display area is conducted by using Ladybug and Honeybee plug-ins for Grasshopper. Ladybug imports *epw into Grasshopper and provides interactive metrics and Honeybee connects it to EnergyPlus, Radiance, Daysim for building energy and daylighting simulation. EnergyPlus, Radiance, Daysim for building energy and daylighting simulation.

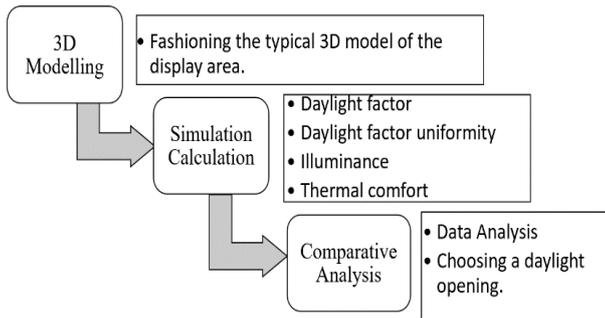
The simulation of daylighting environment in the display area is conducted by using Ladybug and Honeybee plug-ins for Grasshopper. Ladybug imports *epw into Grasshopper and provides interactive metrics and Honeybee connects it to EnergyPlus, Radiance, Daysim for building energy and daylighting simulation.

Daylighting metrics to consider while designing daylighting are:

Daylight Factor (DF): The daylight factor is a very common measure for the subjective daylight quality in a room. The higher the Df the more amount of natural light is available in the room. Rooms having 2% DF are considered adequately lit and rooms having more than 5% DF are considered as well lit rooms.

DF Uniformity: The ratio between minimum DF(%) and average DF(%). If DF inside room varies greatly it may cause visual fatigue. DF uniformity of at least 0.4 should be achieved in the design for a good visitors' experience.

Simulation procedures of daylighting design for the display area:

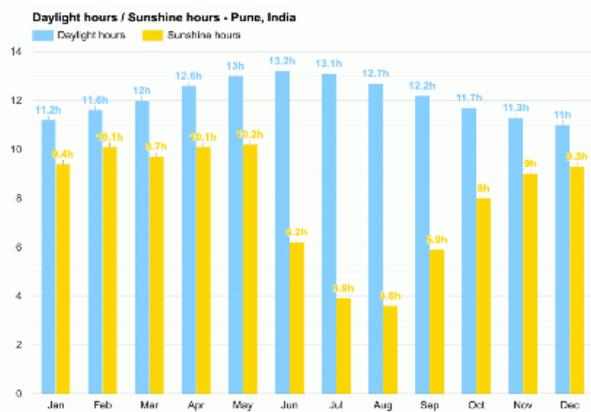


Flow chart 1: Process of simulation based analysis
Set Points:

The guideline for thermal comfort suitable for paintings was obtained from ASHRAE 2003, 21.13, table 3. Under the column “Set point or annual average,” for the option “General Museums, Art Galleries, Libraries and Archives, following set points are noted:

T : A value between 15°C and 25°C

The T set points need not be at a universal value dictated by human comfort, i.e., 21°C.



Weatherstudy

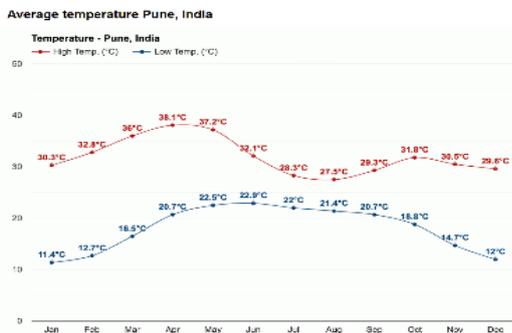


Figure 1: Average Temperature and Daylight Graph

Display Area:

-The display area size will be 12m X 5m X 6m (L X B X H) .

-Five types of lateral openings of different sizes and placed at different positions

-All the openings are facing north

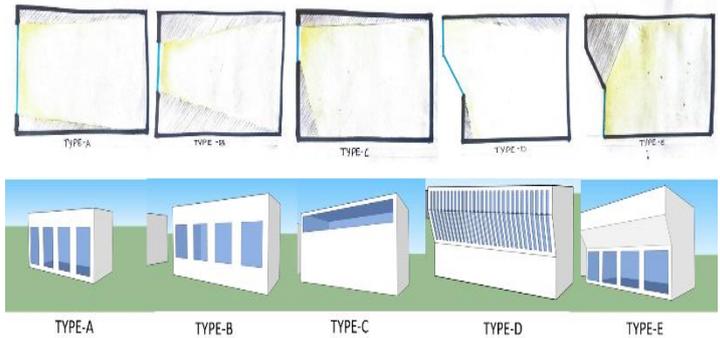


Figure 2: Types of Openings Provided

OPENING	SIZE (WIDTH X HEIGHT)	NUMBERS	POSITION	AREA RATIO WINDOW:FLOOR
TYPE A	2m X 5m	4	NORTH WALL	0.27
TYPE B	2m X 3m	4	NORTH WALL CENTRE	0.16
TYPE C	11.5m X 2.5m	1	NORTH WALL TOP	0.20
TYPE D	0.2m X 2.5m	30	NORTH WALL CENTRE	0.10
TYPE E	2.4m X 2.4m	4	NORTH WALL BOTTOM	0.16

Table 1: Opening Parameters

III. Results and Tables

The 3D model of the said display area is made in SketchUp 2018 which in turn was imported in Rhino for the simulation based analysis in Grasshopper- Honeybee and Ladybug, and the results of the same are recorded and analysed for making an informed evaluation.

DF and DF Uniformity: The ratio of internal illuminances to the exterior illuminances.

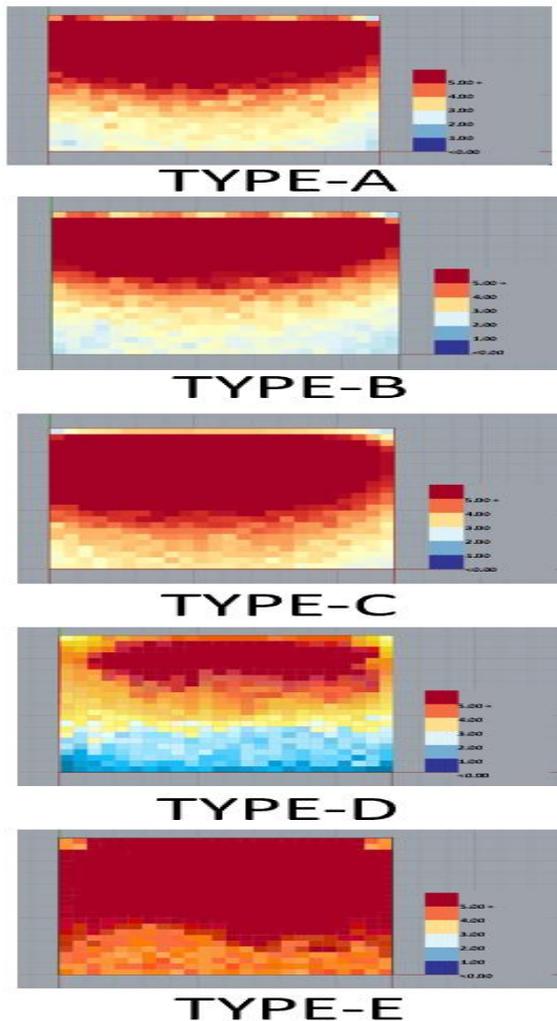
$$DF \text{ Uniformity} = DF_{\text{MIN}} \div DF_{\text{AVG}}$$

The Daylight Factor varies with the orientation of the room, window form and various other factors. In architectural designing the estimation of Daylight Factor is implemented to provide sufficient internal daylight for the dwellers comfort. The calculation results of Daylight Factor in the display area are shown in the figure 3

The DF of Type A is high near the opening, and gradually decreases with increase in depth. DF is quite low at small spaces in the corners of the wall opposite to the wall having openings.

The DF of the opening Type B is high near the opening and it gradually decreases with the increase in depth. DF comparatively is very low at the larger (than Type A) spaces at the corners of the wall opposite to the wall having openings.

The DF near the openings is very high and a very gradual and uniform decrease with increase in depth is seen. The DF does not go below 3 at any time and space which is forms adequate day lit circumstances in the display area.



The DF near the openings is high as in all the other cases but unlike the others the decrease in DF with increase in depth is not gradual and uniform rather it observed to be rapid and at the end of the room DF goes as low a 1 and 0.

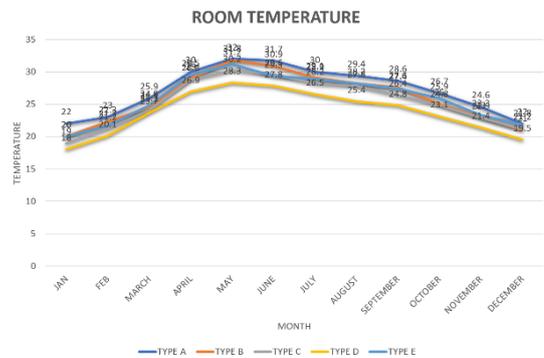
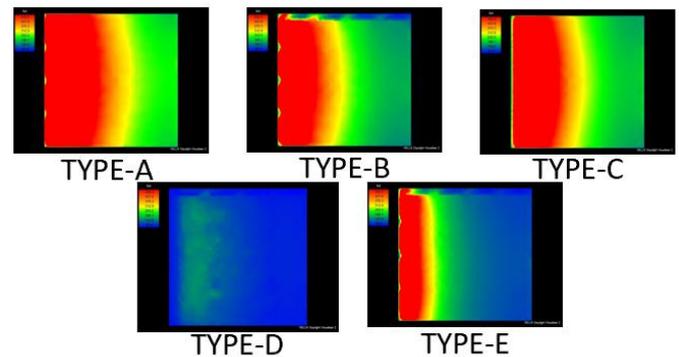
The DF in the majority percentage of the area is higher than 5 and it goes low till 4 towards the end of the end of the room. The decrease in the DF with increase in depth is observed to be gradual and uniform.

The Daylight Factors of the openings Type A, Type B, Type C, Type E are quite high as compared to the Daylight Factor of the opening Type D.

Opening Type	Min. Df (%)	Avg. DF(%)	DF Uniformity
TYPE A	1.5	5.75	0.27
TYPE B	1.2	5.6	0.21
TYPE C	2.8	5.9	0.47
TYPE D	0.7	5.35	0.13
TYPE E	4.2	7.1	0.59

Table 2: Average DFs and DF uniformity.

Thermal comfort:



Type A and Type B openings provides a steady daylight environment, but due to their huge sizes cannot maintain the required temperature. These openings may work if sun shading devices such as fenestrations are used which may hinder the connection of the indoor space and outdoor space.

Type C and Type E openings provide uniformly daylight room and also maintain the suitable thermal condition.

Type D opening provides the most ideal room temperature conditions but fails to cater to the required luminance.

IV Conclusion

This study describes the process of effectively designing a tailored daylighting opening, employing quantitative method, such that the said display area is uniformly lit while maintaining a suitable temperature for the paintings. Type C and Type E openings are the most proficient types of openings of the 5 types studied.

Acknowledgement

I am overwhelmed in all humbleness and gratefulness to acknowledge my depth to my faculty Dr. Manjusha Gokhale and Ar. Bijal Vakharia, who helped me turn this simple idea into something concrete. Any attempt at any level can't be satisfactorily completed without the guidance of my parents and friends to whom I express my gratitude.

References

- i. *Daylighting museums – a case study in Lisbon* [[CrossRef](#)]
- ii. *Daylighting Museums – a survey on the behaviour and satisfaction of visitors* [[CossRef](#)]
- iii. *The Ideal Climate, Risk Management, the ASHRAE Chapter, Proofed Fluctuations, and Toward a Full Risk Analysis Model* [[CrossRef](#)]
- iv. *Human Visual Quality: Art Gallery Exhibition*
- v. *Study on Daylighting Optimization in the Exhibition Halls of Museums for Chinese Calligraphy and Painting Works* [[CrossRef](#)]
- vi. *Weather Atlas* [[CrossRef](#)]
- vii. *Visual Comfort Criterion* [[CrossRef](#)]
- viii. *Daylight Factor* [[CrossRef](#)]
- ix. *Ladybug Honeybee* [[CrossRef](#)]
- x. *EnergyPlus* [[CrossRef](#)]

Grasscrete Paving System-A Step Towards Eco-Friendly Streets

Samruddhi Naik

D Y Patil School Of Architecture , Lohegaon

Abstract: The aspiration of a 'pollution-free' environment or at least with minimum amount of pollution has come to prominence in the last few years. With people from several fields making attempts and trying to achieve the goal of a 'pollution-free' environment, we as Architects have an extremely important role to play here. The concept of Sustainable design has gained some popularity within the construction industry. Using Grasscrete pavers is one of the most effective ways to improve the streets of Pune. The city faces some major issues on the street level such as traffic (vehicular as well as human), unclean and unhygienic footpaths, water clogging during monsoons and many more. To cater to these problems, using Grasscrete pavers on footpaths or driveways can be of great help.

KEYWORDS – Sustainable, street problems, pollution and hygiene.

Grasscrete is a pervious pavement product available in a range of systems specific to the usage. Grasscrete is essentially a cellular reinforced concrete slab, the cells being voids created in the patented casting process which are subsequently filled with soil and seeded with grass or other appropriate ground cover. The Grasscrete system selected can either be purely functional or be a concealed product that is both functional and pleasing in appearance. Grasscrete offers the end-user the ability to provide year round access for a variety of applications without compromising the aesthetics of their exterior landscaping and having to utilize traditional hard pavements, eliminating the need to control storm water runoff. Grasscrete is commonly known as Void Structured Concrete. The pervious nature of the product is not reliant upon a mix design, but rather a mechanical system to incorporate the voids in highly defined and regular manner. Grasscrete is an environmental friendly solution for vehicle access, water management and traffic applications. It provides the availability of using single-use formers to create a monolithic reinforced ready mixed concrete pour that forms a pervious pavement structure with voids that are opened after the concrete hardens, that can be utilized as an exposed application with crushed stone or concrete or utilized as a concealed system with vegetation such as grass or native ground cover. One of the most common problems faced on an environmental level is pollution.

Hence, here come the advantages of Grasscrete over Concrete, used in construction. Grasscrete offers the ability to provide year-round access for a variety of applications requiring structural paving surfaces without compromising the aesthetics of the exterior landscaping. Grasscrete is a very sustainable product that can employ a large number of recycled material content both in the form of aggregate and binder such as fly ash or slag. Its lifespan is indefinite and can be

recycled itself to form the aggregates for future Grasscrete applications; providing a truly sustainable, eco-friendly system to accommodate a variety of needs. The selection of Grasscrete is one of the easiest ways to achieve LEED points.

Advantages over Precast Concrete systems

Occasionally confused with pre-cast blocks Grasscrete is in fact a cast on site cellular reinforced concrete system with voids created by styrene void formers.

This type of construction offers significant structural advantages over precast concrete and plastic systems:

- Load bearing up to 40 tonnes gross vehicle weight
- Resists differential settlement
- Reduces sub-base depths
- Eliminates kerb edges
- No reliance on grass for stability
- Optimum drainage capability
- The lightweight nature of the Grasscrete former moulds enables us to ship economically throughout the world

Typical traffic related specifications for Grasscrete can include:

- Vehicle parking for daily or overspill use
- Emergency access
- Maintenance access
- Highway verges and pull-ins

In addition to its ability to withstand traffic loads, Grasscrete is also massively used for projects in the water environment. Tested to flow rates in excess of 8 metres per second, this self-venting paving system is ideal for armoring the following:-

- Reservoirs
- Spillways
- Storm/drainage channels
- River and sea defenses
- Swales

Speaking about cement concrete, the cement industry is one of the main producers of carbon dioxide, a potent greenhouse gas. Concrete causes damage to the most fertile layer of the earth, the topsoil. Concrete is used to create hard surfaces which contribute to surface runoff that may cause soil erosion, water pollution and flooding. Unfortunately concrete is not an environmentally friendly material, either to make, or to

use, or even to dispose of. To gain the raw materials to make this material, much energy and water must be used, and quarrying for sand and other aggregates causes environmental destruction and pollution. Concrete is also claimed to be a huge source of carbon emissions into the atmosphere. Some claim that concrete is responsible for up to 5% of the world's total amount of carbon emissions, which contribute to greenhouse gases. This is created in the heat that is needed to create the raw cement. Cement is burnt at high temperatures, and materials such as limestone must be burnt to create the high temperature.

Importance of Grasscrete The unique properties of Grasscrete reduce the number of construction operations, hence it gives better flexibility. It also provides an even platform for vehicles and pedestrians.

The importance of Grasscrete in various aspects is explained below in detail:

Structural Stability of Grasscrete-

Grasscrete pavement has its solid concrete structural edge which allowing the surrounding ground levels to blend naturally into the surface without any breaking. The structure of Grasscrete is self-draining, enabling rainwater to discharge naturally to the ground. Due to the self-absorption of water from its surface to the ground base, it also prevents differential settlement of ground.

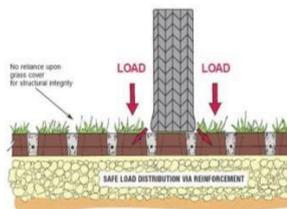


Fig. structural stability of the surface

Self-Draining and Resists Differential Settlement-

The self-draining capacity of Grasscrete helps to preserve the natural beauty of the landscape, thereby providing a perfect aesthetic outlook. The permeation rate of Grasscrete is about 90% that of the natural ground. It also helps to reduce the shrinkage in underlying clays.

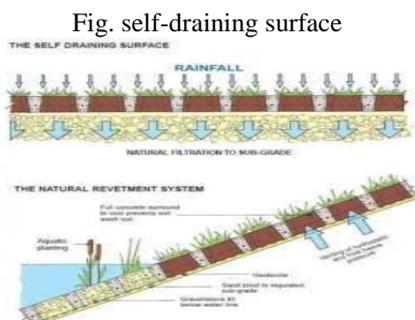


Fig. self-draining surface

Provides safe Emergency Access-

The provision of safe emergency access and escape must ideally be allowed in the design of any building. In naturally grassed areas, the load-bearing capacity of soil can never be predicted. A fire access route must be capable of sustaining not only a load of moving appliances but also the imposed load of static equipment. It is therefore the right environment-friendly response to emergency access problems.

Types

Followings are different types of Grasscrete based on different purposes to be served.

1. Partially Concealed Grasscrete

In the partially concealed concrete, the grass or vegetation is arranged parallel to the concrete. Concrete of five and a half-inch thickness is provided along with half an inch root protection alongside the vegetation. Partially concealed Grasscrete is ideal for sustained traffic areas. In addition to this, due to the presence of vegetation, it is functional, environmentally friendly, and pleasing in appearance.

Commonly, partially concealed Grasscrete can be used for the following applications:

- Vehicle parking
- Access roads
- Road shoulders
- Driveways
- Fire and emergency access

Fig. Partially Concealed Grasscrete

2. Concealed Grasscrete

In concealed Grasscrete, there is a layer of soil of depth of 1 inch above the concrete. The concrete below this layer of soil is concealed and has a depth of five and a half-inch.

This **type of Grasscrete** is ideal for low traffic areas, where traffic volume is minimum. Concealed Grasscrete is also one of the best options for the pavement of homes and garden areas.

Concealed Grasscrete is generally used for the following applications:

- Fire and emergency access
- Overflow vehicle parking
- Low traffic access roads



Fig. Concealed Grasscrete

3. Stone Filled Grasscrete

In this type of Grasscrete, the soil between the concrete materials is replaced with crushed stone. The thickness of the crushed stone is limited up to 1/2 inch or 3/4 inch. Stone filled Grasscrete is efficient for draining at rates of up to 450 inches per hour with 100% retention of water. Stone filled Grasscrete is perfect for heavy traffic areas.

- Furthermore, it provides maximum percolation rates. It is both functional and environmentally friendly.
- Stone filled Grasscrete generally used for various applications like,
- Military installations
- Spillway structure of a dam
- Fire and emergency access
- Vehicle parking

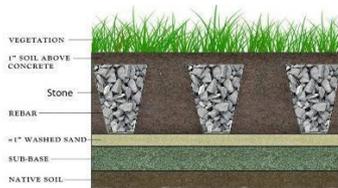


Fig. Stone Filled Grasscrete

Environmental benefits

1.Increases Green Space and Reduces Heat Island Effect:

Heat island is nothing but built-up areas that are hotter than the nearby rural areas. The visually appealing green space or vegetation reduces the heat island effect, thereby creating a comfortable, attractive, and calming atmosphere for civilians.

2.Used Recycled Materials: The use of recycled materials is encouraged in Grasscrete right from the manufacturing process of the concrete mix to fill the voids and the sub-base layers. Grasscrete maintains its environmental focus by utilizing the recycled materials to its 100% capacity.

3.Infiltration of Storm water: It not only maintains the natural stability of the groundwater recharge but also significantly decreases the runoff. Moreover, this infiltration promotes water quality improvement through bio- retention. In this process, the metals are naturally cleaned through vegetation & soil structure.

Survey-A survey was conducted in order to understand the basic hygiene and traffic problems faced by the general public visiting streets of M.G. Road, Camp, Pune as well as the owners of the shops present along the streets. The survey questions asked were as follows:

- Do you feel the streets need a proper garbage dumping facility?

- How does the traffic affect your business here?
- Do you feel the need of a proper parking facility?
- What other problems do you face on street level?
- Do you feel the need of a proper drain system?

Above mention chart shows the common problems faced by the public and the shop owners there. As it is clearly visible, the most common addressed problem is that of the drainage facilities. During monsoons, the footpaths tend to overflow, causing problems to the public as well as the store owners. To cater to this problem, Grasscrete pavers can be an extremely helpful solution. As mentioned earlier, Grasscrete has self-draining capacity, which will enable the water collected water to drain through the voids into the ground, or drainage channels present below; hence preventing the overflowing of footpaths. Considering the second most common problem, addressed no parking space. M.G. Road is an extremely busy area and overcrowded parking has always been a major problem. As a solution, Grasscrete pavers can be added to differentiate between the vehicular access and parking space. This will result in proper functioning of the roads with proper parking facilities.

Need for application of Grasscrete

As we all are aware of the hygiene problems faced by the country on a level as small as the streets, here is a small step through architecture that can bring a possible change in the current pollution levels. One of the most cosmopolitan areas of Pune city, the heart of Camp is M.G. Road, popularly also known as the Main Street. With almost over 500 shops here, some of which running from over 100 years, M.G. Road is one of the busiest streets of Pune making this area highly prone to traffic and hygiene problems. As a solution to this, the commonly used concrete pavers can be replaced by an environment friendly material, the Grasscrete paving system.

Research methodology

Data collection – This research has been carried majorly through secondary data i.e. with the help of study of various research papers, articles, websites related to Grasscrete etc. The paper mainly focuses on the idea of using Grasscrete paving system on the streets of Pune (M.G. Road) and the various advantages of the same. It also states the advantages of Grasscrete over conventional concrete pavers.

Research and Analysis –

The beginning of this paper speaks about Grasscrete and its uses. Further it advances to the comparison of Grasscrete with concrete and its advantages. Furthermore, it focuses on the case study and survey

conducted by the author. Lastly it speaks about the need of using Grasscrete in the area of M.G Road, Pune. This paper concludes by stating the possible ways of achieving a less polluted environment through construction materials.

CONCLUSION

Grasscrete is a concrete surface that is capable of supporting a 40-45ton load because this surface is a unique combination of natural bed and man-made materials. It, gives a new idea or concept to the architect, engineer, or town planner to work with a surface or paving material with load-bearing characteristics of reinforced concrete with an aesthetic appeal of grass. The versatility of Grasscrete that new applications are constantly being discovered. Grasscrete is modern and socially acceptable innovation. It is providing all the practical solutions where concrete, tar, or other materials might be used but, at the same time also softening the urban landscape. The research also concludes that no heavy capital, or big structural changes are required to change the present situation of the streets. Replacing concrete pavers by Grasscrete pavers will give the streets of Pune a complete new look and an eco-friendly value.

REFERENCES

- i. *Grasscrete Sustainable green solutions (September 15, 2020)*
<https://spsgrasscrete.wordpress.com/>
- ii. *GRASSCRETE Technical Bulletin(June,2009)*
<https://www.bomaniteindia.com/Technical/Bulletins/Grasscrete.pdf>
- iii. *Civiconcepts* <https://civiconcepts.com/about-us>

Parametricism And Biomimetics In Architecture

Samruddhi R. Shinde

Abstract:

The aim of the project is to design and built more flexible spaces to provide relations between spaces or compositions of different elements. As parametricism is based on computer technology and algorithms, it helps us to create architectural elements/structures practically in the real world. This style of architecture closes the traditional or typical or particular style of architecture which differs according to the location. The architectural forms of parametric design are based on specific algorithms or rules. And computer technology has given designers and architects the tools to analyze and stimulate the complexity observed in nature and apply in structural building shapes and organizational patterns. Parametricism and biomimicry - the algorithms or the mathematical calculations created in a software are based on the systems of nature i.e., biomimicry. The aesthetics, behaviour, working systems, forms, etc. is inspired by nature.

Keywords: parametrics, biomimicry, nature, façade systems, algorithms, technology

I. Introduction:

Creative methods and innovative techniques in architectural education are continuously developing. Widening the scope of vision of the students in architectural design studios gives them the chance to think critically, evaluate and develop. Designers are usually inspired from different sources to address challenging design problems. One of the methods is to study Nature and comprehend the ways it has developed to address environmental challenges. Nature has always served as an inspiration for architects and designers. By choosing the most appropriate material for design, providing recycling and solutions according to local conditions, Nature is an immense factory which is durable and aesthetic. Nature denotes the world or Universe as created by God.

To experience and practically execute the concept of biomimicry through structures architects have technologies which helps them to practically execute their concepts and designs. Hence, we need to study and research on the structures designed and how these structures work.

The main objective of the research on parametrics and biomimicry in architecture is the develop and create new

design thinking or patterns by combining the principle and aspects of nature, biomimicry and the complex algorithms of parametricism. Biomimicry and systems thinking will provide a framework for looking at skins, growth and bones as paradigms for designing static structures and dynamic systems. This will help us to study how designers have used natural models to generate architectural systems and kinetic constructions.

The scope of the project is the aesthetic values and sensibilities are human universals through which we navigate both the physical and the social world. But as the social world changes simultaneously the built environment or aesthetic values and sensibilities need to change along with the historical development. This shows the importance of aesthetic revolution.

Parametric structure - Where the complete structure is designed and constructed using parametric architecture and algorithms i.e., static structures

Parametric façade - Here only the façade of the building is parametric or a kinetic façade (specific part of the structure is moving) in which we need to carefully design and provide openings. Also, each concept will have the inspiration from biomimetics.

The limitations of this project are -

If we focus on the parametric structure the limitations are:

The form of the structure or The working system of the structure or The materials used.

If we focus on the façade or a specific part of a structure the limitations are:

The system inspired from nature

Form or the module used to design the façade

Materials used

To study how the openings can be provided or design in the façade.

II. Material and Methodology:

Nature as an Inspiration Source:

Nature allowed architects through biomimicry to emphasis their buildings with elements which are characterized by nature such as sustainability, survival, interaction, energy efficiency and structures and materials optimization, as well as interaction with the environment.

With the innovation in the new architectural trend new

methods of design needed to fulfil the complexity of nature geometries, shapes and form generation process, ways could apply the tools which could be used to match the algorithms of Nature.

The appearance of digital tools applications specially "PARAMETRIC DESIGN TOOLS" and the huge development of computer aided design tools has been the answer to this quest. These powerful tools have helped architects to evolve and expand the imaginations inspired by nature and matching them to perfection. This design way is one of the methods used by nature for more interactive and more adapted to the environment. So, buildings which are resulting from this process had the ability to interact and the ability to adapt with nature, more friendly and more sustainable, better at consumption energy reduction and construction structures and materials optimization.

1. PARAMETRIC PATTERNS INSPIRED BY NATURE FOR RESPONSIVE BUILDING FAÇADE

Nature was the source of all that is and an infinitely creative and patient mentor.

Through watching and investigating nature and organisms some principles could be extracted to create a nature mimicked design in art or architecture. Patterns organize and define relationships in nature and can be integrated into design to substantiate and support visual communication. Because design 's purpose is to create a relationship with the viewer, the language of pattern helps to frame what that relationship is before the message is read or even consciously processed. be extracted to create a nature mimicked design in art or architecture.

Responsive Modulation: To modulate a given surface with control over each module which means any module of this system, has to be responsible for some certain criteria. Biomimicry problem-based approach is more appropriate for architectural applications

Architects usually use all transfer methods between nature and architecture. All biomimicry level could be used in the architectural process. Local inspiration sources usually emphasis the architectural identity. Local nature is more efficient in solving local problems. Parametric design tools and mathematical methods in form finding help to get results more aesthetic, efficient, responsive and controllable. Parametric tools help to get more acceptable solutions for design problems.

Case study

i. AL BAHAR TOWERS

Project: Abu Dhabi Investment Council Headquarters

Location: Abu Dhabi, UAE

Architects: Aedas Architects Ltd

Structural/ MEP Engineering: Arup

Completion Date: June 2012

Height: 145m (29 Stories)

Area: 56,000 Sq. M

The heat and glare of the Abu Dhabi sun poses a huge challenge in shading the interior spaces while allowing for adequate daylighting. For the Al Bahar Towers, the team of architects from Aedas took inspiration from the *Mashrabiya*, a jaali like lattice screen used in traditional Arabian architecture as a shading device. A secondary façade of interlocking triangular modules was created which open and close responding dynamically to how much sunlight is incident. This second skin hangs like a curtain wall two metres away from the primary glass façade.

computational design team at Aedas was able to simulate their operation for different solar conditions throughout the year – varying solar angles and sun exposure. Each unit comprises of stretched PTFE (polytetrafluoroethylene) panels and coated with micro fibreglass. The interlocking geometric facade comprises of over 1,000 moving elements, controlled by a building management system to create a smart responsive façade. The south facing roof of the towers incorporate photo voltaic cells that generate about 5% of the building's energy needs, and also drive the system of computer-controlled façade panels.

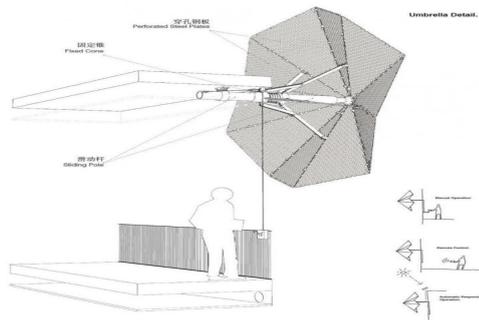
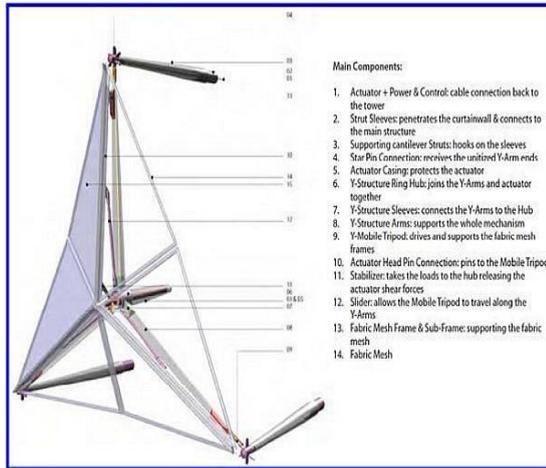


Using parametric models for the shading panels, the All the screens fold at night to reveal more of the internal façade. As the sun rises from the east in the morning, the screens along the east of the building begin to close. Through the day as the sun moves around the building, the strip of closed panels moves across the façade, performing their job of

controlling solar gain. The whole system is protected by a variety of sensors that open the units in case cloud and wind conditions change.

Tall Building Innovation Award by the Council of Tall Buildings and Urban Habitat.

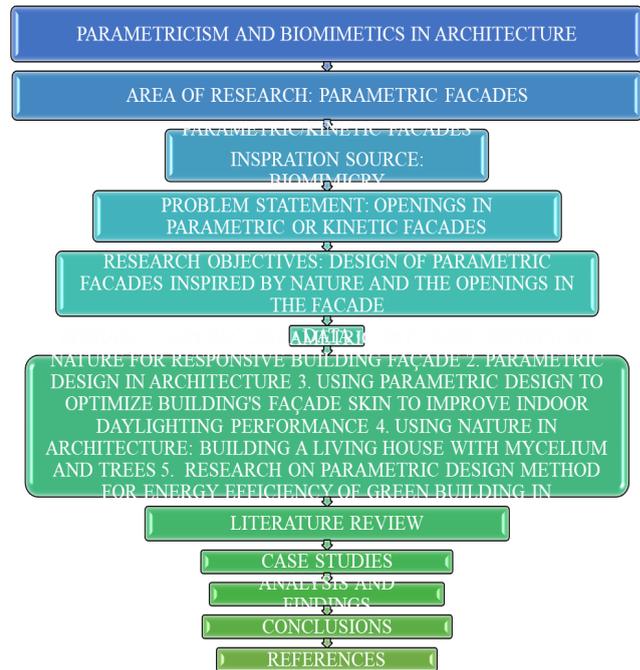
ALBAHAR TOWERS



It is estimated that this screening system cuts out approximately 50% of solar heat gain, effectively reducing the air conditioning load inside the building. Additionally, as the panels even in their closed condition filter some light into the building, they reduce the offices' dependence on artificial light. The result is a much more energy efficient architectural solution to office space requirements that is contextually and climatically relevant to the Middle East. The twin towers save a lot of energy that would have been required for cooling and lighting loads which can be calculated as a reduction of CO₂ emissions of 1,750 tonnes per year.

Such an intricate system of responsive façades has been employed for the first time at such a large scale. It has cleverly taken cues from Pritzker prize winner Jean Nouvel's responsive façade at Monseigneur de la Salette (1981) and evolved it to the next level. The towers have been one of the first in the Gulf to receive a LEED silver rating. For

the project's sustainable engineering and sensitive cultural and urban approach, the towers were also awarded the 2012



III. Results and tables

IV. Conclusion:

1. Many of the reactive facades make the spaces of the building usable and enough ventilated, optimum sunlight and heat gain and at the same time display a spectacle of intricate and aesthetic elements to watch and view.
2. The impact of movement frequently includes the reintroduction of play and playfulness, random consequences and varying rhythm that is impacted either by the environment, the wind, the sun or the different minds of the users. The buildings engage the environment, react to it thus display a simple narrative that might link them firmly to their place while employing high tech solutions.
3. Also, the openings on façade for such structures is complete glazing and the light entering the inside space is completely controlled by the kinetic façade which reacts to the climate, the environment and the sunlight in that location.
4. Kinetic architecture might get buildings a step closer to the phenomena of nature in allowing the parts to move, react and play.
5. Kinetic facades hold great potential for the future, particularly in terms of advancing the technology of building envelopes in the age of global warming. While the executed facades do not all have this aspect as a focus, moving elements in buildings could offer important sustainable design solutions for the future.

6. The involvement of digital design and fabrication tools brings innovation to the built environment but seems to remain in an experimental stage, especially in the realm of facade technology and design.
7. Engineering, art and architecture move closer together to design and build the interfaces and kinetic systems.
8. Kinetic facades can turn mute boxes into dynamic participants within the urban context, sharing spectacle and creating a place to visit and see. This façade system overcomes the static character of architecture and allows an exploration that brings us closer to nature and its phenomena, thus creating dynamic environments.
- 9.

Acknowledgement

Design using parametric models, as studied in the course we discussed, presents significant differences in relation to other digital design models, as discussed by Oxman. First, it manifests the systematic representation, not of form, but of the code that describes it. Second, by contrast to algorithmic design models that automate form-finding, such as the evolutionary design models that use genetic algorithms, and the grammatical transformative models, that use mathematical expressions for the generation of shapes through transformational rules, the parametric model gives designers the capacity to constantly interact with the model (adjusting parameters or even the topological relations that define it through the visual code). Third, designers are able to parametrically control the initial design intentions to generate discreet variations of the model (family of forms), “searching” within a wide range (albeit finite) of virtual results.

References

i

http://www.ijirset.com/upload/2015/september/2_Parametric_foriegn.pdf

ii

<https://www.archdaily.com/270592/al-bahar-towers-responsive-facade-aedas>

iii <https://issuu.com/sebastiansong9/docs/manifesto>

iv

https://www.academia.edu/25834349/PARAMETRICISM_IN_ARCHITECTURE

v

<https://www.architectural-review.com/essays/rachel-armstrong-on-bio-mimicry-as-parametric-snake-oil>

Comparative Study on Factors Affecting Residential Satisfaction In Cosmopolitan And Old/Core Areas of Pune City

Author - Sanika Pandit -

Co-Author - Ar. Vaishali Anagal

Author - Fourth-Year Student, Dr. Bhanuben Nanavati College of Architecture, Pune.

Co-Author - Associate Professor, Dr. Bhanuben Nanavati College of Architecture, Pune.

Author - sanikapandit15@gmail.com

Co-Author - vaishali.anagal@bnca.ac.in

Abstract - Residential satisfaction depends on various factors including housing characteristics, social and economic factors of the residents, neighbourhood conditions as well as the built and natural environment. This research aims to carry out a comparative study of residential satisfaction in core areas and suburbs of Pune city and to identify the significant factors that affect the residential satisfaction in these areas. Identifying the variables through the literature and then analysing the factors affecting residential satisfaction by conducting a detailed questionnaire survey would be an important stage. This study can help the designers and planners to understand the factors affecting residential satisfaction and consider them while planning and designing residential areas.

Keywords : Residential satisfaction, housing characteristics, social and economic characteristics, neighbourhood conditions, infrastructure.

I. Introduction –

Pune is one of the cities that depicts the typical Maharashtrian culture. This is visible through the lifestyle of people, but more importantly though the type of settlement seen in the old quarters of the city. This city having a strong cultural influence and rich heritage background is now rapidly expanding as a cosmopolitan centre with the emergence of the IT sector and education facilities. Pune, once being known as a historic centre is now being identified as a growing metropolis and often referred to as “Detroit of India”.

Rapid growth is seen in the construction of high-rise residential buildings, housing schemes, redevelopment projects which has gradually increased the vertical skyline of the city. Pune’s skyscraper trend kicked off in the prime areas of the city and is now moving to the suburbs. With the recently developed SEZ in Hinjewadi, the migrated population is seeking new jobs offered in the IT sector and is settling in the Hinjewadi, Bavdhan and Baner suburbs. The core city of Pune has a very distinct character than its newly developing suburbs. The development in the core areas is compact, mid-rise, dense and devoid of open spaces; whereas, the new developments in suburbs are high-rise gated communities with modern infrastructure, facilities and community spaces. The residential and neighbourhood characteristics in core areas and suburbs are distinct and so do the population characteristics in these areas. This has affected the housing needs of citizens to a considerable extent where the preference to stay in high rise luxury towers is increasing while at the same time most of the people still opt to reside in the old areas itself. Residential satisfaction, defined as the

feeling of contentment will be an important factor to understand how people are adapting themselves in this rapid development of the housing sector, why they prefer to stay in a certain type of area and what all factors affect the satisfaction in a certain type of residences.

Thus the aim of this research is to understand the variables that affect residential satisfaction with a focus on old and newly developed areas of Pune city and to understand whether residential satisfaction vary between Cosmopolitan and Core parts of Pune city. This research could also pave the way for further opportunities to understand what factors in terms of infrastructure and housing of suburban areas can be introduced in core parts of Pune City.

II. Literature Review –

Many studies in the past of residential satisfaction have shown that Housing and neighbourhood characteristics have a significant impact on satisfying the needs of residence. Housing is considered as the right of every individual and thus any housing programme must aim to enhance the well-being of people. Research conducted in various countries has provided evidence that having satisfactory accommodation is often at the top of people’s human needs (Kiel and Mieszkowski, 1990). Poor housing conditions have a direct effect on people’s health when people are exposed to poor air quality, lack of safety services and other housing hazards. This in turn reduces the satisfaction level of residents. Preliminary research done by Dunn and Hayes (2000) suggests that residents’ perceptions of their homes (e.g. satisfaction with their dwelling or concerns about indoor air quality) are associated with low self-rated health status. Along with housing conditions, neighbourhood conditions plays a prominent role in satisfying the needs of residents and improve their quality of life. Neighbourhoods in which residents express mutual trust have also lower homicide rates (Morenoff et al., 2001). Having a healthy social relationship with neighbours also significantly affect the satisfaction level

as you will have a degree of mutual trust and feelings of connectedness amongst them. Residents well-being is also

affected by home affordability. When rents are too high, residents are not able to afford basic housing services like food and health care facilities creating a potential for eviction, homelessness and unstable environment. Frequent moves in young childhood or adolescence can impair youth's educational attainments as well as psychological and emotional development (Hartman and Franke, 2003; Mueller and Tighe, 2007; Rumberger, 2003). Prior research of Varady & Preiser, (1998) also showed that have shown that age is one of the most important predictors of housing satisfaction (1987; cited in Varady, et.al., 2001) and elderly are more likely to be satisfied than younger households because the elderly have lower aspirations.

IV. Methodology -

For this research, the two areas chosen for comparative study were Kasba Peth and Bavdhan. Kasba Peth is one of the oldest residential neighbourhood in Pune. Narrow lanes and ancient Wada-structured houses are typical characteristics of this area. Redevelopment of old Wada's into commercial and residential blocks have slowly changed the urban fabric of this area. But due to dense development and closely spaced neighbourhoods, the community spirit and cultural identity in this area have remained intact. On the other hand, Bavdhan is a suburb located along the western corridor of Pune. It has a cosmopolitan community. Being in proximity to the IT park, many premier educational institutes and highway, its location is very strategic in terms of scope to urban development. Thus the research hypothesis is neighbourhood is a key factor which affects residential satisfaction in core areas whereas for cosmopolitan areas it the housing character which affects residential satisfaction.

To identify and understand the variables that affect residential satisfaction was the first step in conducting this research. Literature review was conducted and relevant publications were studied identify independent variables and their attributes that affect residential satisfaction. Socio-demo graphic characteristics, Housing characteristics, Neighbourhood characteristics, Behavioural Characteristics, Social environment, Housing Services were identified as important variables that define residential satisfaction. Considering these as the independent variables, their attributes were identified through each of them. Online questionnaire survey form was created which covered all the questions related to main and sub-variables. The data from 50 respondents were collected and analysed through SPSS.

V. Results and Table –

After analysis through the SPSS, some significant findings in terms of corelations with variables were made. Presence of natural environment that is trees, gardens affect the satisfaction

level with respect to the location. Since Bavdhan is nestled amidst three hills, it has scenic viewpoints. Being recently developed it is not a very crowded area and residences are visually connected to all natural elements present. On the other hand, Kasba Peth is a densely developed area with less green cover which results in the absence of visual connection of natural environment from residence. This significantly reduces the satisfaction level of residents. Celebration of festivals and community programmes don't show any significant impact on the residential attachment or neighbourhood attachment in both the areas. Overall residential satisfaction in both the areas is significantly affected by the social environment, bonding with neighbours and community events.

As seen in the scree plot, six significant factors emerged in factor analysis that affects residential satisfaction. Mode of traveling (walking, two-wheeler, four-wheeler etc.) to access neighbourhood facilities emerged as most important factor defining residential satisfaction. Proximity to neighbourhood facilities like cinema and lifestyle and pollution free environment is second important factor that attributes to residential satisfaction. Residential characteristics like house size, number of rooms, sizes of rooms, presence of balcony and terraces, privacy, structural soundness of building etc. contributes to defining residential satisfaction. Other factors like infrastructure in terms of services of building, social environment, other neighbourhood amenities like proximity to gardens, health facilities, bus stop, hotel and bank etc. also define residential satisfaction to a certain extent.

VI. Conclusion –

After comparing the satisfaction levels in both the areas it is concluded that residential satisfaction is not significantly affected by the location of residence. Satisfaction levels are mainly affected by factors like nearness to neighbourhood facilities, residential characteristics of housing, services infrastructure and pollution levels in the neighbourhood.

IV. Acknowledgement –

I am sincerely thankful to D Y Patil School of Architecture, Lohegaon for providing me with the opportunity to write a this research paper. The completion of this undertaking could not have been possible without the participation and assistance of so many people whose names may not all be enumerated and disclosed.

Variables	Mode of	Proxim	Reside	Service	Neighb
		Neighb	Charac	infrast	amenit
		facilitie		like w	
		pollutio		and d	
		environ		social	
				enviro	
Mode of Garden	.609				
Mode of Market	.745				
Mode of Health	.779				
Mode of Cinema	.822				
Mode of Hotel	.685				
Mode of Workspac	.665				
Mode of Bank	.724				
Proximity		0.568			
Proximity Shopping		0.815			
Airpolluti		.861			
Noisepoll		.773			
Number of			.855		
Sizes of r			.817		
Balconies			.823		
Privacy			.651		
Structural			.781		
Drainage			.594		
HVAc			.508		
Garbage c			.708		
Social bo			.831		
Social env			.886		
Communi			.731		
Recreatio			.633		
Proximity				.770	
Proximity facility				.712	
Proximity				.730	
Proximity				.678	
Extraction Method: Principal Component					
Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 11 iterations.					

TABLE 1

Reference-

- i. Kiel, K. A. and P. Mieszkowski, (1990), "An examination of systemic differences in the appreciation of individual housing units", Journal of Real Estate Research, Vol. 5, pp. 301-318.
- ii. Dunn, J. R. and M. V. Hayes (2000), "Social inequality, population health, and housing: a study of two
- iii. Vancouver neighbourhoods", Social Science and Medicine, Vol.51, No. 4, pp. 563-87.

	LOC	AT	TOT	SBO	SS	EV	SN	SR	SC	FEST
Spe	1.000	-.15	.187	.035	-.0	.00	.64	.24	-.0	-.214
LOC										
C										
S	.28	.192	.78	.81	.96	.00	.08	.69	.137	
N	50	50	50	50	50	49	50	50	50	50
ATI	-.155	1.0	-.138	-.16	-.2	-.0	-.0	.09	-.1	.344*
C										
S	.282		.341	.24	.14	.58	.58	.53	.48	.015
N	50	50	50	50	50	49	50	50	50	50
TOT	.187	-.11	1.00	.568	.60	-.20	.34	.24	.37	-.016
C										
S	.192	.34		.000	.00	.14	.01	.08	.00	.911
N	50	50	50	50	50	49	50	50	50	50
SBO	.039	-.1	.568	1.00	.86	.01	.32	.49	.53	-.178
C										
S	.787	.24	.000		.00	.94	.02	.00	.00	.215
N	50	50	50	50	50	49	50	50	50	50
SSO	-.034	-.20	.601	.86	1.0	.16	.37	.58	.71	-.163
C										
S	.817	.14	.000	.000		.26	.00	.00	.00	.259
N	50	50	50	50	50	49	50	50	50	50
EVE	.006	-.0	-.209	.010	.16	1.0	.23	.27	.27	-.060
C										
S	.966	.58	.149	.94	.26		.11	.05	.05	.683
N	49	49	49	49	49	49	49	49	49	49
SNA	.646	-.0	.347	.328	.37	.23	1.0	.58	.40	-.255
C										
S	.000	.58	.014	.020	.00	.11		.00	.00	.074
N	50	50	50	50	50	49	50	50	50	50
SRE	.243	.09	.249	.490	.58	.27	.58	1.0	.51	-.159
C										
S	.089	.53	.082	.000	.00	.05	.00		.00	.269
N	50	50	50	50	50	49	50	50	50	50
SCO	-.057	-.10	.377	.539	.71	.27	.40	.51	1.0	-.258
C										
S	.692	.48	.007	.000	.00	.05	.00	.00		.070
N	50	50	50	50	50	49	50	50	50	50
FES	-.214	.34	-.010	-.17	-.1	-.00	-.2	-.1	-.2	1.000
C										
S	.137	.01	.911	.215	.25	.68	.07	.26	.07	
N	50	50	50	50	50	49	50	50	50	50

TABLE 2

- iv. Morenoff, J. D., R. J. Sampson and S. W. Raudenbush (2001), "Neighborhood inequality, collective efficacy, and the spatial dynamics of urban violence", Criminology, 39/3, pp. 517-558.
- v. Hartman, C., and T. M. Franke (2003), "Student mobility: How some children get left behind", Journal of Negro Education, Vol. 72, No. 1, pp.1-5.
- vi. Varady, D. P., C. C. Walker, and X. Wang (2001), "Voucher Recipient Achievement of Improved Housing Conditions in the US: Do Moving Distance and Relocation Services Matter?", Urban Studies, 38/8, pp. 1273-1304.

Healing Through Built Environment: Architectural Elements And Design Parameters

Sanyukta P. Kulkarni

Fourth Year, B.Arch.

Marathwada Mitra Mandal's College of Architecture, BMCC Rd., Pune 04

Guide: Ar. Jyoti Jain Tholiya

Email: sanyukta.p.kulkarni@gmail.com

Abstract

Vast research has been carried out on healthcare campuses as whole but the research on the architectural elements that make these campuses is limited. Nature forms an important part of the architectural elements and is known trigger the self-healing qualities of the human bodies. This research focuses on studying the effectiveness of courtyards as an architectural element in the healthcare settings for contributing to the healing process of the patients in different ways. Patients from different hospitals were monitored to analyze the effectiveness of these courtyards in form of recording recovery time and medical monitoring of stress management.

Keywords: architectural elements, nature, courtyards, healing attribute, stress management, recovery time

Introduction

The World Health Organization (WHO) defines health as a 'state of complete physical mental and social well-being and not merely the absence of disease or infirmity'. The patients spend most of their time in the enclosed hospital buildings, with limited or no access to nature and the outside world. Scientific researches over the years have proved that a person's surrounding has an impact on his health and well-being. Healthcare architecture, thus, focuses on designing spaces which impact positively on the healing of the patients and also provide support to the families of the patients through the stresses that develop as a result of illness, hospitalization, medical visits, the healing process or bereavement.

Vast research has been carried on healthcare campuses like hospitals, rehabilitation centers, wellness centers, etc. But, a research on elements which impart the healing attributes to an architectural space is limited. Existing studies have shown that in a newer hospital environment, better health outcomes can be achieved when the physical aspects such as access to outside view, patients' privacy, lighting and other factors are appropriate (Aripin, 2006). Various architectural elements, their layouts, materials, colours, etc. and design decisions contribute greatly in designing efficient healthcare campuses.

Along with well-planned private rooms in the hospitals, the shared or semi-private areas also impact the healing process and the overall experience of the place.

Dining halls, counseling centers, common therapy rooms, staircases, courtyards, waiting areas, etc. form an important part of the healthcare settings. Utilization of these architectural elements in the healthcare routines can reduce the patients' dependability on chemical medication.

Healthcare facilities and campuses have access to nature in the form of gardens and courtyards. Gardens are usually observed to be near the entrance points and around the visitors' area. The courtyards on the other hand are planned in the interiors of the campus; primarily aimed for use by patients for various activities. This research thus focuses on establishing the importance and highlighting the natural healing benefits of courtyards in the healthcare campuses. Courtyards in healthcare campuses are shared spaces for various group activities, therapies and as a means of relaxation in vicinity of nature. Courtyards account for allowing natural light, fresh air, natural surroundings and essential pause points in hospitals and similar facilities. It has been long known that nature and healing are closely related, both, psychologically and physically. The healing power of nature recognizes the body's inherent ability to heal itself. This research argues that amalgamating nature's healing attributes with the well-planned courtyards will impact healing positively.

II. Research background

Seyedahmadi (2019) emphasizes on providing pleasing spaces for patients, families and visitors as well as imbibe the cultural concerns of the community. The paper discusses the role of nature in enhancing such spaces. It further discusses the scope of improvement in the methods of treatment through an architectural point of view. The author suggests the inclusion of courtyards in the healthcare campuses in order to facilitate the provision of natural light and ventilation throughout the campus. The importance of natural daylight has also been addressed in Aripin's (2006) paper. The author argues that lack of exposure to natural light and ventilation results in increasing the effect of ill-health on the patients.

Schaller (2012) in her research states that exposure and access to nature provides patients with a distraction from their ailments and sufferings. The paper argues that exposure to nature helps in boosting the confidence of the patients and makes them feel independent and incharge of their own health. While explaining the role of nature in healing, the

author quotes Ulrich (2000): “*Forced perspectives that engage the patient with a framed view of elements like trees or water provide the individual independent moments of self-awareness in the space*”. Similar argument is posed in Yüce’s (2013) paper where the author states that positive distraction reduces anger, anxiety and pain and induces relaxation. The author further raises an argument to verify if these natural healing elements in the hospital setups can help in stress management.

Sanchez (2018) draws relation between the healing attributes of landscape elements and their effect on the human health. The author argues that spatial characteristics of the surrounding are associated with the effectiveness of the indoor landscape spaces. Dejana, et.al. (2010) emphasises on the use of indoor landscape spaces as a part of treatment along with their use for recreational purposes. The authors suggest the consideration of space utilization as a trigger to design the indoor and outdoor green spaces in healthcare facilities.

Bredhe’s (2014) article argues that the concept of healing architecture dates back to 1930’s by citing the example of Alvar Aalto’s Paimio Sanatorium in Finland. The article further explores the architecture and healing qualities of Liverum project through an architectural point of view. Franklin (2012) argues that the need for chemical medicines is reduced when nature is used in the recovery process through a study carried out by environmental psychologist Roger Ulrich. The author also argues that exposure to nature helps reduce stress, anxiety and pain; imparts relaxation and promotes mindfulness.

Marcus, et.al. (1995) prove the health benefits of gardens and courtyards in healthcare settings through case studies. Their research emphasises on including natural elements and promote exposure to nature for effective and longlasting recovery. The authors argue that the spatial relation of these open spaces with the built masses play an important role is their use and effect on the patients.

III. Scope and limitation

The scope of this research is limited to, only one architectural element (courtyards) from the healthcare campuses. Strata are limited to gender and medical condition of the patients, function, and time of use and elements of the courtyards. The sample was limited to 120 patients.

IV. Methodology

The research focuses on closely monitoring the recovery process and stress management of patients suffering from various health disorders. All the patients were observed to have developed stress and anxiety, irrespective of their ailments and disorders. The patients monitored are from 3 different hospitals from India. 50% of the patients were treated indoors, with only medications. The other 50% were treated with medication along with exposure to nature i.e. access to the courtyards. The ratio of male and female patients monitored for the study was 1:1. Age group of the patients monitored was between 35 to 60 years. The patients with

access to courtyards were monitored for the time spent in the courtyards, purpose of use and duration of recovery period, along with levels of stress. Stress was measured through monitoring the vital signs like blood pressure, sugar level, pulse, etc.

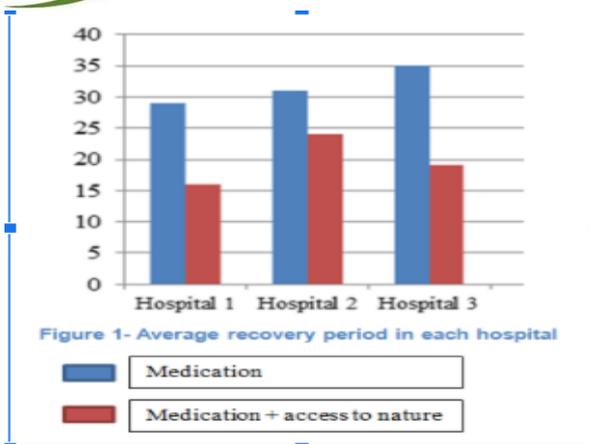
Recovery method	Indoor treatment		Indoor treatment + access to courtyard	
	Males	Females	Males	Females
Adventist Hospital, Pune	10	10	10	10
D. Y. Patil Hospital, Navi Mumbai	10	10	10	10
Life Care Multispecialty Hospital, Latur	10	10	10	10

Table 1- Sample data

A second research was carried out where the courtyards were further studied for their purpose of use and elements used for design. Data generated was by behaviour mapping of the patients and studying the medical records with the help of medical professionals.

Name of the hospital	Purpose of use	Time of use	Duration of use by patient	Elements
Adventist Hospital, Pune (Hospital 1)	Physiotherapy, recreational activities, counseling sessions, visitors’ area, group sessions	5-9 am, 5-8 pm	0.5 to 2.5 hours	Lawn area, water body, acupuncture flooring, native landscape, sitting area, semi-open area
D. Y. Patil Hospital, Navi Mumbai (Hospital 2)	Physiotherapy, recreational activities, visitors’ area, group sessions	6-10 am, 4-6 pm	0.5 to 1.5 hours	Lawn area, acupuncture flooring, therapeutic landscape, sitting area
Life Care Multispecialty Hospital, Latur (Hospital 3)	Physiotherapy, recreational activities, counseling sessions, visitors’ area, group sessions, seminars and lectures	7-10 am, 5-9 pm	0.5 to 3 hours	Lawn area, acupuncture flooring, therapeutic landscape, sitting area, semi-open area

Table 2- Courtyard analysis



Results



presence of water body is observed to enhance the healing effect and enhance the user experience of the natural surroundings.

The courtyard spaces in DY Patil Hospital are well shaded during the day time with the shadows of the surrounding built mass. The courtyards are so planned that 50% of the courtyards in the campus receive sunlight from north and thus can be used throughout the day.

The courtyard spaces in Life Care Multispecialty Hospital are shaded throughout the day with the surrounding built mass. The courtyards thus can be used throughout the day. Some of the courtyards receive the early morning sunlight and are mostly used by patients during those hours for therapy sessions.

The patients, who were allowed to access the courtyards during their recovery period, expressed of feeling fresh and rejuvenated after their time spent in the courtyards. The presence of natural light, fresh air and greens enhanced the healing experience and helped the patients gain confidence post illness. The stress and anxiety during therapy sessions and appointments could be managed in presence of natural surroundings without the need for chemically induced relief.

The hospital courtyards had native trees and shrubs with therapeutic qualities. This induced a sense of familiarity among the patients. The native landscape elements had an effect on controlling the microclimate of the hospital campus

by maintaining a comfortable temperature even during the harsh summer days.

Presence of water quickened the recovery process and enhanced the meditative experience as compared to the courtyards without water bodies. Water, thus, can be identified as an important element in the hospital courtyards.

Presence of courtyards also altered the experience of those patients using the rooms and other areas surrounding the courtyards. Availability of natural light and ventilation, fresh air and natural views impacted the recovery and experience of the patients positively.

VII. Conclusions

It can be said that natural spaces, especially courtyards, play an important role in the process of natural healing. Architectural parameters such as positioning of the courtyards, use of native landscape elements and use of water shall be considered in the design process of healthcare campuses. The paper concludes with proposing the need for research on the courtyards as architectural elements in the hospital campuses of India.

Acknowledgements

I express my deep sense of gratitude to Ar. Jyoti Jain Tholia for her constant guidance and support extended throughout the writing of the paper. I would also like to express my gratitude to Dr. Manas Marathe and Ar. Ravindra Patwardhan (RIA faculty) for their constant support extended for the research.

References

- I. Aripin, S. (2006). Healing Architecture: A Study on the Physical Aspects. *The ARCHITECTURAL SCIENCE ASSOCIATION* (pp. 342-349). Adelaide: The ARCHITECTURAL SCIENCE ASSOCIATION.
<http://anzasca.net/paper/healing-architecture-a-study-on-the-physical-aspects-of-healing-environment-in-hospital-design/>
- II. Bredhe, E. (2014). Healing Architecture-Liverum in Naestved, Denmark. *Swedish Wood*.
https://www.swedishwood.com/publications/wood-magazine/2014-3/healing_architecture/
- III. Clare Cooper Marcus, M. B. (1995). *Gardens in Healthcare Facilities: Uses, Therapeutic Benefits and Design Recommendation*. The Center for Health Design, Inc.
https://www.brikbase.org/sites/default/files/CHD_GardensinHCFacilityVisits.pdf
- IV. Dejana Nedućin, M. K.-F. (2010). Hospital Outdoor Spaces - Therapeutic Benefits. *FACTA UNIVERSITATIS- : Architecture and Civil Engineering Vol. 8*, 293-305.
https://www.researchgate.net/publication/270470555_Hospital_outdoor_spaces_Therapeutic_benefits_and_design_considerations
- V. Franklin, D. (2012, March 1). *How Hospital Gardens Help Patients Heal*. Retrieved December 26, 2020, from Scientific American: <https://www.scientificamerican.com/article/nature-that-nurtures/>
<https://www.scientificamerican.com/article/nature-that-nurtures/>

- VI.Holmes, D. (2017, April 3). *The Landscape Spaces of Nelson Mandela Children's Hospital*. Retrieved December 16, 2020, from World Landscape Architect: <https://worldlandscapearchitect.com/the-landscape-spaces-of-nelson-mandela-childrens-hospital/#.YDaUIOgzZPZ>
<https://worldlandscapearchitect.com/the-landscape-spaces-of-nelson-mandela-childrens-hospital/#.YEjvpv0zZPY>
- VII.McBride, J. (2019, May 4). Are Courtyards & Atriums a Gateway to Health & Happiness? *Houzz*.
<https://www.houzz.in/magazine/are-courtyards-and-atriums-a-gateway-to-health-and-happiness-sisetivw-vs~121604059>
- VIII.Sanchez, F. (2018). *Healing Landscapes*. Flowscapes Graduation Studio.
<http://resolver.tudelft.nl/uuid:3e2f7196-6694-4e22-9a9a-7b1f346584cd>
- IX. Schaller, B. (2012). *Architectural Healing Environments. School of Architecture Dissertations and Theses*. Syracuse, New York: SURFACE.
https://surface.syr.edu/architecture_theses/62/
- X. Seyedahmadi, S. (2019). Role of Natural Elements in Provision of Healing. *European Journal of Sustainable Development*, 401-408.
<https://ecsdev.org/ojs/index.php/ejsd/article/view/776/771>
- XI. Yüce, G. F. (2013). Hospital Outdoor Landscape Design. In M. Ozyavuz, *Advances in Landscape Architecture* (pp. 381-398). Istanbul: IntachOpen.
https://cdn.intechopen.com/pdfs/45442/InTech%20Hospital_outdoor_landscape_design.pdf

Evolution of Senses & Enhancing The Vision Through Architectural Design Spaces For The Blind And Visually Impaired

Author: Saurabh Gaikawad
D.Y. Patil School of Architecture
Email id: sau131099@gmail.com

Abstract - *A Utopian world is a myth. Mankind has evolved irrespective of the flaws of this world and has reached to its apex. Whereas even today a visually impaired person is not only termed as “specially abled person” but is also treated as a disabled person. Humans have somewhere lost track of humanity and have forgotten their basic duty of assisting these people who are a step behind in this so called “race” of the society. The research paper focus of the modifications which will be a step towards improvement of the daily lives of the blind, also our constant efforts can make the world a better place for the blind and visually impaired as a person who loses sight, must never lose his vision for life.*

Introduction

Designing for the visually impaired poses its own challenges and obstacles. One cannot completely make a visually impaired person forget about his disabilities but as humans and designers it the not only a responsibility, but a duty to meticulously work towards making an atmosphere that is of utmost comfort to the visually impaired citizens and bridge the discriminatory gap between the abled and specially abled. Numerous methods and design modifications can be done for private spaces, public spaces and landscapes for the blind which are very minute, whereas are of great aid to the blind. Careful consideration of tactility, touch, smell, sound, temperature and technology and combining all these aspects together will create an surrounding which will make a visually impaired person forget about his inability of sight and visualize the surrounding spaces. Apart from the basic recommendations of universal design, some extra additions and modifications will be of great assistance for the blind. The use of tactile paving in indoor and outdoor will allow them to walk without any assistance of a helper. These tactile pavements symbolize the independent progress of the blind in the various walks of life. The use of brail script along with the usual informatory medium in all possible places will make the blind understand and comprehend the details of the surroundings and use the services with ease and without any hesitation. The sense of smell by the means of natural and artificial fragrances will be indicators to the blind for various spaces and in both interiors and landscapes. These fragrances also give a refreshing feel to keep head and body calm. Sound also plays a very important role for the visually impaired. Sounds help them to locate the essential services and using the sense of sound in a multidimensional way will open many doors for the blind in terms of accessibility. Technology is also an important factor, as modern developments are constantly striving to improve the life of blind. Virtual assistance is the key to the future for the visually impaired citizens.

Material and Methodology

The use of tactility, touch, smell, sound, temperature, and technology are the things that assist the visually impaired to calibrate and form and understanding about the outside world. Tactile paving is a very useful method for aid of the blind to walk around in a certain area. These tactile pavements are used on footpath, public buildings- like railway stations, airports, schools etc. The design of tactile pavements can be modified and used in an innovative way to ease the lives of the visually impaired. Tactile can not only be used for locomotive assistance but also for sensing of areas and destinations in indoor and outdoor. Tactile pavements can be used for indication of domestic locations. Smell plays a vital role in the five sensory organs of the body. Smell helps an individual to sense the surroundings of any arena. A pleasant smell lightens and enriches the mood of any person. Landscapes can be created in such a way, with pleasant odor flowers and trees that would be lighten the mood of the visually impaired. In the interior of the structure, also sense of smell can be used. Sense of smell can be used to indicate spaces and location of interior spaces. Smell indicatives can be used instant of sign boards for indication of spaces. Use of candles of various fragrances can be indicative to various interior arenas.

Auditory System is an important aspect for blind and visually impaired. Sound helps the visually impaired to recognize people and surroundings. Sound is the major source of entertainment for the visually impaired. The olfactory sensory receptors can be vitally used to create a source of entertainment for the visually impaired. Sounds can be used in forms of music, tunes, rhythms for entertainment purposes. Use of natural elements like water, air can be a good alternative for landscape and interior sounds. These sounds can help to increase the efficiency of the blind and visually impaired. Natural sounds can be obtained from design of the ancient times like the water fountain and sound columns. These sounds can be incorporated with the site to also reduce the negative sound coming from the surrounding. Windows can be oriented to the natural wind direction of the site to allow maximum natural ventilation and to reduce the burden of mechanical ventilation. Technological advancements have reached its apex and are still developing. Microsoft Seeing AI is an app designed to help people with low vision or who are blind. It enhances the world around the user with rich audio descriptions. It can read a handwritten note or scan a barcode and then tell the user what the product is. Point a camera at something and the app will describe how many people it can see and where they are in the image – center, top left and so on. Thus this app can be incorporated with the design for virtual assistance. For a sighted person, walking along the street can mean taking in every detail that surrounds them. Microsoft Soundscape replicates that behavior by building a detailed audio map that relates what’s taking place around a person with visual impairment. It creates layers of context and detail by drawing on location data, sound beacons and synthesized 3-D stereo sound to build a constantly updating 3-D sound map of the surrounding world.

Results and Tables

Use of senses other than the sense of sight

Senses	Incorporation in Design
Auditory System	Use of water and air to create a soothing atmosphere and to cancel out negative noises.
Somatosensory System	Use of brail in design and also proper orientation of windows for proper ventilation. Also use of AI
Olfactory System	Use of natural and artificial fragrances in landscapes and interiors.

Conclusion

Meticulous strategies and modifications will be a step towards improvement of the daily lives of the blind. Use of sensory receptors other than the sense of sight- can be very useful in the daily activities of the blind and visually impaired. Also as architects and designers its a duty to make considerations for blind is universal design and basic design.

Acknowledge

I would like to thank Prof. Sanjita Maindargikar and other faculty members of D.Y. Patil School of Architecture who of constantly guided me come up with this research paper.

References

- i. *Questionnaire filled by the blind and visually impaired members of the N.G.O.- Sunrise Candles (Mahabaleshwar).*
- ii. *<https://www.microsoft.com/en-us/ai/seeing-ai>*

An Eco Resort

Saurabh Jagtap, Prof. Chaya Chavan-Tirvir

Student of Fifth year B.Arch., Dr. D. Y. Patil College of Architecture, Akurdi, Pune, India.

Professor at Dr. D. Y. Patil College of Architecture, Akurdi, Pune, India.

E-mail address: saisanskirutichaya@gmail.com

Abstract: *An eco-resort is a lodging facility that takes active steps toward environmental sustainability and social responsibility by helping its natural surroundings and the local community. The modern concept of a resort is that planned as an integrated development with consideration given to its compatibility with the natural environment and possible benefits to local communities. The problems facing due to general resort designing are Priority of local and national economy, the lack of infrastructure to support sustainable tourism development, Sustainable development policy focus, Structure of the public administration system, Lack of awareness.*

Keywords: eco-architecture, bioclimatic, eco-urbanism, eco-resorts, sustainability.

INTRODUCTION

The need of eco resort is for minimizing the impact of tourism on nature and culture; educating tourists about the importance of conservation; promoting responsible business practices; providing financial benefits for the conservation of the natural areas; educating the traveller about the local community and its culture; use of local building and landscape materials; hiring local labour during construction and operations processes; applying innovative water and energy management and conservation solutions; preparation of informative environmental education programs and materials.

Aim of the project is to design an Eco resort not only for leisure but to offer tourist a complete eco experience.

For this we need to focus on:

- Climatic and energy consumption issues raised by present day architecture through sustainable design.
- To provide a recreational environment for verities of facilities and functions.
- To provide comfortable design that portrays an environment of leisure and promotes interaction with nature.
- To respond to the climatic and energy consumption issues raised by present day architecture through sustainable design.
- To design with suitable perspective to the surrounding environment and without the environment disadvantages.

- To locate the building with public spaces and common facilities for encouraging social interaction.
- Cost effective and functional design.

The scope of project is the eco resort with recreational facilities. They intended to go some distance far from city so that they can enjoy the environment. The project provides a lot of scope for site planning and landscaping.

The project provides an outlet to study the local architecture: an exercise in the evolution of an architectural vocabulary which takes the inspiration from the local and architecture, keeping in mind of the climatic factors, behavioral patterns and the user attitude.

It also provides the opportunity to study the local cultural and heritage.

A resort demands the formulation of an ambience which can provide people to relax and leisurely spend their time, at the same time satisfying all their functional needs. Thus, this project gives the opportunity to deal with the visual, behavioral, technical and functional aspects of the design.

The research methodology is based on a case studies and comparative analysis in which major focus is on environmental, economic, social benefits, water efficiency, energy and atmosphere, indoor environment quality and sustainable materials. Conclusions and recommendations are tourism is to move, answering the new ecological and environmental concerns, to a develop a mass tourism, Structural changes will make it more responsible, environmental and social.

MATERIAL AND METHODOLOGY

Literature review:

Until the decade of 80, of XX century, the related global problems with the ozone depletion and with the climate change are apriority for a minority of scientists who did not hear its voice in the medias. The few that had attended the oil crisis of years 70 forgotten the problem that the “energy crisis” raised and, each time, raise more. Why the smashing majority of the experiences in architecture and urbanism

consumes so much energy and produce a great impact in the environment?

Based on the consideration that we do not learn the sufficient with the good practical examples or we do not systemize the technical standards which answer with severity to the sustainable principles of human being survival according to actual standards of life. (Emmanuel, 2005).

According to Emmanuel (2005) the questions related with the global heating, the exhaustion of the energy resources and the bankruptcy of the speculative capitalist model meet in an impasse. Today we reach the border between the concerns of sustainable comfort and the projection of conducive secular shares to the survival of the species (Geyer-Allely, 2002).

Our generation, probably, is conditioned to prevent future cataclysms provoked for a set of factors that, cumulatively, has come to play a basic role in the constant degradation of the ecosystem conditions of the planet. Almost two decades that we are going to create knowledge capable "to support" the development model, guaranteeing the occidental way of life to emergent countries that intend for in practical. According to possible scenes such as the considerable increase of the average level of waters of the oceans for saw of the global heating or the announced end of the fossil fuels, the world that we know would be obliged to move drastically (Stern, 2007). In such a way, we can consider that the climate changes, each time more visible, allied to the social changes and politics in the world provoked by the energy crisis need being equated according to a new "paradigm". In this picture, it will be necessary to review the models currently acceptances for the organization of the built environment, in general, and of the architecture and urbanism in particular.

The "eco-resort" means a friendly environment development of the area and has assumed the figure of a concept of resorts whose localizations and destinations offer a set of products, services and animation related to the environmental questions. Referred by Baud-Bovy (1998) a resort is essentially a place developed for the sojourn of tourists, providing multiple facilities for their accommodation, recreation, entertainment, rest and other needs. Through the concentration of facilities, the resort acquires an identity and character: it becomes a specific place to go to and to enjoy in its own right, in addition to serving as a gateway to other resources in the area. Tourist resorts enable the best use to be made of infrastructure and land and operational services.

In a next future the "eco" will have to be transversal to all this development. A layer is not treated more than, a concept but yes of an imposition of market to the developments. This attitude came to be whichever the concept of the resort, the type of exploration or the classification for the development. Based on this vision it is necessary to understand the emerging concepts in eco-architecture and Eco urbanism. Schwanke and al (1997) stressed that one of the primary objectives of resort planning and design is to create a sense of

place and the effort begins with the setting. Planning and design are essential on shaping the setting, visitors' or residents' perception of it, and, ultimately, the sense of place conveyed by the resort in the context of its natural surroundings. Sustainability has become a widely applied concept – so much, that the meaning lost precision and definition; today, it probably acts more like a symbol of a necessary civilizational change, i.e., a different perception of human activities and values, in relation with an environment conscious attitude and accounting. According to Camagni (1996) and others (Marret, 1995; Fusco and Nijkamp, 1997; Lombardi and Basden, 1997), it is the following: "A process of balancing and integration (or co-evolution) between sub-systems, i.e., social, economic, physical (including the built heritage) and environmental". This process should be able to guarantee both: "a non-decreasing level of well-being to local community in long term (quality of life) and the reduction of negative effect in the biosphere (environmental quality)."

The word sustainable suggests the idea of constant, permanent or continuous and it is translated to some language as durable (e.g., Dutch, Finnish and French) but this may change the meaning of the concept. In this study, it refers to the "opening process" of all the fifteen "aspects" in a built environment and its community. A specific definition has been provided by Lombardi and Basden (1997), saying that: "Sustainability in the built environment is a result of the subjects related to the built environment acting in line with the laws of all aspects in an integrated and balanced manner over the long term, and threats to sustainability come from going against or ignoring the laws of one or more aspects". The concept of environment was also evolving, at the same time - from an almost identity with nature and the physical quality of its components affecting mankind, to the perception and evaluation of the surrounding universe, through social, economic, philosophical and cultural criteria, focused on the more subjective goals of "quality of life" and "sustainable development".

In the field of architecture, sustainability is now also becoming mainstream; but the seeds were already there for the last decades - mainly after the oil crisis of the 70s: - passive solar, bioclimatic, green and eco-architecture had often claimed for the need of a better relation with site, physical environment, resources, human scale and cultural diversity, pointing out the importance of local input and scale, towards a more humane architecture. Governments, specially of the industrialized northern countries, have supported the climate conscious approach that some of these trends proclaimed, on a saving energy policy basis; but up till now, failed to influence the majority of architects and public opinion - besides the first buildings formal inconsequence and certain lack of quality, the consumerist way of life that the industrialized world also sustained and publicized, and the civilizational blind faith on techno scientific solutions to dominate nature and mechanically solve problems, prevented a wide acceptance of an environmental attitude in the

architectural process. A very representative number of architects and theories choose the ecological principles as the reference to follow, in order to achieve the desired sustainability in architecture- even here with a wide range of attitudes. If one follows the original concept applied in the Brundtland Report, and besides the optimal resolution of the binomial relation between resources, management and quality of life, sustainability requires also other fundamental aspects: - continuity, which translates better in the dynamic adaptation of a building (or urban fabric) to the continuous changing ways of life and specially, ethical responsibility towards next generations, to incorporate local and civilization information, seen as the essential resource to understand the past and to provide alternative paths to build the future.

Some authors consider sustainable architecture impossible, if a strict meaning is applied to the concept; in the context the definition was presented above, but it can be considered a redundancy, because a responsible architecture should always incorporate those fundamental aspects referred, regardless of programmatically, economical, formal or other conditioning aspects in the process of architecture design and implementation. However, that is still not yet the case for the majority of the architectural approaches all over the world, and so, rather than another trend or formal style, sustainable architecture should stand for a basic integrative attitude to introduce in all levels of the architectural process. The bioclimatic architecture consists of the conception of buildings having in consideration the local climate, using to advantage the available natural resources (sun, wind, vegetation) with the purpose to get through the drawing and with low energy consumption a degree of comfort raised in the use of the building. The bioclimatic architecture integrates some climatic, ambient, cultural knowledge and partner - economic finding only solutions for each design. The application of bioclimatic strategies in the buildings is essential to reduce energy consumption and carbon emission. A bioclimatic architecture is that one that takes care of all climatic conditions in the conception of project, using passive solar systems of form to increase and energy efficiency. Not to confuse with the active solar architecture that is associated with the use of mechanic instruments, for example, solar and photo voltaic panels, hybrid systems of cooling for evaporation, etc. These active concepts are out of the bioclimatic definition but they find in sustainability vision the justification.

Based on the roots of empiricism, the bioclimatic architecture is unproved of the one of technologies to acclimatize or to illuminate. Such constraints compelled to an efficient and inserted construction in the surrounding climate, using the local materials mainly. The sustainable construction is defined as a constructive system that promotes interventions on the environment, adapting it to the use necessities, production and human consumption, without depleting in this intervention the natural resources.

Thus, the systems of exploitation of pluvial waters, passive heating and cooling, quality of air and the water, maximization of the natural illumination as well as the use of renewed energies and impact of the used materials, are in pair and integrated in its global with the programmatically and aesthetic questions in the conception of the buildings. As result of sustainable construction, we have a building that generates the resources rationally such as the energy, the water and the impact of the materials used in construction, taking care as a building to all estimated calculus of resistance of time, to allow the continuity of its function of shelter for a definitive use based on the waited indices of comfort.

To relate that the sustainable construction is transversal to all the concepts, styles and stylistics languages adopted and employed in the buildings. The used passive measures can modify the form but never the language of the building. As action base we have to find a good relationship of the building with the local climate searching in its selective permeability the capacity to accumulate and to absorb heat or cold, to renew air and to control illumination.

RESULT

The building construction industry produces the second largest amount of demolition waste and greenhouse gases (35-40%). The major consumption of energy in buildings is during construction and later in lighting or air-conditioning systems. While, various amenities like lighting, air conditioning, water heating provide comfort to building occupants, but also consume enormous amount of energy and add to pollution. Further, occupant activities generate large amount of solid and water waste as well. Eco Resort will help to minimize the harmful impact that buildings have on the environment.

Detailed environment assessment will not be done due to limitation of knowledge in this field and it is not our primary focus as the project is virtual. The project will not cover all the details related to green design incorporated, though research will be made and required level of detailing will be done to meet the architectural requirement.

CONCLUSION

1. Tourism is to move, answering the new ecological and environmental concerns.
2. To develop mass tourism.
3. Structural changes will make it more responsible, environmental and social.
4. Looking for creative standards of quality and propitiate a bigger contact of the tourist / customers with nature.
5. Eco- campaigning- resort appears as a valid option to the construction of a new construction of a new conventional tourist enterprise, and search to create permanent employment.

6. A change in society creates new human and physical conditions on the built environment which defines emerging concepts for eco resorts.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Prof. Chaya Chavan-Tirvir for his valuable guidance, inspiration and encouragement. His keen and indefatigable indulgence in this work helped me to reach an irreproachable destination.

REFERENCES

- i. https://en.wikipedia.org/wiki/Eco_hotel
- ii. <https://www.indian-architects.com/en/anagram-architects-new-Delhi/project/vaansa-eco-resort>
- iii. https://www.irbnet.de/daten/iconda/CIB_DC24679.pdf
- iv. <https://greenloons.com/2010/07/25/criteria-that-makes-a-hotel-an-eco-hotel/> <https://issuu.com/sulmankhalid/docs/co-resorts.planning.and.design>.
- v. <http://www.fao.org/docrep/X5626E/x5626e0a.htm>
- vi. http://www.garretthardinsociety.org/articles/art_tragedy_of_the_commons.html
- vii. <https://www.cia.gov/library/publications/the-world-factbook/geos/bh.html>,
<http://www.energystar.gov/>

Impact of Sadar Bazaar Street on User Safety

Shanu Rathi

Sinhgad college of Architecture, Pune India

Email: 4.shanurathi.06@gmail.com

Abstract: *Every city has its own History, Culture, and Architecture defining the long back and the upcoming story. In the same way, every street has its own narrative and charisma explaining the surrounding environment, the locality, the user group, and most importantly its impact on the user. There are many parameters of how a street reacts to the user and vice versa. The impact created on the user goes hand in hand with the category and the age of the user group. Different elements and different time zones create varied impacts on different user groups.*

KEYWORDS – Streetscape, Elements of street, Street furniture, Impact on user, Pedestrian safety, Sadar Bazar Street

AIM: To study how Sadar Bazar Street creates an impact on Pedestrian safety

OBJECTIVES:

- To understand different Parameters of Pedestrian Safety.
- To analyze Architectural elements of Sadar Bazar street.
- To study how street furniture affects pedestrian safety.

INTRODUCTION

User, user safety, user friendly or universal design are some of the important terms used in field of Architecture. User or User group is a vast category which varies according to the contexts. As talking of the street, here it can be differentiated into many such as Pedestrian, vehicle user or the shop owner or the residents. And user safety can be explained as the sense of being safe for the user in day to day activities and could be categorized in to two main criteria:

- i. Physical safety
- ii. Psychological safety

- Physical safety includes safety from accidents, threats, natural disasters, health problems, etc.
- Psychological safety includes safety emotional threats or fears of being stuck in some serious situation, etc.

In this paper we would be talking about Pedestrian safety on the Sadar Bazaar Street. Sadar Bazaar is an area with many commercial street located in the most crowded part of Paratwada. The time line from Wooden to Modern Architecture can be seen here. It's main clothing market of the

locality which also has visitors from nearby villages and towns. It has an average footfall of 10,000 visitors in a day with 5000 residents living there. This street notices a transition of a deserted area to the most crowded area of the locality in different time zones of a day.

There are different types of pedestrian group visiting this street such as

- i. Residents taking walk
- ii. Localities came for shopping
- iii. Visitors from nearby villages came for shopping
- iv. Vendors
- v. People appointed by municipal-corporation for cleaning

These all people visit the street in different time zones and the impact created on them varies according to the time zone and the activity they are engaged in.

When we talk about user and user safety the build environment and environmental psychology play an important role in it. Impact created on the user safety is also an important factor to consider while designing as it affects many parameters such as number of tourists or visitors visiting the street, the market sale of the day, the number and class of the residents living there, etc. There are factors that influence the impact of the street on the user such as crowd, traffic, landscape, light, time zone and locality. Street furniture can create or manipulate these factors and give a varied outcome.

LITERATURE REVIEW

RESEARC H PAPER	AUT HOR	DATE OF PUBLIS HING	AIM	KEYW ORDS
ROLE OF STREETSC APE IN SHAPING URBAN DESIGN	Rikhi Arindam Gayary1, Kanika Bimra h2, and Rudra priya Yadav 3	April- June, 2016	To study how streets impact urban design	Sustainable, Streetscape, Urban Design, Visual Image
AN ANALYTI CAL STUDY OF	Dr. Mohamed Fekry	April 18-19, 2016	To study the Impact	Streetscape - social behavior

<p>THE IMPACT OF STREETSCAPE IN JEDDAH ON SOCIAL BEHAVIOR OF THE USERS</p>	<p>Mahmoud, Dr. Samah El Khateeb</p>	<p>2012</p>	<p>of Streetscape in Jeddah on Social Behavior of the Users</p>
<p>SUSTAINABLE STREETSCAPE AS AN EFFECTIVE TOOL IN SUSTAINABLE URBAN DESIGN</p>	<p>Reema Mohamed Rehan</p>	<p>2 December 2012</p>	<p>To study how Sustainable streetscape as an effective tool in sustainable urban design</p>
<p>TALK ON THE STREET: THE IMPACT OF GOOD STREETSCAPE DESIGN ON NEIGHBORHOOD EXPERIENCE IN LOW-DENSITY SUBURBS</p>	<p>Zainab Ibrahim Abass, and Richard Tucker</p>	<p>28 January 2020</p>	<p>To study how good street design can have an impact on neighborhood suburbs</p>

IV. RESULT
• Streetscape

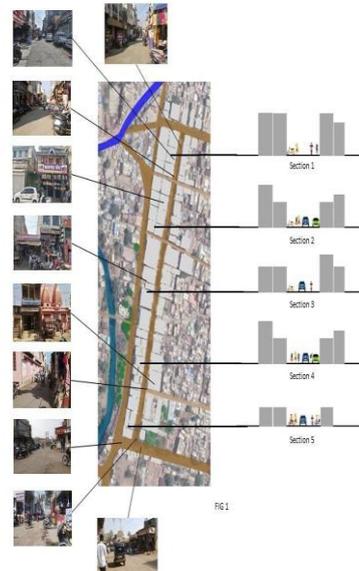


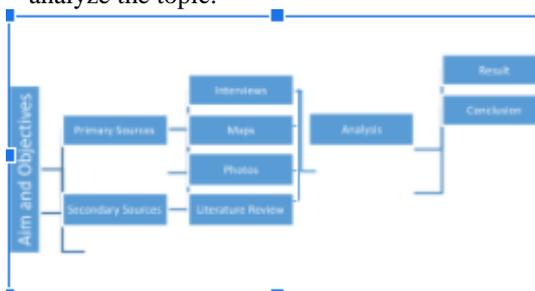
FIG 1

- It is a 500 m tar road with Buildings of G+1 to G+3 on both the sides.
- The road has width of 8-9 m.
- There are 2 or 3 junctions in the street which creates blind turns.
- Vehicles are parked on both side of the road.
- There is no proper segregation of road for pedestrian or vehicular movement.
- One or two trees could be seen on the street.
- Encroachment done by the shop owners can clearly be seen.
- There are some houses made up of wood and some made of concrete, both are used for residential as well as commercial use.

METHODOLOGY

• MATERIAL

- This research paper involves the study of “IMPACT MADE BY THE SADAR BAZZAR STREET ON THE USER SAFETY”
- This paper studies about the Streetscape, Traffic movement and Pedestrian activities in different time zones, the street furniture and the impact that all these points create.
- The Interviews of the users, Maps and Photographs taken in different time zones were used to study and analyze the topic.



• BUILDING TYPOLOGY



FIG 2

- Different typologies of buildings can be seen.
- There are commercial buildings such as general stores, cosmetic stores, grocery store, electronic store etc.
- There are many small and big cloth shops, which attracts the crowd.
- There are many residential buildings at the end of the street.
- There is a famous temple in the street.
- Many buildings are used for mixed purpose such as commercial at ground floor and residential at the first floor.
- ROAD TRAFFIC AND FOOTFALL

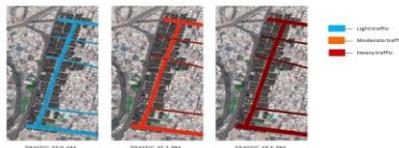


FIG 3

- As it's the market street, the traffic and footfall varies according to the day and time of the opening and closing of the market.
- As the market opens at 11 am, there is light traffic and very minimum footfall before or till 11 am.
- There is moderate traffic between 11 to 3 pm, and heavy traffic between 4 to 8 pm and then it gradually lowers down till 10 pm.
- Again the area is just occupied by the residents who have come out for a walk or the children playing cricket or etc.
- After 10 or 10:30 pm the area seems to be deserted as there is a bit chaos due to the nearby wine shop.

IMPACT ON USER SAFETY

- As it's just 500 m stretch it's easily gets over crowded which increases the chance of mass spread of diseases.
- Due to small and crowded internal roads and T junctions, blinds turns are created which are major factor for accidents.
- As the street is not well planned, there is no control over the pedestrian or vehicular movement, which could lead to accidents.
- Pickpocketers get advantage in crowd which results in incidents such as robbery.
- As due to lack of green spaces, there is lot of carbon emission in the area, it traps heat and it could be

harmful for health in summers as well as in long term.

- As there are some old structures, there is a threat of them collapsing any time.
- As it's overcrowded, it becomes an unnoticed spot of eve-teasing and harassment.
- It's unsafe for women and children to use this street after 9, as the market closes down the junction or the internal roads becomes the blind spots with minimum lights.

V. CONCLUSION

Many transitions can be seen on Sadar Bazaar Street according to different time zones and the user activity. The Impact created also varies accordingly. Addition of some street furniture can lead to change in user experience and could be an important step with respect to user safety.

VI. ACKNOWLEDGEMENT

I would like to express my heart full gratitude to my Ar. Priya Chitale mam and Ar. Anita Kaythekar mam for

their keen guidance, inspiration and encouragement that helped me to do better and achieve my desired result.

REFERENCES

Bibliography

- Dr. Mohamed Fekry Mahmoud, D. S. (April 18-19, 2016). An Analytical Study of the Impact of Streetscape in Jeddah. An Analytical Study of the Impact of Streetscape in Jeddah, 6.*
- Levels, A. (2019). RETHINKING THE STREET. Berlin .*
- Oakman Boulevard, D. M. (n.d.). Green Streetscapes Study. 3434 Washington Boulevard .*
- Rehan, R. M. (2 December 2012). Sustainable streetscape as an effective tool. Sustainable streetscape as an effective tool, 14.*
- Rikhi Arindam Gayary1, K. B. (April-June, 2016). Role of Streetscape in Shaping Urban Design . Role of Streetscape in Shaping Urban Design , 4.*
- Streetscape and Social Life: Contextualizing the Study. (n.d.).*
- Zainab Ibrahim Abass a, b. a. (28 January 2020). Talk on the Street: The Impact of Good Streetscape Design on. Talk on the Street: The Impact of Good Streetscape Design on, 23.*

Outdoor Gyms And Its Impact on Human Behaviour In Pune

Shravani Awati, IV year B.Arch, BNCA, Pune
awatishravani2016@gmail.com
Prof. Mahesh Bangad, BNCA, Pune.
mahesh.bangad@bnca.ac.in

Abstract: *There is worldwide concern about inadequate levels of physical activeness among a large part of the population. Outdoor gyms are open and built-in natural settings, free, accessible and have physical and mental health benefits. This research aims to understand and compare indoor and outdoor gyms and the perception of the users. The research methodology used during the study included passive observation, a survey based on a questionnaire, data collection through newspaper articles. The outcome of the research is to understand whether people are comfortable using outdoor gyms and factors that can promote their use and thus physical and mental health.*

Key words: outdoor spaces, physical fitness, gym, physical health, mental health

1. INTRODUCTION

The global pandemic situation has brought to fore the need to look after low levels of physical inactivity in people and lack of association with nature that have been linked to increased rates of poor physical and mental health[2]. While outdoor gyms are being speedily installed around the globe, less is known about their implications on physical activity, and fitness and other health-related outcomes[3]. Among all physical activity built environment, open gyms in parks and along footpaths plays crucial role in addressing inadequate levels of physical activeness because they are open to all age groups and are free of cost. Recently, Pune has set up 120 open gymnasium by civic bodies in localities of Aundh and Baner to engage people in fitness activities[8]. In recent times outdoor gyms are becoming a priority in terms of physical fitness, accessibility, and ease of use, hence there is a need to study why outdoor gyms are preferred over indoor gyms[5,6]. The objective of this systematic review was to examine the effects of outdoor gyms on physical activity, fitness, user characteristics and outdoor gym usage by public. The study area for this research includes outdoor gyms in parks and footpaths settings. The synergistic combination of exercise and exposure to nature thus the 'great outdoors' could be used as a powerful tool to reduce physical inactivity. The purpose is to investigate the preference of users towards the use of space-indoor closed gyms and outdoor gyms, perceived health benefits achieved.

LITERATURE REVIEW

More recently, some studies have suggested that natural spaces are essential to health and well-being. This is something that people recognize as important strategy to perceive public health agendas promoting habitual physical fitness when they are more exposed to environments that have more natural and green settings [1]. Wanting to escape from stress routine and to experience calm and stimulation are some of the psychosocial benefits that motivate people to seek natural and outdoor places [7]. The study aimed to determine the acceptability of outdoor gym use among public, evaluating its usage, intention to use, frequency and preference for use. Regarding experiences and perceptions of outdoor gyms major themes emerged: "health", "social connectness", "affordable", "support"[4]. The synthesis revealed that health was a central theme of outdoor gym users experiences, also spaces where neighborhood can find social linkage while participating in outdoor physical activities.



Figure 1- People using open gyms at Vartak Park

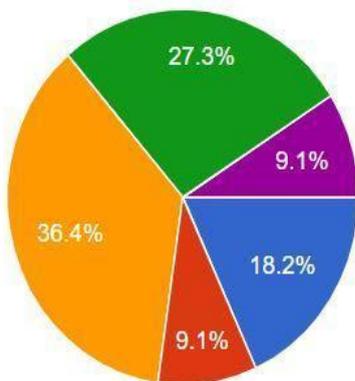
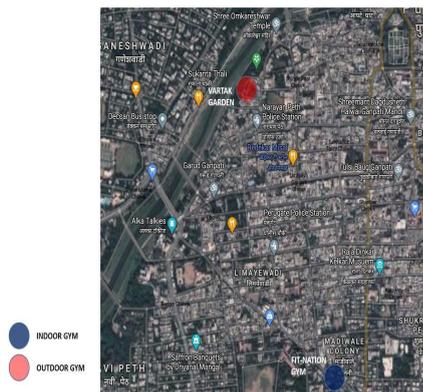
MATERIAL AND METHODOLOGY

To understand comparative usage of indoor and outdoor gyms[10]. This review sought to address both qualitative and quantitative analysis, questionnaire survey and passive observations were chosen.

2.1 Questionnaire survey analysis

Survey was conducted among five open gyms and five closed gyms in localities of Pune.

Responses of each were considered so as to have comparative analysis regarding perception and preference of usage. Outdoor gyms were identified at Rahul nagar, Kothrud, NDA Shivane road, DP road near Mhatre bridge, Smrutivan park, Warje malwadi, and Vartak Park. Indoor gym survey was taken at Fitness gym, Tilak road; Wild craft gym, Karvenagar; Fortitude Fitness, Karvenagar, Artemis Gyms.



- Cost effective
- Time convenient
- Workout in fresh environment
- Intake of Vitamin E
- Self Explanatory Equipments
- Other

Figure 3 depicts several reasons while interviewing users for preferring outdoor gym equipment's; usability, safety and comfort of using outdoor gym equipment's is shown in Figure 2[6]. More than 54% users experiences safety and comfort using these equipment's.

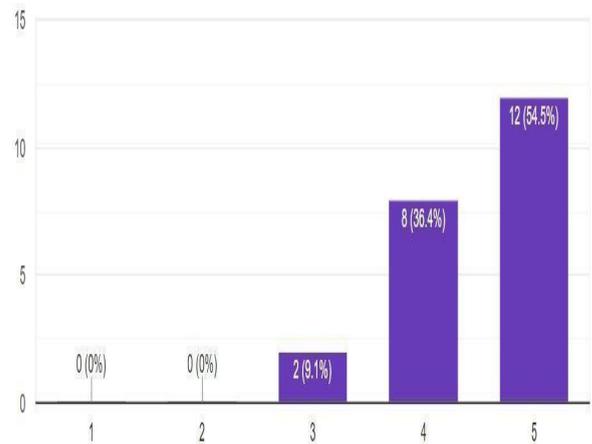
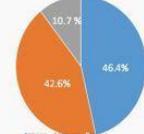
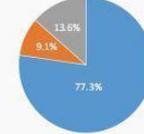
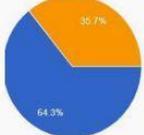
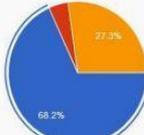
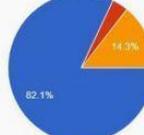
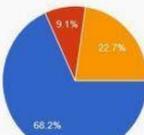
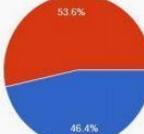
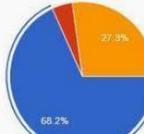


Figure 4- Safety and comfort for outdoor gyms

2.2 Passive Observation-

It was observed that around 30-60 years age group were actively engaged in outdoor gym equipment's whereas kids were also using them. During morning 6-9 am number of users were seen more. In some areas vegetable sellers encroaches the footpath at evening time which caused disturbance to the use rs. Few people use open gym equipment's inappropriately as time pass which in-turn can lead to serious health issues [8]. People park their bikes over footpath causing hindrance to open gym users.

Table 1 shows comparative analysis of Indoor Gyms and Outdoor gyms. It indicates that more than 50% of user prefers towards outdoor gyms. It is observed that some people prefer workout in fresh environment enjoying intake of vitamin D.

Sr.No	Questions	Indoor Gym	Outdoor gym
01.	Do you prefer Indoor gym or outdoor gym? <ul style="list-style-type: none"> ■ Indoor gym ■ Outdoor gym ■ Both 		
02.	Do you think fitness in an outdoor environment lead one step ahead to improve physical and mental health? <ul style="list-style-type: none"> ● Yes ● No ● May be 		
03.	Do you think your level of physical activity is related to your gym activities? <ul style="list-style-type: none"> ● Yes ● No ● May be 		
04.	Can gym/physical fitness lead us to connect with nature rather than a typical four-wall enclosed gym? <ul style="list-style-type: none"> ● Yes ● No ● May be 		

iii. *The relationship between built environments and physical activity: a systematic review.*

iv. *Ferdinand AO, Sen B, Rahurkar S, Engler S, Menachemi NAM J Public Health. 2012 Oct; 102(10):e7-e13*

v. *3. People's experiences of using outdoor gym equipment in parks.*

vi. *Furber S, Pomroy H, Grego S, Tavener-Smith K*

vii. *Health Promot J Austr. 2014 Dec; 25(3):211*

viii. *4. Mora R., Weisstaub G., Greene M., Herrmann G. Outdoor gyms in santiago: Urban distribution and effects on physical activity. Motriz: Revista de Educação Física. 2017;23 doi: 10.1590/s1980-6574201700030005. [CrossRef] [Google Scholar]*

ix. *5. Madren C. Hit the outdoor gym. Parks Recreat. 2013;48:40-46. [Google Scholar]*

x. *Fitness Equipment in Public Parks: Frequency of Use and Community Perceptions in a Small Urban Centre.*

xi. *Copeland JL, Currie C, Walker A, Mason E, Willoughby TN, Amson AJ Phys Act Health. 2017 May; 14(5):344-352.*

xii. *Impact of an outdoor gym on park users' physical activity: A natural experiment.*

xiii. *Cranney L, Phongsavan P, Kariuki M, Stride V, Scott A, Hua M, Bauman A Health Place. 2016 Jan; 37(0):26-34*

xiv. *Chow H.-W., Fang I.-Y., Ho H.-H., Ho C.-H. Use of outdoor fitness equipment in the park and functional fitness among taiwanese older adults; Proceedings of the 6th Biennial Congress of the International Society for Physical Activity and Health (ISPAH); Bangkok, Thailand. 16-19 November 2016. [Google Scholar]*

xv. *Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental well-being than physical activity indoors? A systematic review*

xvi. *J Thompson Coon L, K Boddy, K Stein, R Whear*

xvii. *J Barton, M H Depledge*

xviii. *PMID: 21291246 DOI: 10.1021/es102947t*

xix. *10. Gladwell, V. F., Brown, D. K., Wood, C., Sandercock, G. R., & Barton, J. L. (2013). The great outdoors: how a green exercise environment can benefit all. Extreme Physiology*

49456464. CONCLUSION

The installation of outdoor gym equipment's in public spaces has become popular as a means to encourage physical active user and expedite social life. In addition, the study provides data for present situation and usage of outdoor gym equipment's in Pune. Further research should broadly survey on encouraging people for outdoor gym activity.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Prof. Mahesh Bangad for his valuable guidance and encouragement. I would thank my parents for supporting me during questionnaire survey for this research in pandemic situation.

REFERENCES-

- i. *Scott A., Stride V., Neville L., Hua M. Design and promotion of an outdoor gym for older adults: A collaborative project. Health*
- ii. *Promot. J. Aust. 2014;25:212-214. doi:10.1071/HE14037. [PubMed] [CrossRef] [Google Scholar]*

Street Furniture Participates To Add Value To The Streets.

Shreesha Shripad Bidkar, IVth year B.Arch, Sinhgad College Of Architecture, Pune
shreeshabidi@gmail.com

Ar. Pronati Lad, Sinhgad College Of Architecture, Pune.

Abstract - Street furniture gives service & visual detail to the people on foot. Compilation & observation of building façades, placements of street furniture, or if any pattern, theme is followed, will be noted. This is a field research, which include two case studies, i.e F.C road, & Aundh road, Pune. Opening a wide vision to how it begins to create a character to a street with even a small pavement pattern & will make aware of how development can shape by a small decision of the designer. Street furniture brings a character to the street, adjacent, perpendicular lanes, locality, and lifestyle.

Key words - Street furniture, Building facades, Value addition/reduction, Street Image/character

I Introduction

Street furniture can be defined as a step towards growth or a level up in every aspect viz: the society, the city, the visual aspect, the thought process of the locality, the surroundings etc. It enhances the perspective of the street with what it carries. It includes comfort - (benches, shades, shelters) information - (signage, advertisement boards, hoardings) circulation control - (bollards, planters) protection - (pedestrian railings, dividers) convenience - (urinals, lighting, cycle parking) hygiene - (litter bins, planters) and public art etc. Designing street furniture is the manner by which it influences street safety, street character, & importance of the street. Street furniture should not only be functional but also aesthetic concerns should be taken in consideration, so that it would help to carve the identity. While each urban space is enhanced, individuals mental comfort can likewise be expanded. Any street with a furniture throws equality in the pedestrians and the vehicular actions. Street furniture is more satisfying if it has rhythm, balance, theme and also at the same time the sense of usefulness, comfort and configuration. If street furniture adds or reduces the value of the street then also does the building facade's participate in the same? Yes, they do. Building facades are skins or the make up to the concrete or any material for that instance. Every detail on the building skin shapes the view towards it. The building facade is the first view of the interior of it, and also tones the exterior surroundings. The exterior surroundings is the street on which the building is located. It is very common that the street is defined by the building or to the extend the road is also named after a building. Every minute material on the facade does not only satisfy it structurally but also aesthetically to the

viewers. Deeply, designing is the factor to keep hold on to scapes of streets, be it the furniture, locality or facades of the buildings. Designers are the ones who have to consider all the aspects to hold on to the flow, tones, frequency of the streets. Value of the street is declared by the majority of the votes of the viewers. Each and every point of the viewer is unique and wants to express in their own way. Probability of a value can be reduction or addition in other words nice, looks beautiful, attractive or a positive sentence defining the street. And on the other side a negative sentence, worth of being said that, 'this building shouldn't have been here', notifies reduction of the value of the street. Fusing all of this together falls the image of the street. If the majority statistically falls higher to the value addition of the street than surely the image of the street is appealing. This can be avowed when the street furniture and the building facades are considerably designed to fall together in the viewers eyes.

II Materials and Methodology

This study is a qualitative and a case study based. The primary data to rely on are the two live case studies done. The data gathered is a first hand observation, interviews, questionnaires and non-numerical. Data elaborated below has been done more or less by observations and by directly participating in the activities.

Live Case Study I - Fergusson College Road, Pune.

This road is located centrally in Pune. The construction of street furniture has been developed recently from 2019 and is still going on, on a small scale as per observation. A tremendous variety of street furniture was observed and captured. It included - Pergolas, under which seatings were constructed, the pergolas were left to be covered with beautiful creepers and climbers to climb and create shade below. (also adds up to a design consideration) Bollards, Concrete tree gratings, Dust bins, Cycling tracks, parking was introduced, Paintings with focused lights, Street lights in different ways, Different colours of the pavement patterns, Soft scape and hard scape were blended thoroughly for a pleasant view etc.



Fig 1: Paintings focused with lights.



Fig 2 : Building facade



Fig 3 : Cyle Parking

Building facade's on FC road are a combination of different skins all together. And of course they do not hamper the viewers as per the observation.

Live Case Study II - Aundh Road, Pune.

Street furniture is observed from Parihar Chowk to Breman Chowk. It is located on the outskirts of pune. The street furniture developed here is also in the same period as of the FC road and is going on. One of the different furniture observed here is, at preferred intervals sculptures were captured, they also had a small board explaining the activity. The sculptures were self explanatory and exposed a message. They were super catchy and blended with the surroundings. Play areas for children were observed on the footpath with a sand pit dug, the road also included cycle track and cycle parking, cycle tracks were painted red, and have the cycle symbol to notify people. Also litter bins of 'ADAR POONAWALA' were captured. Bollards,

Seatings, Hard and soft scapes, Different coloured pavements, Signage, Street lights etc were some of the street furnitures observed.



Fig 4 : Children's play area.



Fig 5 : Sculpture with a board explaining it.

The building facade's were not over done and blended with the street furniture and the theme that it followed. After circulating the same questionnaire, the observations are recored below. These roads were two way roads which were divided and the dividers carried plants and the street lights. The facade's of the buildings were mainly painted with soothing colours like white, grey etc. The ground floors of almost all the buildings were shops, stores etc.

III Results and Tables

As this was a qualitative study. The value of streets could be noted by interviewing a few people, who were regular visitors, and the people present there. The results weighed more towards the need of street furniture and of how it participates in shaping the locality and identity of the street.

The following is a table which carries most of the common answers ticked (Not at all, Little, Very much) by the questionnaire circulated to the people present.

	Case study I FC road.	Case study II Aundh road.
Pedestrians and Vehicular should be given equality.	Very much.	Very much.

Footfall has increased after the construction of street furniture.	Little.	Very much.
Safety, comfort, conversations have increased .	Very much.	Very much.
Adds value to the street.	Very much.	Very much.
Paths are much more cleaner than before.	Little	Little
Building facade's blend with the streetfurniture.	Little	Very much

Table 1 : Most common answer by people.

Collecting data for the usage of street furniture was important to gradually lean on, on the addition of value to the streets. After interviewing a few people, there are a few points put forth including both the live case studies by observation.

Street furniture has drastically changed mindsets of people, social gatherings, different activities on street (Happy Streets, Pune), energy grew among the pedestrians, no.of cycler's increased, there came a systematic way of parking, driving, riding, symmetry was indulged in everything on streets.

Below is a bar graph which declares a few points before & after the street furniture was installed, by observation and interviews.



Bar graph : Comparing the increase of the particular activity, before and the after installing the street furniture.

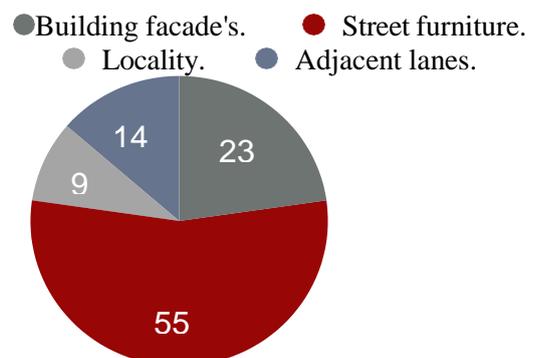
Considering points, below are some of the observations noted -

	Case study 1 FC road.	Case study 2 Aundh road.
Placement of street furniture.	Seating has been placed at perfect intervals and the hawkers have	Not much of seating was observed as compared to FC road, as the no.of

	acquired that area. Few seatings have pergolas above them. Lights, dust bins, bollards have been placed as per needs, so that two wheelers don't ride on the foot paths.	people using it is comparatively less. Seating around the plants was observed. Placement of furniture was balanced.
Theme/pattern based.	A soothing pattern where the furniture was invisibly visible. Colours used were camouflaging with the street as a whole.	A lowkey or a casual theme or pattern was followed, to not hamper or be centric at any point.
Building facade's.	The buildings are not much storey, and do not impact much on the street. They are not over done to hamper any part of the street.	Buildings here were double storey or more. But the skins dropped were merging with the streets.
Material, Colour.	Stone, steel, tiles, and a pallet of black ,white and grey have been used.	Stone, pavements, steel etc were the materials used and the colours were almost the same as the FC road.
Design aspects.	Connectivity, a flow of rhythm, balance was observed.	Connectivity, and balance.

Table 2 : Observation noted.

There are a few factors that add value to a street. Under observations and discussions following is a pie chart with percentage of which factor acts more to add value to a street.



Flow chat 2 : Pie chart explaining the percentage of value addition by the particular factor.

IV Conclusion

The arranging, designing, planning, and locating street furniture is participative to add value to the streets. Street value is depended on street furniture, locality, surroundings, building facade's etc.

Street furniture also nurture's the area, open mind sets, curelifestyle, and bring a drastic change as a whole.

Acknowledgement

Thanking my faculty guides respected Ar. Pranoti Lad and respected Ar. Shreyas Paranjape to guide and build in confidence for this research to progress. I'm grateful to them to share their knowledge and give advice on every segment of the paper. This study could only be possible under their supervision.

References

- i. www.researchgate.net
- ii. www.wikipedia.com
- iii. www.academia.edu
- iv. atlantis-press.com
- v. www.slideshare.net
- vi. www.sciencedirect.com
- vii. www.ijltet.org
- viii. cdn.intechopen.com
- ix. papers.ssrn.com
- x. www.atlantis-press.com
- xi. eudl.eu
- xii. www.furnitubes.com

Analysis of Geometry in Plans of ‘Sangameshwar Temple’ and ‘Baneshwar Temple’ with Respect to ‘Samarangansutradhara’

Author 1 - Shrotri Pooja

Email id - poojashrotri03@gmail.com

Author 2 - Ar. Amol Holey

Email id - ash.pune@aayojan.edu.in

Aayojan School of Architecture and Design, Pune.

Year of study – 5th year, B.Arch.

Abstract : Hindu temples in India evolved between 5th to 15th century. During this period, proportioning systems and geometry gradually became more complex. The paper aims to analyze shapes used in the geometry of Hindu temples. The paper talks about method used for deriving grids and dimensions of Garbhagriha and Mandapa in Bhumija style of Hindu temples. The research process includes analysis of plans of ‘Baneshwar temple, Nasarapur’ and ‘Sangameshwar temple, Saswad’ in the Maharashtra with respect to its geometry by referring book-case studies. The analysis shows development of plan followed the rules in ‘Samarangansutradhara’ mentioned in the literature by Hardy.

Keywords: ‘Samarangansutradhara’, Ritual diagrams, Geometry, Intersecting points of grids, ‘Bhumija’ style temples.

Introduction

Temple architecture is not only about aesthetics, but also it includes various aspects of planning like proportion systems, grids, geometry in plan, modular system or system of measurement about which we have records of the temples from 5th century till now. A complex system of evolving the temple plan using grids which was derived from lines, circles and squares was developed. These shapes have symbolic values and each shape stands for some deity. This system was codified in the various architectural treatises in Ancient India like ‘Samarangansutradhara, Manasara, Mayamatam, Ishanshivavurudevpadhati,’ etc. Out of these, ‘Samarangansutradhara’ gives rules for construction of ‘Bhumija style’ of Hindu temples which can be seen in Madhya Pradesh and Maharashtra. It is very interesting to study the way and process of planning, the shapes and dimensions of the temples used by architects of that time. It is observed that the grids with certain geometry of temples were not a method but a process which we can conclude it as evolution of geometry of temples. In ‘Samarangansutradhara’ the methods and the processes of evolving shape in the plan of temples of different types are described.

Adam Hardy referred ‘Samarangansutradhara’ and he has concluded the types of ancient temples in India and has given how the classification is done according to their offsets in plan and Shikhara in elevation. In ‘Bhumija’ style of temples there are 3 main types –

1. Square types (*caturasra*)
2. Stellate types (*vrta*)
3. 8-*bhadra* types (*astasala*)

BHUMIJA TEMPLE TYPES IN CHAPTER 65				
Name	No.	Projections in plan (or stellate equivalent)	Bhūmis (storeys)	Points in star
Square types (<i>caturasra</i>)				
Nisadha	Sq. 1	5	3	-
Mahāvātri	Sq. 2	5	3	-
Mahāvān	Sq. 3	7	6	-
Navamālīka	Sq. 4	9	8	-
Stellate types (<i>vrta</i>)				
Kumuda	*1	3	4	8
Kamala	*2	(no corner)	4	16
Kamalodbhava	*3	5	4	20
Kīratja	*4	5	5	20
Satasrīṅga	*5	7	6	28
Nīravadya	*6	9	7	36
Sarvāṅgasundara	*7	9	8	36
8-bhadra types (<i>astasala</i>)				
Svasrika	8-1	(5)	4	24
Vajrasvasrika	8-2	(7)	6	32
Harmyatāla	8-3	(7)	6	32
Udayācala	8-4	(9)	8	40
Gandhamādāna	8-5	(9)	8	40

Table 1 : Bhumija Temple Types in Chapter 65 (Hardy, 2015)

We can conclude and find a particular type of temple by using the table by Adam Hardy given in the reference material. The books and the articles referred have very important content about Hindu temples in Maharashtra which has detailed descriptions about geometry of temples and its types. It gives direction and background about methods and processes to find the temple type according to the offsets in plan as well as in

Shikhara i.e., elevation. The research paper based on the geometry and grids in plans of temples can help to understand basic concepts about technical aspects of designing temples. Also, analysis and conclusions from the paper can give direction to analyze different methods of the same. It is important to understand proportioning systems from the history while designing temples to keep the core and essence of our architectural heritage.

Material and Methodology

The literature available on proportions and geometry of temples is studied to understand different traditional methods of planning the *Mandapa* and *Garbhagriha* of Hindu temples. The process includes study of geometry in plans of temples, references for book case studies identifying live case studies, collecting architectural drawings of temples for analysis of geometry, application of study and analysis. The analysis is based on the drawings on which grids are drafted. The architectural measured drawings of temples with accurate measurement are the main components of the analysis. The layers of grids and geometrical shapes are superimposed on the plans of the selected temples to understand intersecting points by process.

Process of evolving the geometry

(*Bhumija* style temples)

The paper introduces the process and method of using squares and circles in the plan of temples. According to the '*Samarangansutradhara*', Figure1 (image 1) 1st square is drawn and then, (image 2) the circle inscribed in this square is drawn. After that, (image3) the lines are drawn by joining the intersecting points of square and circle (Hardy, 2015). All these shapes have symbolic values. The square represents Brahma who is considered as a creator of life, circle represents Vishnu who protects life from start to end which is the period between birth and death. Hence circle is inscribed in square and the lines forming triangles represents the Shiva who is destructor and ends life and in plan of temple these lines complete the geometry.

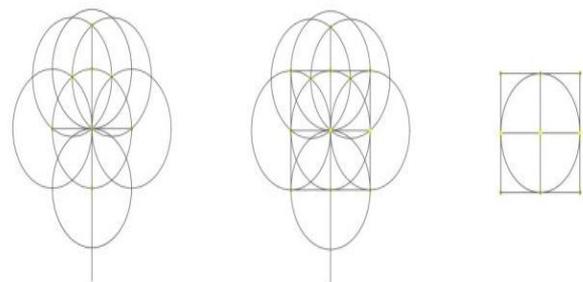


<https://images-na.ssl-images-amazon.com/images/I/71zStTH4KKL.SL1400.jpg>

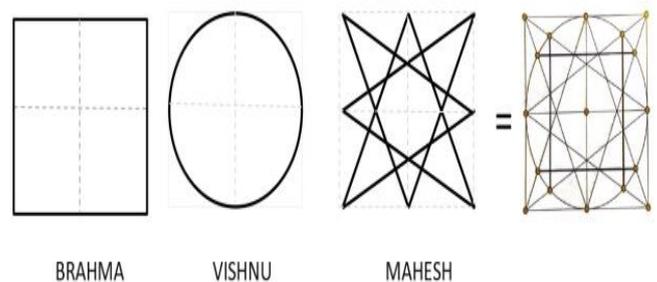
Image 1 Image 2 Image 3
Symbolism of the geometrical shapes

Figure 1

As the sequence of Brahma, Vishnu and *Mahesha* is according to their responsibilities, Adam Hardy mentioned in his book 'Theory and Practice of Temple Architecture in Medieval India' that, it also reflects in the system of geometry used in the plans of temples. In the '*Samarangansutradhara*', it is mentioned that why these 3 shapes and the process from which *Garbhagriha* is derived by the square obtained from this geometry. The proportions and the dimensions of inner side and external side of *Garbhagriha* and *Mandapa* temple can be derived from this geometry and because of these reasons behind designing, even after thousand years temples are still stable with peaceful atmosphere. Every research paper, article and the books written on such topics gives direction to study the geometry and the reasons behind shape of temples which we can cross check on the plans of the temple as an analysis.



Limitations and Scope



The analysis and cross checking of geometrical diagrams is limited to till identifying the process of getting inner square of the *Garbhagriha* of the case studies. The scope is in the process of identifying the offsets in the plan of the *Garbhagriha* can be done for the *Bhumija* style Temples according to the further geometrical analysis.

Grids and alignments in Temples

The centers of '*Nandi Mandapa*, *Sabhamandapa*, *Garbhagriha*' are in same line. According to the theory of grids taken from ritual diagrams, any temple grid is in multiples of 4 or 8. (MEISTER, 1985)

Mythological Story and Geometrical Relevance

The story of creation of Brahma from Vishnu's navel

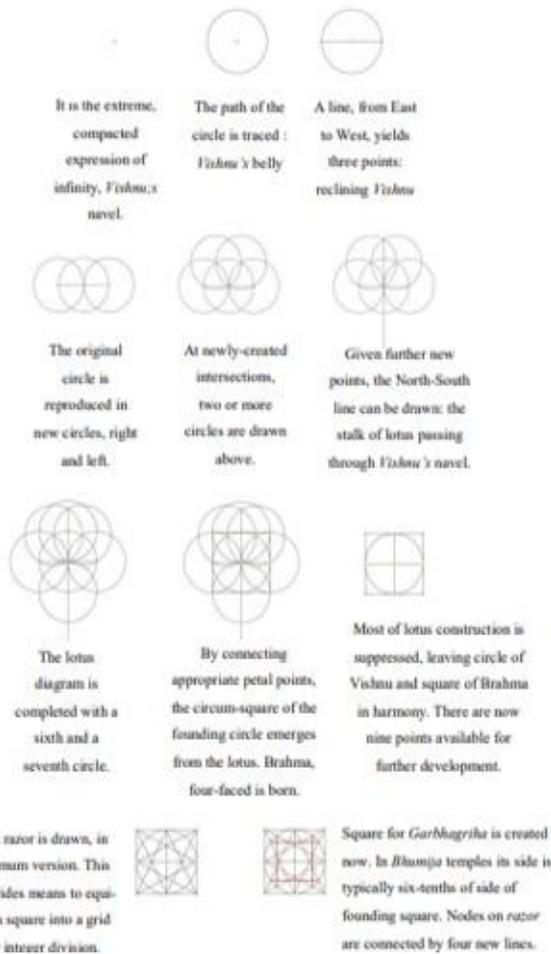


Figure 2

Process of getting square of Garbhagriha (Hardy, 2015)

Case study 1: Sangameshwar Temple, Saswad.

The temple is located in Saswad in Pune District, Maharashtra. It is built alongside of rivers Karha and Chamali. It is dedicated to lord Shiva and it was built in Yadava reign (Sohoni, 1998). According to the Table 1, this temple has 4 stories in Shikhara and 5 offsets in plan. Hence, type of 'Sangameshwar' temple is 'Malayadri' in Square type.

Geometrical analysis of plan of temple:

According to the Figure 2, the Square in the geometrical diagram represents Brahma, the circle represents Vishnu and then by joining 9 points the, Shiva's razor is drawn. The points intersecting these lines will be same as points of the columns in Mandapa. The grid of Garbhagriha and Sabhamandapa are different. If it is divided in 8 parts as given in Ritual diagram, the grids do not match in Garbhagriha.

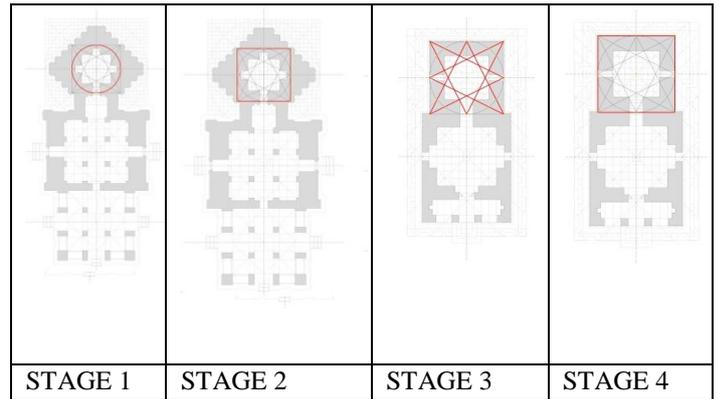


Figure 3

Analysis of Garbhagriha Plan Sangameshwar Temple, Saswad

Case study 2: Baneshwar Temple, Nasarapur.

The 'Baneshwar' temple is located in 'Nasarapur' in Pune District, Maharashtra. It is built in 1749. It is dedicated to lord Shiva. According to the Table 1, this temple does not have a particular type of 'Bhumija' temple because it was built in period where simplistic elements were designed for construction. But the grids and geometric shapes on plan can be applied accurately according to Adam Hardy's statements.

Geometrical analysis of plan of temple:

The outer walls of Garbhagriha and Mandapa do not have offsets. But in Mandapa there are arches at corners. Both Garbhagriha and Mandapa are simple squares but to derive these squares there is complex geometry of squares and circles. It seems like simple form is always achieved from complex process. Even the grid of Garbhagriha and Mandapa is not same. when the geometrical shapes are drawn, the sequence given in the 'Samarangansutradhara', (Figure 3) it is proved that the form of temple is achieved from this method using geometry.

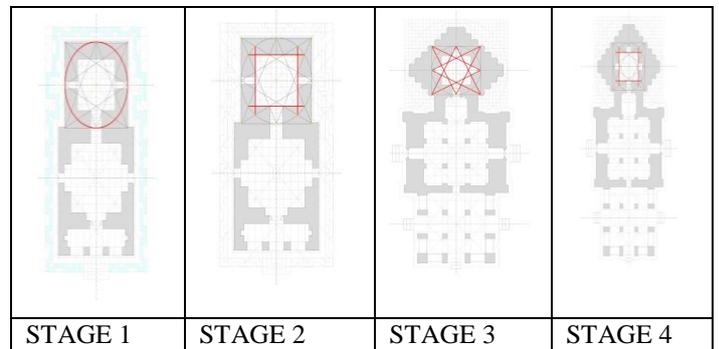


Figure 4

Analysis of Garbhagriha Plan Baneshwar Temple, Nasarapur.

In 2 case studies, it is observed that if length and breadth are divided in 8 parts the grid, these lines intersect points at some another grid lines of other part. The extended lines of square drawn from centers of 4 sides of opposite walls intersect. The grid of *Mandapa* and the grid of columns match. The center points of *Umbara* and centers of outer walls *Garbhagriha* and *Mandapa* forms the square. Diagonals of *Garbhagriha* and corners of water channel have same alignment. Steps at entry of temple and columns at entry have same alignment.

Grid inside temple and grid for walls of temple are same. The location of tortoise in *Mandapa* is at the point of intersection of diagonals. The center line of *Shivalinga* and the *Gomukh* are same. The circle inscribed at external wall line is intersecting the point of center on *Umbara* at entrance of *Garbhagriha*. The centerlines of steps towards *Pradakshina Marg* and centerlines of *Nandi Mandapa* and *Sabha Mandapa* are same.

Conclusion

The analysis supports the process of studying architectural drawings of Hindu temples of 'Bhumija' style. Process can be used to analyze geometry in plans of different temples. Gives direction to understand process of temple designing by referring mentioned grids, basic geometry in the plan specifically *Garbhagriha* and *Mandapa* of temple.

Acknowledgement

I would like to express my gratitude from bottom of my heart to my guide and Professor Fatema Kabir, Sneha Bendre, Manjusha Ukidve for valuable guidance, inspiration and encouragement. I am thankful to Aayojan School of Architecture and Design, Pune. The drawings were done by the students of batch 2016-17. I want to extend appreciation to those who helped me directly or indirectly.

References

- i. Hardy, A. (2015). *THEORY AND PRACTICE OF TEMPLE ARCHITETURE IN MEDIEVAL INDIA*. Delhi: Indira Gandhi National Centre for the Arts Central Vista and Dev Publisher & Distributors.
- ii. MEISTER, M. W. (1985). Measurement and Proportion in Hindu Temple Architecture. *INTERDISCIPLINARY SCIENCE REVIEWS*, 10, 248-258.
- iii. Sohoni, A. (1998). *Temple Architecture of the Marathas in Maharashtra*.

Wayfinding in Alzheimer's Healthcare Centre

Shubha Rao, Associate Prof. Seema Thippeswamy

Bharati Vidyapeeth University College of Architecture, Pune

kirashubha06@gmail.com, sth@bvcoa.in

Abstract - Alzheimer's disease is a progressive disease that destroys memory and other important mental functions. It is a form of dementia. The patient's poor cognitive ability of the environment makes them more eager to get a sense of belonging. This research paper will revolve around different aspects of way finding, which refers to the information system that guides people through a physical environment and enhances their understanding and experience of space, and this relation, of patients and built spaces, would help the people with Alzheimer's disease to engage in the social life and be part of society.

Keywords: Alzheimer, way finding, built environment, relationship between spaces, landscaping and therapies

Introduction

According to the WHO report 2020, Alzheimer's disease has affected 50 million people worldwide and there are nearly 10 million new cases every year where 4 million patients reside in India, according to the Alzheimer's Association of India. Alzheimer's patients start to show the symptoms by forgetting small things like the names of individuals or their whereabouts and start misplacing things. But the disease can rapidly transform to the stage where the patients tend to have difficulties in speaking, swallowing and walking. According to the ARDSI report, estimation for 2026 of Alzheimer's affected patients would increase to 5 million patients. And there is no pharmacological research that provides treatment. Thus, it becomes necessary to improve the quality of life of patients with therapies. There are 2 basic types of therapy – clinical and non-clinical. Built spaces and designed landscapes are the part of non-clinical therapies which indirectly aid in patient's comfort.

In assisted living, the complex plays an important role on the patient's ability to navigate through the space. The built environment is a space, wherein the patient resides and it has to attenuate the psychological and perceptual discomfort. The self-esteem lost with wandering and not achieving the basic daily chores on their own, leads to the need of having ease in way finding. Therefore way finding in the built environment becomes crucial in design so as to behave as a non clinical therapy by maximising the patient's ability to move freely and safely within the space. This makes them self-sufficient and independent. The general reduction of the need of staff for self-care purposes in residents, would allow for the increase of staff help and care in critical areas. It becomes important to create a space for communication, and to find the connection between the public and private spaces. Having

permeable barriers is an aspect of design which allows them to interact with no physical boundaries. These permeable boundaries also avoids dead end so as to have an ease in movement around the spaces. Engaging individuals with nature and open door policy helps them in ease of getting around. The necessity of community engagement will develop communication skills within them and helps them to express their feelings, which is an important aspect in one's life. Finding the balance between space and the patient's psychological and perceptual abilities would provide the patient with the sense of belonging. The 'harsh' institutional environment is very common which creates discomfort and a feeling of being lost in space. To minimize this feeling and to boost the resident's self-esteem, personalization of the space should be adapted for the designing of self-care centres. Personalization is the term used to describe the action of designing spaces which has the sense of belonging for an individual. It can be accomplished by simple means such as adding some personal photos – frames, letters, furniture or paintings. This helps individual to identify their room and their whereabouts.

Literature Review

The most important design aspect in wayfinding is the spatial distribution of the floor layout. Different corridor patterns such as straight corridors, L-shaped, circular based or the U-shaped corridors, the straight corridor with less openings proved to be the best option. On the dead ends of the corridor, one can design big window openings or gathering spaces, if at all the resident was lost. If there are many rooms connected to the corridor, the circular corridor would be best suited for the design. The study also states that the community spaces which were nearer to the residents' rooms, were frequently visited than the ones which were farther away.

The study also suggests that working with five senses namely touch, smell, sight, hearing and taste acts as a healing therapy in Alzheimer's patients, giving an opportunity to creativity within. Indoor and outdoor spaces designed bringing, inside out and outside in, would act as a healing space. Landscaped gardens engaging in activities and community engagement are few of the therapies which help them to be self-reliable and being expressive. Animal therapy, where the residents take care of small animals, has been proven to decrease depression and increase their desire to be seen and heard.

Material and Methodology

There are various ways in which wayfinding can be achieved in the interiors and in the landscape spaces. If one understands the theory behind designing the space and asks the question ‘Why’, one will surely understand the comfort and need of the patients. Way finding can be considered as a game of treasure hunt in which the player is a patient and treasure is the place/activity/function which is to be performed by the player. The objective of the game is to lead the player forward and navigate towards the destination by giving direct or indirect clues in the form of speech, signage, action or visuals. It can be achieved through dividing various aspects of surrounding according to different functions. Environment plays a very important role in triggering memories or subconscious thoughts and can be maintained easily by providing and segregating different spaces to each activity or facility.

If the 5 senses of an individual is targeted for designing, one can observe the direct connection between the ability to find one’s way and to have comfort in the space. Sight: the ability to perceive the surrounding. Light plays an important role in identifying the space, if the space is dark and gloomy, the resident might not explore the space. This can be used to an advantage for planning spaces which the designer doesn’t want the residents to explore. The staff should encourage the residents to be near windows if they can’t wander in garden. The natural light doesn’t damage the perceptual senses rather helps in developing them further. Colours also help to differentiate between the walls and doors. The resident remembers that this coloured wall with this coloured door is my room. This helps them to build a sense of belonging to the room. They can further decorate their doors with photos or letters for developing ownership to the space. Smell: to help the residents in remembering things, smell or aromatherapy can be used. The simple form of having narrow pathways near flowering, scented flowers for the residents to appreciate the flowers and to remember which fragrance belongs to which flower. Having scented candles in the rooms, helps the residents to calm down their nerves. The aroma of their favourite food would develop the hunger and they would eat their food. This can help the dietician to maintain their diets and to look after their nutrients. Touch: the different textures help the residents to distinguish between two objects. Walking barefoot on the grass and on the smooth tile surface, could help them understand the different spaces and its purpose. Use of numerous textures can confuse the residents, so finding a balance is very important. Hearing: to different music genre, helps to change the mood. The calm, soothing music helps to soothe the nerves whereas the high pitched music creates adrenaline rush and directly affects the nerves. Taste: becomes an important factor whether the resident eats and takes the nutrients on time. If the taste does not appeal them, they can tend to throw tantrums and not consume the food. The landscape having seasonal fruiting trees, where one can go and pick their fruits for consuming, adds to having a daily activity with the staff and visitors. The residents can prepare their own food

using the fruits and vegetables they grow and take care of. This helps to build a sense of responsibility and gives them the reward of having their own vegetables and fruits.

Results and Tables

The areas should be divided according to the levels of activities they accommodate. The common way of spatial division is arrangement of spaces related to each other, to provide spaces with specific activity and to define levels of privacy. The spaces can be divided into 4 zones: 1. Private zone 2. Semi private zone 3. Semi-public zone 4. Public zone

Fig 1: Spatial division of Spaces

Public zone – Areas in building where daily activities happen. The areas included are the pathways, reception areas, visitor areas.

Semi-public zone – Areas where residents get together for socializing. Recreational spaces like auditorium, cafes, gardens, where formal and informal gatherings are held. Other users would be guests and the staff.

Semi-private zone – Areas which are shared by residents; like the corridors leading to their rooms, dining spaces and lounges. These areas include small intimate socializing, circulation and service orient activities.

Private zone – The personal or shared rooms of the residents is included in the zone. Zones are conceptual divisions and can be modified according to the design considerations and requirements.

Fig 2: Restricted entry/exit from the interior space

Entry and reception areas should be visible for the people entering the building, but it must not be easily visible from the interior as the resident might wander outside or would want to congregate in the space. The entry must be accessible from the parking and should be universal design.

Fig 3: Visual connection

The most appropriate zone for activity areas would be in the centre of resident rooms. This would encourage residents to go in nature and socialize with each other, rather than sitting alone in their rooms. The centre space is also beneficial for the staff members as they can visually keep an eye on the residents while doing their assigned tasks.

Fig 4: Endless corridor

The resident rooms should be placed in a small cluster style for more of a homely feel. With fewer rooms close to each other, residents would find it easier to locate their respective rooms. Rooms should have

to exterior views and lighting. The layout of the room should be flexible and manageable by the resident. If they want they could add their belongings such as furniture and home décor. Endless corridors help eliminate the dead end hallways. This helps the resident wandering to come back to the point he/she initially started from. Where dead ends can't be eliminated, windows or quiet rooms could be established.

and eliminates the visual blockage. Having raised planters, help the physically challenged residents to appreciate the plants. With more seating space around the garden and on the pathways, help the residents to take a break and relax in nature. Through various materials and colours, residents can either be encouraged to visit the space or discouraged to visit the spaces. With the increase of contrast, like for example, between the floor and walls would help increase resident's ability to distinguish the objects and remember their way. Signage with the name and symbol should be provided as residents could either be comfortable with words or with symbols. Elders are more sensitive to the glare. Shining floor textures should be avoided, if not, the windows can be covered with the translucent curtains. Mirrors and mirroring windows should be avoided as this could create confusion among the residents.

Fig 5: Permeable fences or compound walls

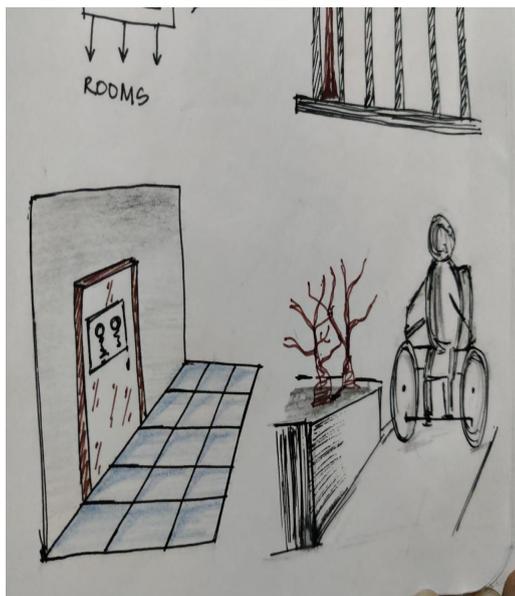


Fig 6: Different colour and texture used for wall, door, floor. Use of photographs on the door



Fig 7: Raised planters

The permeable fences in the landscape area, encourages the residents to socialize with each other

Conclusion

To create opportunity to be creative and to maintain their autonomy in the nursing homes, people with dementia are increasingly depending on their surroundings. The importance of layout and its wayfinding, which was not addressed before, was established and understood. Through this empirical study, the features for a nursing home and its circulation were identified.

Acknowledgment

I am sincerely thankful to my faculty Associate Prof. Seema Thippeswamy for her active guidance throughout the research paper. I would also extend my appreciation for the people who inspired and guided me in the completion of this research paper.

References

- i. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5767317/>
- ii. *Health Building Note 08-02, Dementia-friendly Health and Social Care Environments*
- iii. *Excellence in Design: Optimal Living Space for People with Alzheimer's Disease and Related Dementias* by Emily Chmielewski, EDAC, Perkins Eastman
- iv. *Dementia-Friendly Architecture: Environments That Facilitate Wayfinding in Nursing Homes* Gesine Marquardt, PhD, and Peter Schmieg, PhD
- v. *Optimal spaces for those living with dementia: principles and evidence* - Peter Barrett, Monika Sharma & John Zeisel
- vi. <https://www.healthcaredesignmagazine.com/>
- vii. <https://ardsi.org/>
- viii. <https://www.alz.org/alzheimers-dementia/what-is-alzheimers>
- ix. <http://www.designcurial.com/news/brilliant-projects-senior-living-uk-7415296/>
- x. <https://www.youtube.com/watch?v=l6gCCx9sM0g>
- xi. <https://www.scie.org.uk/dementia/support/housing/design>
- xii. <https://best-alzheimers-products.com/activities-for-alzheimers>
- xiii. <https://www.gamesforchange.org/game/healing-spaces/>

Healing Centre: Evoking the Human Senses

Author: Siddhi Sunil Somani

Co-Author: Prof. Shubhashree Upasani

E-mail Id: sssiddhi98@gmail.com

SSMS College of Architecture, Pune, Maharashtra, India

Fifth year B.Arch

ABSTRACT: *We live in this century where, there is less communication with others and self. Practically, all urban people are now familiar with the word “stress” and use it knowingly. A large number of populations are somehow suffering from various diseases due to lifestyle and ignorance of people. The focus is to improve one’s life from inside out instead of outside in. Architecture knowingly/unknowingly is vital; affects our behavior, mood, etc. and intervened by senses. The use of complementary/alternative therapies is to achieve more and more interactions so that one gets out of the comfort zone and is able to express.*

Keywords – Stress, diseases, lifestyle, health, complementary therapies.

INTRODUCTION

The World Health Organization defines health as a state of complete physical, mental and social wellbeing and not simply the absence of disease or infirmity. [1] Eating right, exercising and sleeping well is a sign of healthy life. However, along with the love and care, continuation of personal growth is very important for our self-wellbeing. There are various ways of improving of improving the health, which include use of: traditional and modern medicines. Mental health is an integral part of health; it is more than the absence of mental illnesses. It is the main core for well-being and effective functioning of individuals. We live in this century where, where our mornings begin with TV yoga and continued by our routine chores and also the junk food we eat. The awareness that health is more than just striving to be rid of diseases is important. It’s rather having a balance of both physical as well as mental health. This COVID acts as a big eye opener to be fit and fine to overcome any situation. If the therapies are interesting, then one might be able to enjoy as well as treat him/herself more efficiently and be stable to deal with everyday life situations. Stress is a normal feeling. Stress is in every field and is experienced by everyone. Two main types of stresses are observed:

- **Acute stress:** As the name says, it is a short-term stress that goes away quickly. It helps you manage dangerous situations. All people have acute stress some or the other time.
- **Chronic stress:** This is stress that lasts for a longer period of time. Any type of stress that goes on for more than 4 days, weeks, or months can be termed as chronic stress. One can become so used to chronic stress that they don’t realize it as a problem.

Stress. Stressing. Stressed; these seems to be the scenario of most corporate people/working age in India. Stress is a normal psychological and physical reaction to the demands of life. A small amount of stress can be good, motivating you to perform well. But multiple challenges daily can make beyond one’s ability to cope. The effects of stress are seen differently in different people as according to the situation and can be recognized by various symptoms.

Architecture plays an important role in controlling our mood, behaviour, etc. One gets connected to the place/ has a memory attach with it. The peaceful environment created from the proportions of built and unbuilt spaces helps in achieving the control on our mind. The consequence is seen in our sudden/reflex actions. Connectivity with the architectural design of a structure is crucial when one gets connected with it. The colour, form, proportions have an impact on the users.

LITERATURE REVIEW

In the research paper “Architectural Psychology” by Professor S.T. Janetius describes that the psychology is directly related to the art, culture and architecture. Using the appropriate artistic components such as colour, shape, size, etc. enriches the atmosphere. This paper significantly explains about the interaction between the human and the environment. In the thesis project, “The Psychological Impact of Architectural Design” the author is trying to explain the importance of spaces on human psychology by using various examples. “Buildings, beauty, and the brain: psychological responses to architectural design” in this PHD dissertation, author explains that how the design can impact one’s mood and behavior. The connectivity with nature, architecture interiors, natural patterns, etc. plays an important role.

MATERIAL AND METHODOLOGY

The research method carried out is descriptive and analytical type. Primary data was collected through:

- Google form questionnaire. The questionnaire was based on the awareness of such healing centers, therapies, mental illness, etc. Also, responses from different fields were recorded and were surveyed among the youth and working age group. The questions were as per the daily psychological problems like stress, anxiety, etc.
- Taking interviews of at least one expert/practicing, therapists, doctor, counsellor, healer from the mentioned therapies. This helped the author to understand the therapies in depth as to: the functioning, implementation on various people, the co-ordination of hand-brain-mind, the need and importance of such therapies

Secondary data was collected through newspaper articles, research papers of scholars, videos of some experts, some standard data regarding mental health and its consequences. From all the data collected, author was able to analyze the data and identify the gap/need of such centers.

RESULTS AND DISCUSSIONS

• IMPORTANT USERS:

- Youth and working age group
- People facing problems related to stress, depression, not happy with life, etc.
- People who want to relax and make the use of different therapies

There are various researches that prove the global impact of mental illness. Mental health problems are among the most **important contributors** i.e. the **youth** and the **working age** group. Some problems faced by youth may be due to studies/work, family/friend relationships, income issues, etc. Some of the consequences of mental health problems in the workplace can be summarized as follows:

a. Absenteeism

- Increase in overall sickness absence, particularly frequent short periods of absence;
- Poor health (depression, stress, burnout);
- physical conditions (high blood pressure, heart disease, ulcers, sleeping disorders, etc.).

b. Work performance

- Reduction in productivity and output;
- Increase in error rates;
- Increased amount of accidents;
- Poor decision-making;
- Deterioration in planning and control of work.

c. Staff Attitude Behavior

- Loss of motivation and commitment
- Staff working increasingly long hours but for diminishing returns
- Poor timekeeping

d. Relationships at work

- Tension and conflicts between colleagues
- Poor relationships with clients
- Increase in disciplinary problems

• COMPLEMENTARY THERAPIES:

Complementary therapy is known by many different terms. A wide range of treatments exists under this canopy term 'complementary therapy'. It is used alongside conventional medicines or treatments. The methodology may differ from usual. Many a times the benefits and healing abilities of these therapies are established through research, other times they may be unproven scientifically.

• Type of complementary therapies:

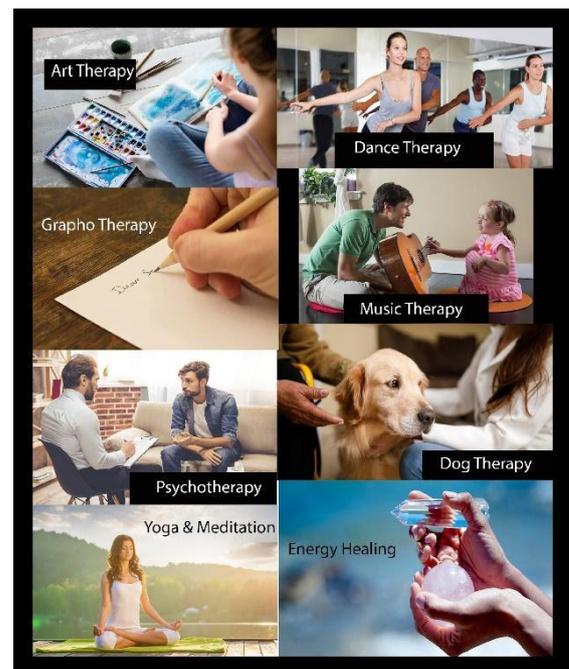


Fig 1: Complementary Therapies

Following are some of the complementary therapies can reduce pain and improve well-being:

- **Physical activity**: It builds strength; relieve pain, fatigue, anxiety, and depression, etc.
- **Massage**: Researchers show that massage can:
 - Reduce pain, decrease tension and stress, help with recovery after surgery, ease anxiety and depression
- **Mind and body practices**: It is important to manage stress and depression. Mind and body practices can help improve quality of life and the confidence to deal with:

- Yoga:** Yoga comprises of breathing exercises/techniques, mediation, and flexibility of different muscle groups. It helps to regulate stress hormones and improve mood and physical well-being.
- Meditation:** Meditation is a mind and body practice that has a long history of use for increasing calmness and physical relaxation, improving psychological balance, etc. and focuses on the interactions among the brain, mind, body, and behaviour.
- Music therapy:** Music is heard by people in every part of the world and is felt and has shown effect to the moods and behavior. Music therapy is an effective mean to treat depression.
- Art Therapy:** Art is a form where one can reduce stress through activities carried and develop a harmony and pleasure. Art activity soothes and helps to develop a good conception of mind and body.
- Psychotherapy:** Psychotherapy, or talk therapy, is a way to help people with mental illnesses and emotional difficulties by listening to them. It can help eliminate or control troubling symptoms.
- Dance therapy:** Dance/Movement Therapy (DMT) is a type of therapy that uses movement to help individuals achieve emotional, cognitive, physical, and social integration.
- Graphotherapy:** Graphotherapy or graphical re-education goals to modify the graphical gesture in a conscious way, in order to produce changes in personality at a subconscious level to improve in numerous challenges. [v]
- Animal Assisted Therapy:** Animal therapy refers to various activities in and around animals to help people with specific physical or mental health conditions.
- Yoga Prana Vidya (Energy Healing):** Healing is an ancient science using the ‘Chi or ‘Prana Energy’. Yoga means Union, Prana Vidya is knowledge of using Pranic Energy (Available abundantly in sunlight, earth & air). [vi] It helps in balancing the physical body, the personality, the environment of a person’s life.

ANALYSIS

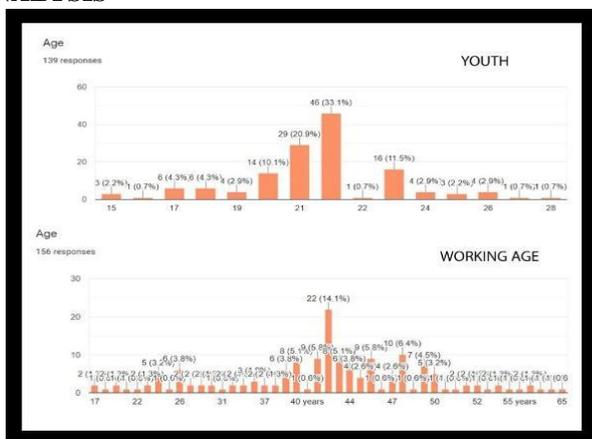


Fig 2: Google Survey(Users)
Source: Author

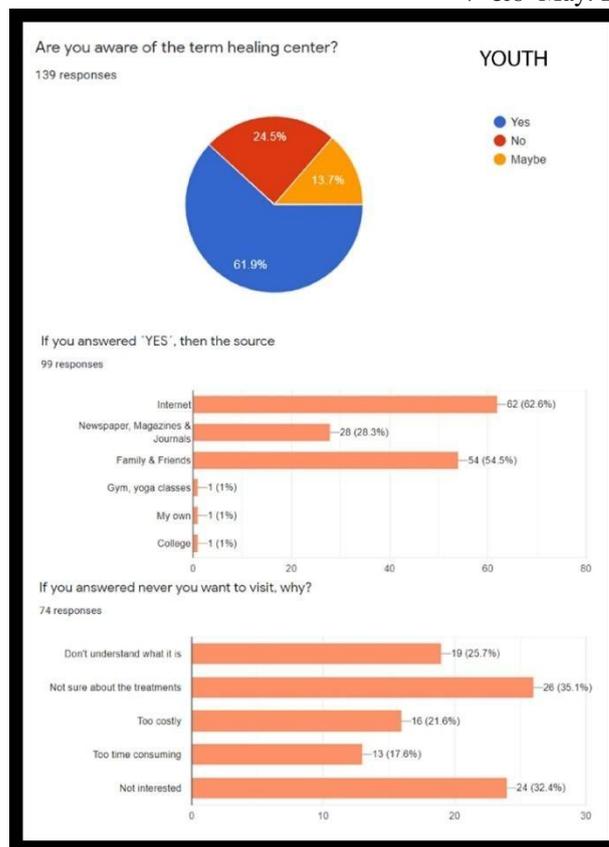


Fig 3: Google Survey (awareness- youth)
Source: Author

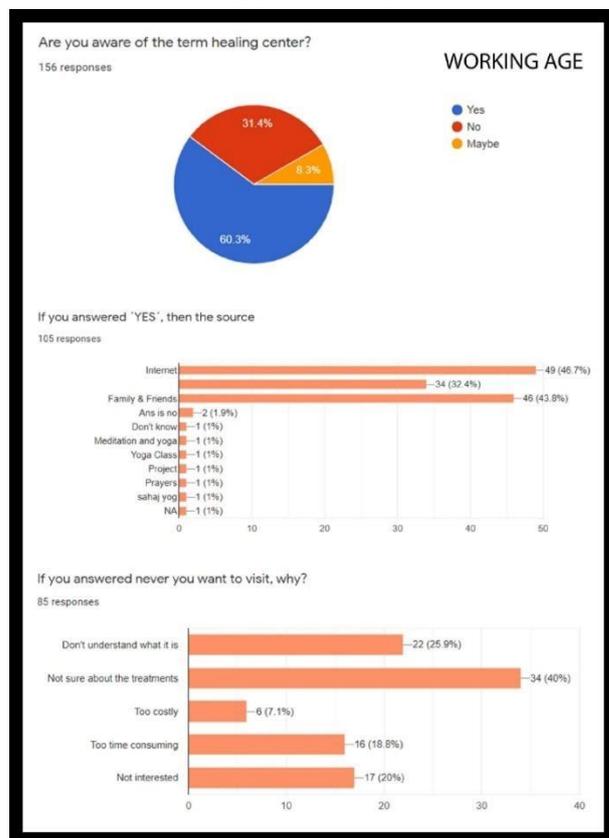


Fig 4: Google Survey (awareness- working age)
Source: Author

VII. REFERENCES

- i. <https://www.who.int/about/who-we-are/constitution#:~:text=Health%20is%20a%20state%20of,belief%2C%20economic%20or%20social%20condition.>
- ii. <https://ecommons.cornell.edu/handle/1813/76479>
- iii. <https://www.collegestuff.info/post/world-mental-health-day-2020>
- iv. <https://medlineplus.gov/ency/article/003211.htm#:~:text=Acute%20stress.,do%20something%20new%20or%20exciting.>
- v. <https://www.writechoice.co.in/writechoice/what-is-graphotherapy/>
- vi. <https://www.yogaprana.org/>
- vii. <https://www.medicalnewstoday.com/articles/animal-therapy>
- viii. (PDF) *Music and the Mind: Music's Healing Powers* (researchgate.net)
- ix. (PDF) *The Power of Dance: Health and Healing* (researchgate.net)
- x. (PDF) *The Psychological Impact of Architectural Design* Natalie Ricci Claremont McKenna College
- xi. (PDF) *Architectural Psychology* (researchgate.net)
- xii. <https://www.thewellproject.org/hiv-information/stress-management>
- xiii. <https://www.mayoclinic.org/healthy-lifestyle/stress-management/basics/stress-basics/hlv-20049495>



Fig 5: Google Survey (mental health)
Source: Author

V. CONCLUSION

By providing these kinds of healing centers comprising of complementary therapies would achieve in having a stress free environment, people involving in various activities, being able to overcome the situations, etc. These therapies are interconnected to mind body and soul, hence helps in generating better outcomes.

VI. ACKNOWLEDGEMENT

I would like to express my gratitude from the bottom of my heart to my guide Prof. Shubhashree Upasani, Prof. Harshada Bramhe, Prof. Hrishikesh Puranadre for their valuable guidance, inspiration and encouragement. I would also like to thank the doctors, therapists who guided me and also my friends and all those who have indirectly guided and helped me.

Evolution of Mosque Architecture over the Centuries, an Overview of Contemporary Mosque Architecture

Simran Karim Virani

Prof. Dhruv Chandwania

viranisimran27@gmail.com, dhruv.chandwania@bnca.ac.in

Abstract : *Mosques first appeared in the 7th century. Since then, the architectural style of the mosques has evolved in the region where Islam has spread. Over the years architectural styles of mosques have formed in diverse regions. In Contemporary Mosques, Modern architectural techniques have been used and they eliminate stereotypical tall elements such as domes and minarets, they challenge the age-old architectural tradition of Mosques. To evaluate this significant Mosque from every century that is from the 7th century to the 21st century has been taken to study. And various architectural features, styles, reasons they were introduced, have been determined through evaluation, comparative method and visual documentation.*

Keywords- Evolution, Contemporary Mosques, Mosque architecture, Mosque architectural styles

Introduction

Islamic architecture comprises the architectural styles of buildings associated with Islam. It encompasses both secular and religious styles from the early history of Islam to the present day. Early Islamic architecture was influenced by Roman, Byzantine, Persian, Mesopotamian, and all other lands which the Muslims –conquered in the seventh and eighth centuries. Further east, it was also influenced by Chinese and Indian architecture as Islam spread to Southeast Asia. Later it developed distinct characteristics in the form of buildings, and the decoration of surfaces with Islamic calligraphy and geometric and interlace patterned ornament. New architectural elements like cylindrical minarets, pointed arch, muqarnas, arabesque, multifoil was invented. The principal Islamic architectural types for large or public buildings are the Mosque, Caravanserai, the Tomb, the Palace, and the Fort. From these four types, the vocabulary of Islamic architecture is derived and used for other buildings such as public baths, fountains, and domestic architecture.

Islam started in the 7th Century C.E, and so did architectural components such as Mosque. The most important building type in Islamic architecture is the mosque, which is the center of Islamic culture and society. Not only is it a religious space intended for worship, but it is also a place for a lively discussion about topics relevant to daily life. The first mosque was the Prophet Muhammad's house, which contained many basic design features that were included in later mosques.

Two types of mosques are the congregational mosque, which is built to accommodate an entire community and the smaller type that is intended for a particular ethnic group. While there is no overall unifying style for mosques, they can be generally divided into regional categories.

The hypostyle mosque became one of the main styles to emerge. It has a courtyard surrounded by colonnades on three sides. A covered sanctuary at the far end of the courtyard showcases a directional wall that shows a religious practitioner which way to pray.

Islam does not mandate specific rules regarding the physical form of the Mosque. When we look at the earlier Mosques of 7th Century C.E. they set the basic vocabulary, model of which was followed in the centuries to follow. Rapidly styles started getting developed spatially and physically. Islam spread like wildfire since the beginning, so did the architectural characteristics of a mosque, with varied regional architectural influences. The Mosques of the 21st century with their contemporary approach in architectural styles are challenging all those dogmas about the design of a Mosque sans domes, minarets, and arches, yet providing a peaceful environment for devotees to worship in.

Evolution

(I). Development of Typology and Basic features of a Mosque

Era of Ibrahim:

Kaaba was the first house of worship. It is a **cuboid stone** structure made of granite Stone. Ibrahim is credited with having built Kabba in Mecca and consequently its sanctuary Al-Masjid, Al-Haram. If Kabba was the First Mosque on Earth, the Second is Al Aqsa in Jerusalem. The historical significance of Al Aqsa Mosque in Islam is that Muslims turned towards Al Aqsa when they prayed for a period of 16 to 17 months after migration to Medina from Mecca in 624 AD; **it thus became qibla** where Muslims faced for prayers.

7th Century:

During the life of Muhammad Quba was the **first Mosque** built which he built on the site of Oasis where they stopped while migrating from Mecca to Medina. The origin of **Mosque architecture** is traced back to the House of

Muhammad who came to Medina to avoid persecution. The home of Muhammad and his family was a simple structure, made of raw brick, which opened on an enclosed **courtyard** where people gathered to hear him. In 634 Muhammad decreed that prayer be directed toward Mecca, against the wall facing Kabba, after receiving revelation during a prayer session. He built a **roofed gallery** to shelter his companions, the antecedent of roofed galleries in later mosques. In 628 a **Minbar or pulpit** was added so that prophet was raised above the crowd besides leading prayer, Muhammad declared his new law and decided disputes from the Minbar. In 705, when the Mosque of Prophet at Medina was rebuilt **Mihrab** was furnished to commemorate the place where Muhammad led prayers.

A recent study has established that the **first Minarets / Towers** were erected at the four corners of the Mosque of Medina between 707AD and 709AD. Their function and symbolic meaning were for the exclusive perception of Muslims. Minarets then spread slowly to other regions.

Dome of rock built between 691-92 CE is the **first dome** built in Islamic Architecture. It is one of the earliest Monumental buildings in Islamic Structure. The Dome's structure and ornamentation are rooted in the Byzantine architectural tradition yet its construction in the 7th Century represents an early stage in the emergence of distant Islamic Visual style.

8th Century: The Great Mosque of Damascus

Built between 705 and 715 it is one of the **largest and oldest mosques** in the world. Since its establishment, the mosque has served as a **model for Congregational Mosque architecture** in Syria as well as globally. According to Art historian, Finnbar Barry Flood, "the construction of the Damascus Mosque not only irrevocably altered the urban landscape of the city, inscribing upon it a permanent affirmation of Muslim hegemony, but by giving the Syrian congregational Mosque its definitive form it also transformed the subsequent history of the Mosque in general."

For the first time, the prayer Niche in the qibla wall within the prayer hall was given prominence by its setting in the transept and the building of a **dome in front of the mihrab**. The builders of later courtyard Mosques took up and modified these ideas, later Maqsura was added.

This period saw the beginning of Monumental Islamic Architecture. In each country, local building traditions prevailed, but the new image was diffused from the center with well-established norms, especially concerning mosque design, the mosque with a courtyard the original pattern remained unchallenged. The principal features were **the haram as a hypostyle hall, the Sahn surrounded by colonnades on arcades (riwaqs in Arabic), Minaret towers, Mihrabs, Minbars, and Maqsuras (possibly with symbolic domes), and decorative pattern based on geometry**. The basic constructs of a universal Mosque design were thus established.

(II). Addition of Spatial elements:

9th Century: The Great Mosque of Samarra, Iraq commissioned in 848. In spatial terms, this was a more articulate building with several innovations. The Mosque which also featured a **Minaret with a spiral ramp** has a large rectangular enclosure with riwaqs of different widths surrounding the Sahn. The haram, for the first time in this type of building, **was planned with two aisles**, separated from the other arcades by **very large rectangular piers** running parallel to the qibla wall, the central aisle is slightly larger than others. This arrangement with some refinement became common in North African Mosques. Maqsuras became important in this era.

(III). Introduction of New Architectural Features:

10th Century: Fatimid Mosque- The first Fatimid Mosque after the founding of Cairo was Al Azhar Mosque, built-in 970 and 972 AD. Its plan followed the classical pattern: a haram five bays deep, a central nave perpendicular to the qibla wall, a dome over Mihrab bay, three-aisled arcades on the long side of Sahn, but none on the Northside. Another important Fatimid Mosque was Al-Hakim Mosque, its main contribution to Mosque design lay in the introduction of a **gateway protruding from the main Facade**, which was the beginning of a new concept that would develop, in the Mamluk period, into a rich and articulated design.

Muqarnas- The origin of Muqarnas can be traced back to the mid-tenth century in Northeastern Iran and Central North Africa as well as the Mesopotamian region. The exact origins of Muqarnas are unknown. They are important in Islamic Architecture because their elaborate form is the symbolic representation of universal creation by god.

11th Century: The Great Mosque of Isfahan, Iran

The Mosque's core structure primarily dates from the 11th century when Seljuk Turks established Isfahan as their capital. Its present configuration is the sum of building and decorating activities carried out from the 8th century through the 20th century. Under the reign of Malik Shah (ruled 1072-1092) and his immediate successors, the mosque grew to its current four Iwan Design. Indeed the great mosque of Iwan is considered the **prototype for future four-Iwan Mosques**.

12th Century: Kutubiya Mosque, Marrakesh, Morocco

It is an example of **the Maghrebi** type of Mosque. Three features that distinguish Maghribi Mosques from those found elsewhere in the Islamic world, though all have their origins in Andalusia: **1) the use of pierced, ribbed or fluted domes, especially over the mihrab, 2) the manipulation of arch forms to create hierarchical distinctions through gradual enrichment; 3) and a readiness to alter the size, shape, and location of a specific design.**

(IV). Regional Architectural Influence on mosque:

13th Century: Jamia Masjid, Srinagar, India

Jamia Masjid is a mosque in Srinagar, Jammu & Kashmir, India. Situated at Nowhatta in the middle of the Old City, the Mosque was commissioned by Sultan Sikandar in 1394 CE and completed in 1402 CE. The Mosque remains a central zone to the religiopolitical life in Srinagar. The Jamia Masjid is heavily influenced by **the Indo-Saracenic style of architecture** and has been constructed in **the Persian manner**, with some similarities to **the Buddhist pagodas**. These are in the middle of each side and covered with **pyramidal roofs**. This courtyard is based on **the traditional Chaar Bagh plan** and has a tank in the center. The entire courtyard is made up of a **pointed arched, brick arcade**. The court which was originally planted with a series of chinars is enclosed by arched *was* (cloisters) **covered with two-tiered sloping roofs**.

14th Century: Great Mosque of Xian, China

The Great Mosque of Xi'an is the largest in China. In Chinese style, there are **a series of pavilions**, with the four courtyards of the mosque between them. The wall, however, is decorated with Islamic art. The mosque is a walled complex of **five courtyards**, with the prayer hall located in the fourth courtyard. Each courtyard contains **a central monument**, such as a gate, and is lined with greenery as well as subsidiary buildings. Overall, the mosque's architecture **combines a traditional Chinese architectural form with Islamic functionality**. For example, traditional Chinese buildings align along a north-south axis as per feng shui, the mosque is directed west towards Mecca, while still conforming to the axes of the imperial city.

15th Century: Demak Great Mosque

Masjid Agung Demak or Demak Great Mosque is one of the oldest mosques in Indonesia. Although it has had many renovations, it is thought to be largely in its original form. It is **a classic example of a traditional Javanese mosque**. Unlike mosques in the Middle East, it is built from timber. Rather than a dome, which did not appear on Indonesian mosques until the 19th century, the roof is tiered and supported by four saka guru teak pillars. The **tiered roof** shows many similarities with wooden religious structures from the Hindu-Buddhist civilizations of Java and Bali.

(V). The appearance of prototype multiple dome Mosques:

16th Century: Süleymaniye Mosque-The Süleymaniye Mosque is an **Ottoman imperial mosque** located on the Third Hill of Istanbul, Turkey. The mosque was commissioned by Suleiman the Magnificent and designed by the imperial architect Mimar Sinan. It is designed to glorify the sultan. A minaret stands on each of the four corners of the courtyard, two tall and two short. Traditionally, four minarets were used for mosques that were endowed by a sultan. **Princes and princesses could construct two minarets; others only one**. The Mosque has **several domes** The main dome is 53 meters (174 feet) high and has a diameter of 26.5 meters (86.9 feet) which is exactly half the height.^[13] Sinan decided to make a radical architectural innovation to mask the

huge north-south buttresses needed to support these central piers.

(VI). Indian Subcontinent, triple domes, and an extensive courtyard :

17th Century: Jama Masjid, Delhi, India.-Jama Masjid of Delhi is one of the largest mosques in India. It was built by the Mughal Emperor Shah Jahan between 1650 and 1656. With three great gates and two 40 meters high minarets constructed with strips of red sandstone and white marble. The courtyard can accommodate more than 25,000 people. There are three domes on the terrace which are surrounded by the two minarets. The mosque is considered the best among all mosques built during the Mughal Empire as it has the best mixture of marble and limestone.^[14] The mosque has three great gates, four towers, and two 40-meter tall minarets constructed of strips of red sandstone and smooth white marble.

(VII). Mosque as a symbol of tolerance:

18th Century: The Mosque of Schwetzingen-Germany's first mosque is found in the gardens of Schwetzingen Castle. It shows the fascinating **connection between east and west**. The Schwetzingen mosque is Germany's last representative of the paradigmatic **"garden mosques"** that were popular in late 18th-century Europe and emblazoned the palace gardens of absolutist rulers. By erecting a mosque (along with other "exotic" buildings), kings and dukes wanted to **show their enlightenment, tolerance, and cosmopolitanism**. Architect Nicolas de Pigage planned this mosque, which was finished in 1795 after 16 years of construction. Besides a cupola building and two minarets, the flamboyant complex consists of a huge colonnade and a "Turkish garden." The **combination of occidental and oriental architectural language** is fascinating. Thus, Baroque domes, ogival windows, and rounded archways are found alongside minarets, pavilions, and half-moons.

19th Century: Taj ul Masjid- The Tāj-ul-Masjid is a mosque situated in Bhopal, India. It is **the largest mosque** in India and one of the largest mosques in Asia. The mosque has a pink facade topped by two 18-story high octagonal minarets with marble domes, an impressive main hallway with attractive pillars and marble flooring resembling Mughal architecture the likes of Jama Masjid in Delhi and the huge Badshahi Mosque of Lahore. It has a courtyard containing a vast number of tent poles and a large tank for ablution in the center. It has a double-storeyed gateway with four recessed archways and nine cusped multifold openings in the main prayer hall. The mosque has two entrances from the west and south. The south entrance is marked by the grand staircase which is a well-known sight for the people of the city.

(VIII). Sub-Saharan West Africa, Hypostyle hall with rammed-earth construction:

20th Century: Djenne Mosque, Mali-The Great Mosque of Djenné is a large banco or adobe building that is considered

by many architects to be one of the greatest achievements of the **Sudano-Sahelian architectural style**. Along with the "Old Towns of Djenné" it was designated a World Heritage Site by UNESCO in 1988. The walls of the Great Mosque are made of **sun-baked earth bricks** (called *ferrey*), and sand and earth-based mortar, and are coated with a plaster which gives the building its smooth, sculpted look. An earthen roof covers the building, which is supported by monumental pillars. The façade of the Great Mosque includes three minarets and a series of engaged columns that together create a rhythmic effect (below). At the top of the pillars are conical extensions with ostrich eggs placed at the very top—a symbol of fertility and purity in the Malian region.

(9). Contemporary Mosque:

21st Century: KAFD Mosque- The 6,103-square-meter structure sits on a large urban plaza that functions as a public space and, when needed, an outdoor area. Inside, the column-free space can accommodate 1,500 prayer spaces over two levels — a large central hall and a mezzanine. The general concept of the KAFD Grand Mosque is inspired by the desert rose, a naturally-occurring crystalline structure commonly found in the deserts of Saudi Arabia. The specific geometries of the building, however, are based on traditional Islamic patterns and provide integrated sun shading as well as a sculptural articulation that is consistent with the design principles of the KAFD master plan developed by Henning Larsen. The stone cladding and minimal glazing also protect the building from the environment while reinforcing the idea of the desert landscape.

Methodology

This research is classified into qualitative descriptive research with an interpretive approach. Archival data mainly from books and the results of previous research. For a case study, a Mosque from every century is taken and a comparative method is carried out by comparing architectural features that were introduced and used by mosques in the centuries to come through the comparative method and visual documentation. To find out if the features are being used to date and if not, what the new features are, those are being introduced.

Discussion- Overview of Timeline

The Mosques of the 7th century were simply having an enclosed courtyard where people gathered to worship due to the heat roofing was introduced as the years passed due to different needs of rituals, needs of the devotees, need of the time different features got introduced. Since this was the very beginning of the introduction of Islamic Architecture and Mosque Architecture in specific it set the basic features and the Mosque of this era became a model of the Mosque Architecture for the centuries to follow. In the 8th Century For example in the Great Mosque of Damascus more and more features started getting introduced. In the 9th century in Mosque of Samarra it started getting developed spatially. In the 10th Century in Al-Hakim Mosque protruding façade was introduced before this entrance of the Mosques were muted. In the 11th Century prototype, 4 Iwan-type Mosques

appeared. From the 12th Century, local architectural traditions started showing up in Mosques for example Moorish architecture in Kutubiya Mosques, Morocco, Indo Saracenic Architecture in Jamia Masjid, India. In the 13th century, the Chinese architectural style in the great mosque of Xian, China; in the 14th CE Indonesian Architecture in Denmark, the great mosque; in the 16th century Suleymaniye Mosque and multiple domes appeared. In the 17th century for example in Jama Masjid 3 domes at the front were seen. In the 18th century in the western world Mosque appeared as a sign of tolerance. Early features, local features, and different architectural styles of Mosques are seen in the Mosques of the 19th and 20th Centuries.

Minaret it's reinterpretation and disappearance

Minarets were never structurally or architecturally essential to the mosque building, in the sense that if you take them out nothing would fall. Their only function was to elevate the Moazin.to a higher pedestal so that Azan could be heard in a wider circle. But loudspeakers made them unnecessary. [i] In some places, Minarets were constructed to continue the visual language or we can say that the Minarets are reinterpreted differently. For example in Great Mosque Xian, Some scholars speculate that the three-story, octagonal pagoda in the third courtyard, called the Shengxinlou or "Examining the Heart Tower," originally served as the mosque's minaret, used for the call to prayer.

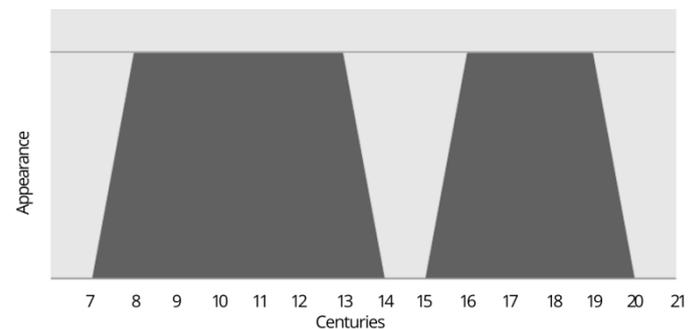


figure.3 Appearance of Minaret according to the timeline

Domes

One major change that has crept in recent times is that domes have disappeared. Domes were an engineering solution to roof the halls that had larger dimensions than the maximum available lengths of planks. The brick and mortar domes were also more long-lasting than a flat roof built with wooden planks. The introduction of reinforced concrete (mortar of cement, crushed stones, and sand embedded with a mesh of steel rods) provided a much better solution to roof even bigger halls. These are more durable and economical than the traditional domes or flat roofs.

From a structural point of view, reinforced concrete obliterated the need to have domes. But the mosque builders did not immediately quit it as they valued domes for the spatial experience that most people had come to associate with praying and also for their visual value which served as a strong religious symbol. [i]

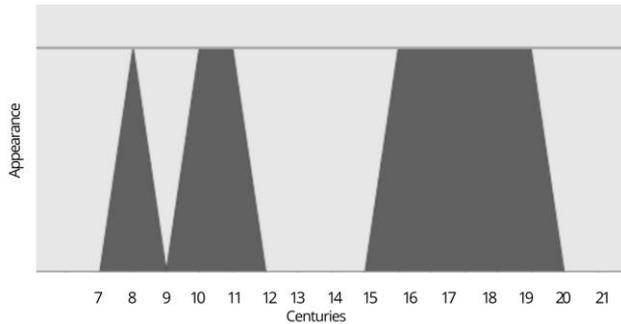


figure.4 Appearance of Minaret according to the timeline

Planning

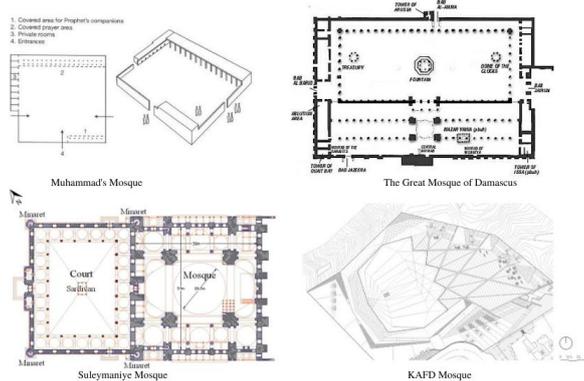


Figure 6

Mosque started being constructed in the 7th Century C.E. Since then there have been various reformations in its design from being simple to becoming complex with every changing era. But Architects of the 21st century are again drawn towards making the plan of Mosque simple. Their approach has rather become philosophical and more focused on making the Mosque, a peaceful place to engage in exaltation.

What does the Architect of Valiasr Mosque have to say about its design?

Valiasar Mosque created a huge controversy due to its design acceptance amongst the masses. Architect of Valiasr Mosque says “We studied the history of mosque architecture,” said Reza Daneshmir, managing director at Fluid Motion Architects to Middle East Architect. “And we found our solution in the first mosque built in Islam – the Quba Mosque in Medina. It is a horizontal structure that is very simple, modest, and without any extensions.”

Daneshmir added, "We eliminated the stereotypical tall elements, such as the dome and minarets, and to harmonize with the context, we designed the roof of the new mosque in the form of a sloping surface that rises gradually from the ground along the park to the height of the City Theatre. It's a three-dimensional surface that's partly concave and partly convex. Besides maintaining the interconnection between the park and the project, the mosque's roof changes its function into a public space that can work with its neighboring theatre at certain times and serve as a seating platform."

“After Prophet Mohammed, elements like the dome and minarets were added to the architecture of the mosque,” Catherine Spiridonoff, CEO at Fluid Motion Architects, added. “And over the centuries, the mosque’s peaceful horizontal form transformed into a vertical shape as a symbol of authority, boasting the dominance of religion.

Contemporary Mosques and their design

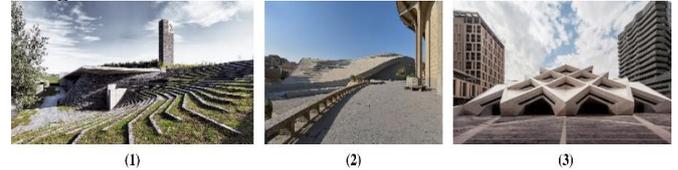


figure. 7

1. Sancaklar Mosque, Turkey

"Sancaklar Mosque aims to address the fundamental issues of designing a mosque by distancing itself from the current architectural discussions based on form and focusing solely on the essence of religious space," said the architects. [iii]

2. Valiasr Mosque, Tehran

“We tried to create an interaction between the mosque, which has a cultural essence, and the City theatre” the architects explain. “We wanted to make it a cultural project that would be in harmony with its surroundings.” [ii]

3. King Abdullah Financial District (KAFD) Mosque, Riyadh

The inspiration and basis for the unique geometry of the mosque are the crystalline intersecting plates of a desert rose. The skin of the building appears to rise from the earth as an emerging crystal mass, bursting from the earth. In the same way, the minarets appear to rise, piercing the landscape.- Omrania[vii]

Modern-day Architects are articulating the Mosque's vocabulary to come up with a modern-day yet authentic spatial experience.

In contemporary world mosques at some places, have architectural features of old mosques while in others architectural features are reinterpreted in the design of Mosques, some Mosques go completely avant-garde, some are designed to go with the surrounding of the structure and some get inspired by the architecture of old mosques and are built in a new way.

Acknowledgement

This research was supported by Dr.B.N.College of Architecture. I thank my guide Prof. Dhruv Chandwania who provided insight and expertise that greatly assisted the research.

Conclusion

There has always been controversy regarding the design of contemporary mosques due to social acceptance. Architects of the 21st century are again drawn towards making the Mosque simple. Their approach has rather become philosophical and more focused on making the Mosque, a peaceful place to engage in exaltation.

References

- i. <https://www.dawn.com/news/1034532>
- ii. <https://www.yatzer.com/valiasr-mosque>
- iii. <https://www.dezeen.com/2015/04/06/sancaklar-mosque-emre-arolat-architects-istanbul-concrete-stone-terraced-landscaping/>
- iv. Martin Frishman, Hasan-Uddin Khan, Mohammad Al-Asad, *The Mosque: History, Architectural Development & Regional Diversity*, Thames & Hudson, 2002
- v. Markus Hattstein; Frederick Delius, *1st. 2004, Islam, Art and Achitecture*, Konemann
- vi. Richard Ettinghausen, Oleg Grabar, and Marilyn Jenkins Madina, 2003, *Islamic Art and Architecture, Second Edition*, the Yale University Press
- vii. <https://omrania.com/project/kafd-grand-mosque/>
- viii. <https://www.schloss-schwetzingen.de/en/erlebnis-schloss-garten/garten/anlage/the-mosque/>
- ix. <https://www.atlasobscura.com/places/the-mosque-of-schwetzingen-palace-gardens>
- x. <https://www.khanacademy.org/humanities/ap-art-history/africa-ap/a/great-mosque-of-djenne>
- xi. <https://www.middleeastarchitect.com/42203-fluid-motion-architects-designs-controversial-mosque-in-tehran-that-challenges-traditional-islamic-design>
- xii. *Influence of Hagia Sophia on the Construction of Dome in Mosque Architecture Dr. Saqer Sqour May 5-6 2016 Dubai (UAE)*

Bamboo: A Futuristic Construction Material

Sneha Dhotre (4th year B-Arch student, D Y P S O A, lohegaon)

Prof. Sonam Kute (Professor, D Y P S O A, lohegaon)

Email : dhotreketaki@gmail.com

Abstract: *Global warming is a concern, not only for the generations that live but also for the generations to come. We, the human beings are the cause of this rising global issue and needless to say, the sufferers too. Global warming has far-reaching effects on us all and it becomes our sole responsibility to safeguard ourselves and the generations to come by reducing carbon emission and so, we strictly need to adopt and implement methods and materials which has low carbon footprint, sustainable and pollution free, in short, methods that are less or not hazardous to the earth as a whole.*

With reference to the same, this paper talks about one of the most unrecognized and underestimated sustainable material - Bamboo, about how bamboo can withstand natural disasters like earthquakes. The paper also throws light on a study of bamboo and its features as its strength to weight ratio, energy required for construction, pollution aspect, etc. and so, how bamboo can be considered as a futuristic material for humankind.

Keywords : Global warming, carbon footprint, pollution, need for sustainable material, bamboo, futuristic material.

INTRODUCTION :

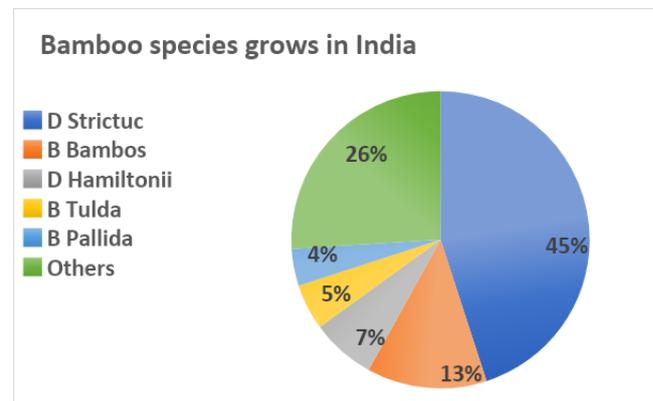
Construction world is ever-evolving, from design, construction methods to the construction materials. Taking a building into consideration, from Architect, to Builder, to building owner, everyone is demanding for a strong, durable, cost efficient, sustainable and easily available construction material. And bamboo is a material which can right tick all of this with few additional benefits.

Bamboo is a gaint grass from gramineae family, which grows in tropical, sub-tropical and mild temperate zones. Large tracts of bamboo forest occur in tropical Asian countries including India, Myanmar, Thailand and China. In India, it grows naturally in almost all parts of country except Kashmir. 125 indigenious and 11 exotic species of bamboo from 23 different genera are reportedly found in India.

Bambusa bambos and Dendrocalamus strictus are two genera constitute the highest proportion of bamboo forest in India. D. strictus is one of the predominant species of bamboo in Uttar Pradesh, Madhya Pradesh, Orissa, and Western Ghats.

Following pie chart shows the percentage of different bamboo species grows in India.

Figure 1 :



Bamboo is a fast growing natural building material, which is easily available. It is sturdy, easy to use, inexpensive, reusable, and can be treated to give different shapes while growing, hence flexible.

LITERATURE REVIEW :

Here are some of the statements shared by PWD authorities, construction team of BRTC and bamboo experts to TOI.

“Till now, bamboo was seen as a cosmetic material and was used for furniture and small canopy or sheds only, but now we have included new items which will promote use of bamboo even in construction of buildings and complexes. Not only PWD, but other departments will be able to promote it in construction activities,” said **Ulhas Debadwar, principal secretary, PWD.**

“These items were included in the SSR(state schedule rates) taking a cue from Bamboo Research Training Centre (BRTC) in Chichpalli in Chandrapur. Entire BRTC is made out of bamboo. For the first time, RCC columns and beams of bamboo were put to use as non-scheduled items. We documented them and now have put in the SSR,” **Debadwar told TOI.**

“Bamboo has a long and well-established tradition of being used as a construction material throughout the tropical and sub-tropical regions of the world. Bamboo is a critical resource as it is very efficient in sequestering carbon and also

helps in combating climate change,” says **PWD superintending engineer Sushma Sakharwade**.

“In the modern context, when forest cover is fast depleting and availability of wood is increasingly becoming scarce, research and development undertaken in the past few decades has established and amply demonstrated that bamboo could be a viable substitute for wood and several other traditional materials for housing/building construction sector and several infrastructure works,” said **another bamboo expert Sunil Joshi**.

WHY BAMBOO ?

According to research, years left for the following raw materials which are obtained from nature and used in making of different construction materials are as follows :

Figure 2 :



It does means that this generation will see the end of ore to produce metals. i.e. the end of oil based plastics.

This leads us to explore and adopt such materials which are renewable, reusable and strong at the same time. While exploring, there is also need to take aesthetics, strength and availability of the material into consideration. And bamboo is such a material which fulfills it all.

Bamboo grows in almost all types of soil and grows best in the areas near to equator. It can grow up to 1 meter/day and can reach 25-30 meters within 2 months. It takes 4 years in total to get mature/ ready to harvest. Where bamboo takes 4 years; other trees which are used as construction material like, Pine and Oak takes 30 years and 80 years respectively.

Bamboo can be treated to obtain different shapes while its growing. For example, we can have a square cross section which can be created by compressing its stalk within a square section or it can be also made to grow in arch shape by compressing. Addition to this, bamboo can be heated and pressed to create curved and flat shapes as per requirement.

Because of its flexibility, high strength to weight ratio it is one of the best roofing materials. It provides adequate sturdiness and offers shield against nature. It also has potential of being

used as flooring. Nowadays, bamboo structures are built as disaster shelters in many regions. And earthquake prone regions are adopting it as a permanent shelter due to its elastic property, which helps the structure to withstand natural disasters.

There are several methods for chemical preservation of bamboo, i.e. water borne, oil based, and organic solvent based and it is still developing. One of the methods which have proved very effective is the ASCU method which is developed by Forest Research Institute, Dehradun, India. Here, bamboo is treated with a solution of arsenic pentoxide, copper sulphate and sodium dichromate. The bamboo can also be treated with a natural boron salt solution which prevents bamboo from insect attacks.

Table 1 :

PROPERTIES OF BAMBOO	
Specific gravity	0.575-0.655
Bond stress	5.6 kg/cm ²
Safe working stress in shear	115-180 kg/cm ²
Safe working stress in compression	105 kg/cm ²
Ultimate compressive stress	794-864 kg/cm ²
Modulus of Elasticity	1.5-1.0 x 10 ⁵ kg/cm ²
Modulus of rupture	610 to 1600 kg/cm ²

EXPERIMENT ON BAMBOO :

Bamboo can be used as an alternative for steel reinforcement in concrete and here is one of the testing. Atul Agrawal and Damodar Maity studied axial compression and bending test in 2009. It was performed on plain, steel and bamboo reinforcement members. As explained in a experimental program, there were 12 columns in total of size 150mm*150mm*1000mm which were casted using design mix M20 as per IS code. These 12 columns includes 4 different types, i.e. 3 columns of steel reinforcement, 3 columns of plain concrete, 3 columns of untreated bamboo and 3 columns of treated bamboo.

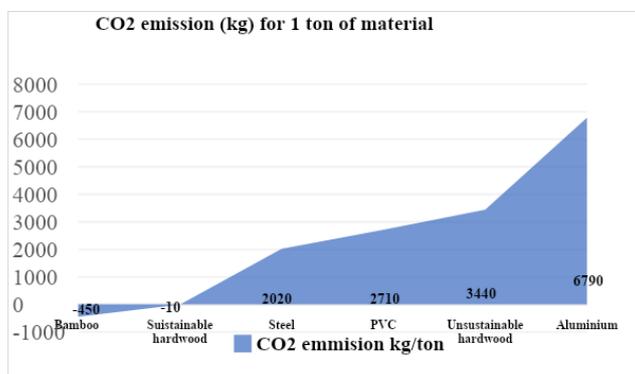
In this plain concrete column and untreated bamboo column showed brittle behavior, tiny cracks occurred at the surface of column at about 80% of maximum axial force and at maximum axial force it finally failed in few seconds. Whereas, in steel and treated bamboo reinforced columns more ductile behavior was observed in which cracks become visible at 80-90% of maximum axial force. Furthermore, the results exhibited that the maximum load carrying capacity of steel reinforced (0.8%) column is nearly equivalent to treated bamboo reinforced(8%) column.

Transverse load test performed on same set of columns revealed the lateral deflection, strain characteristics and failure mode pattern of steel, plain and untreated bamboo reinforced columns. Hence further results obtained was, Bamboo concrete composite structural members can provide tailored solution to eco-housing initiative at cheaper costs.

IMPACT ON ENVIRONMENT:

The bamboo plant releases almost 35 percent more oxygen and absorbs nearly 35 percent more carbon dioxide than most trees. It is a material which can change impact that construction industry has on carbon footprint. Unlike asbestos, cement, etc. bamboo does not pose any risk to human health.

Figure 3 :



Simply saying , if bamboo takes in 10 part of CO₂ inside it , then it just emits 1 part of CO₂ during the whole process (including transport and processing).

China had already planned for reforestation in 2007, and government decided to actively reforest with bamboo and analyzed that, 1 hector of bamboo plantation captures 1000 tones of CO₂ and provide us with 20 cum of building material/year.

FUTURE POTENTIAL OF UTILIZATION :

Golden Revolution in bamboo market began with introduction of bamboo in industrial sector. India and China considered bamboo as industrial material since the early 1990s. Exact statistics on trade on bamboo is insufficient because of unavailability of custom codes and national market analysis.

With the implement of proper management and preservation techniques utilization potential of bamboo can be achieved properly.

CONCLUSION :

While concluding we can say that bamboo is a well-established and renewable building material which can help us in preserving environment and has strength to compete with other non-renewable materials, which are also hazardous for

human health and nature. So there is a need for more researches and trainings in sustainable material like bamboo, so that it can be used prominently.

ACKNOWLEDGEMENT :

Thanks to all the well-wishers for their support and encouragement to this research work.

REFERENCES :

- i. <https://nbm.nic.in/>
- ii. http://timesofindia.indiatimes.com/articleshow/79189140.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
- iii. <https://www.researchgate.net/>
- iv. https://www.youtube.com/results?search_query=tedx+talks
- v. <https://www.inbar.int/>
- vi. <https://brtc.org.in/contact>
- vii. <https://ibuku.com/>
- viii. <https://www.downtoearth.org.in/>
- ix. Lectures by Elora Hardy
- x. Lectures by John Hardy

Role Of Womens' Lifestyle In Spatial Planning In Pol Houses, In Ahmedabad

Srushti Panchal

Prof. Pooja Godbole Soman
srushtipanchal.2000@gmail.com

Abstract : *Lifestyle of people residing in a community is directly reflected in the architecture and spatial planning of the spaces. With the progression of time, the spatial requirements alter in turn to manifest these changes. In this due course of time, the societal role of women has significantly changed. The lifestyle of women is becoming distinct and evolving considerably. In Indian society, women have an important role to play in the household. With the current time, women are not limited to household, but are also actively pursuing their professional careers. In the older days, the role of women was mostly limited to the household and revolved around their families. Women are a major part of the family, residing in the houses during the majority of the time of the day. This required an important aspect of design to be linked to the individual lifestyles of these women. The societal role of women was an important factor to impact the spatial planning and organization the spaces which formed the house as a whole. The traditional pol houses are an instance of intricate planning design based on lifestyle and the societal role of women. The foundational idea of these houses is based on a vast factor of social norms, cultural aspects and climatic conditions. The traditional pol houses are a very ideal example of women centric design. Eventually, there was an increase in requirements in the present day, and these horizontal houses transformed into vertical residences, majorly constituting high rise apartments. This paper aims to study the evolution of household spaces with the societal evolution of the women's lifestyle and how the women are an important component about how the houses are designed, taking an example of the traditional pol house, which developed horizontally to the modern-day high-rise apartments, which have evolved vertically.*

Keywords : Woman, pol houses, spatial organization, lifestyle

1. Introduction

1.1 History

The walled city of Ahmedabad was established in 1411, by Sultan Ahmed Shah. In his rule, he established the city for reasons of trade, since the location of the city was strategic to

the former trade routes. This is one of the reasons, why the population of the city to date remains trade oriented, and the economy was balanced on the basis on the trades established. The trades carried out in the pols ranged from a huge array of jewelers to merchants to food businesses and so on. The day to day trade and business was carried out in the houses itself, which was reflected in the how the nature of spaces was implemented.

Every Pol house had a different aspect about itself, but the pols were never segregated based on the financial background of the residents.

1.2 Spatial planning

Pol houses are based on a similar ideology, but they incorporate so many factors. The economic background gets reflected. The design of a pol house is completely apt for the kind of temperature Ahmedabad experiences. Certain other aspects that require study are the socio-cultural aspects which affect the designing of a pol house.

The spaces in the pol houses were each of a distinctive characteristic and could still be modified according to the requirements of people. The pol house is not just a residence, but it also has an economic aspect, based on the occupation of the residents. Every house in the pol is separate based on the spatial planning as well the connection of spaces. The spaces have been designed to completely incorporate the needs of the family and also provide spaces which can be modified as and when required. Certain spaces included in the planning are multipurpose and can be used by various members for a diverse range of activities.

The pol houses are set in such a historic time period, that in some way or the other the socio-cultural are yet reflected in the design and planning. The social background of the time was completely different as compared to today's modernization. Hence, like it is for every type of traditional architecture, the designing of these houses might have been significantly designed to incorporate the needs of the family at the time.

One striking aspect to be considered in these spaces is the incorporation of the need of women of the household. The

women were obliged to stay indoors in those days in the time period of history. When a person stays indoors for the majority of their time, incorporating their needs in the space becomes necessary. Hence, this research paper aims to study the incorporation of needs of women in the pol houses.

As the society advanced, the women were encouraged to step outside and interact with the world more. In this sudden transition of modernization, the spaces of household did undergo a transition too. Hence, it becomes a necessity to understand if the gap between the requirements and the actual design of houses, is bridged. This paper will encourage the personal interaction of spaces and women of the household, if that is not already the case. The aim would be to study and carry out a comparative analysis of the pol houses and the present-day residences in Ahmedabad. Also, the way the spaces have been altered and their ease of usability based on the perspective of women. This research would in turn help to design and plan efficient homes, according to the comfort level of the women.

2. Methodology

The process of the research involves the literature study of the pol houses. The basic spatial organization of the pol houses and their social relevance was focused on. This information was then analyzed in context of the women using the spaces.

To carry on the comparative analysis of the evolution of spaces, based on the lifestyle of the women and the social progression, individual residences are studied. These studies compare the compatibility of a woman's requirement and the output of spaces, in the architecture and planning of four different time periods. These studies highlight the similarities and differences based on the modernization and if it has impacted the inclusion of women's perspectives in the modern architecture of today's day. The houses which are studied are considered at intervals of 50 years. Half a century is considerable time to study the basic idea which was incorporated in the traditional architecture.

A number of factors have been considered while comparing these spaces- the connectivity, the planning, the nature of spaces, the privacy factor, the individual requirement of spaces, the usability and functionality of the spaces. These factors are selected and a survey was conducted to ask women about their opinion on what they would require in the highest preference. These aspects of pol houses could in turn be incorporated for the newer residences, as per the comfort of the resident.

Four case studies of houses are considered so as to map the stages in which the evolution of spaces occurred.

Case study 1-Haveli- Mangaldas ni haveli- Lakha Par- more than 200 years old

Case study 2-Pol house- House of Bipin pasawala, Desai ni pol- more than 150 years old

Case study 3-Pol house- House of Jagrutiben, Jethabhai ni pol- more than 100 years old

Case study 4-Row house- Shyamal row house- almost 40 years old

The following aspects are used to analyze the spatial organization of the pol houses, haveli and the row house. The most crucial factor is connectivity of spaces, spaces use primarily by women, placement of toilets, movement through spaces, visibility into the spaces and thus the intimacy, the sense of privacy depending on hierarchy of nature of spaces and the time period, which is at a gap of 50 years.

3. Analysis

Each of the houses studied represent a different time period in the history of pol houses. This gradual evolution and alteration can be seen and studied based on the various aspects of connectivity, circulation, visibility and movement within these spaces.

Connectivity as an aspect gives an idea on how efficiently spaces are linked and how it can be easy for women to access these spaces. In this aspect, we observe that the spaces become increasingly interconnected, thus easing the functionality and use of spaces which women use throughout the day, especially the utility spaces. This idea of utility spaces has developed into kitchen storeroom and separate utility spaces for each space if required.

In the olden days, the women used spaces specifically for household work, in the recent times women have started being an active part in the public spaces of the house as well. The spaces which women used during the earlier time, were limited to the kitchen and bedrooms. Over time, in case 2 and 3 it is observed that courtyards start getting included closer to spaces used by women, thus forming a semi-private aspect emphasizing on how the spaces which women used, began to extend further beyond the kitchen. In the row house, the spaces used by women have expanded to almost most of the house, and thus not limited to kitchen and bedroom.

The location of toilets marks a crucial factor in affecting the privacy of women with respect to their personal need. Initially, the toilets were placed closer to the ordo, but as time progressed, the washrooms started getting attached to the

bedrooms, and thus provided for comfort and privacy of women.

The movement analysis gives us a clear idea of how effectively the users accessed the spaces and whether the spaces were easily accessible. In the case 1, we observe that the movement is interrelated with spaces like the utility, for most of the spaces. In the case 2 and 3, we see that the accessibility is primarily straight, as the spaces align linearly. In the case 4 of the row house, the movement is majorly on the ground floor of the residence and comparatively lesser through the staircase on the upper floor. The upper private spaces were used only at the time of need, but the normal circulation included much of the living, dining and kitchen space. Thus, we see the movement through spaces has become smoother due to the interlinked design.

According to the visibility aspect, we can understand how much privacy the women experienced in their private spaces, which were designed to provide comfort and privacy to them. In the first case, the haveli is designed in a way the vision is directed towards the courtyard, all the other spaces like kitchen and bedroom are completely concealed or hidden, based on the proportion. In the next two cases, the visibility is absolutely linear, which can violate the privacy, but it helped women keep an eye on the functions going on inside the house and outside as well. In the last case, the kitchen has been kept open and the bedroom is completely separated from the vision, due to the extension into the first floor. Here, the visibility decreases, and thus we see an increase in intimacy among the private spaces.

The sense of privacy for women did evolve with time, and the nature of spaces shifted as women moved beyond the kitchen. In the first case we observe that the courtyard marks a public space, while the kitchen and bedroom are completely concealed from the view. In the second and third case, we observe that the nature of spaces follows a strict hierarchy from public to semi-private to private and the courtyard is eventually included in the private spaces and are used by women for various purposes. In the row house, we observe that the private space has been completely shifted to the first floor and the kitchen has changed its nature from private to semi-private.

4. Comparison & Discussion

The design of houses initially was such that it provided more interlinkage and the courtyard was a public space. In the later times we observe that the spaces are linearly connected and the nature of courtyard has been changed to accommodate the comfort and privacy of women. In the much recent times, the layout is spread out and courtyards have been eliminated. The visibility of older houses was linear, which lead to easy

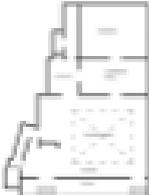
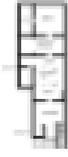
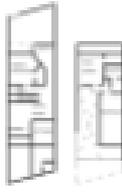
connectivity, but did not provide complete privacy even though it was the remotest. As the lifestyle advanced, the spaces spread out over an area, which accommodated for less visibility, but complete privacy for the woman residing in the house.

Acknowledgement

I hereby express my profound gratitude and deep regards to all my colleagues and people who have willingly helped me out with their abilities, time and constant encouragement throughout this process.

References

- i. Neeta Lamba. (August 26, 2016). *Analysing Social Relevance of Spatial Organization: A Case Study of Traditional Pol Houses*, Ahmedabad, India. https://www.researchgate.net/publication/306920358_Analysing_Social_Relevance_of_Spatial_Organisation_A_Case_Study_of_Traditional_Pol_Houses_Ahmedabad_India
- ii. Gaurav Gangwar. (June 26, 2020). *Traditional Pol Houses of Ahmedabad: An Overview*. <https://www.hrpub.org/download/20200730/CEA5-14816242.pdf>
- iii. Naman Gajjar. (2019). *Nature of Changes which occurred in Row Houses in Ahmedabad: A Post-occupancy Study*. <https://issuu.com/gajjarnaman/docs/thesis>
- iv. Krushnkumar Khasiya. (July 6, 2017). *Pol Houses and Reusability*. https://issuu.com/krushn_khasiya/docs/krushn_b-arch_thesis
- v. Krystina Kaza. *The Ovla: A 'Free Space' in Balkrishna Doshi's Aranya Settlement*. <https://unitec.researchbank.ac.nz/bitstream/handle/10652/1568/Kaza%20-%20Ovla.pdf?sequence=1>
- vi. Shraddha Sejpal. (1982). *Theory and City Form: The Case of Ahmedabad*. <https://dspace.mit.edu/bitstream/handle/1721.1/78964/17064068-MIT.pdf;sequence=2>
- vii. https://www.researchgate.net/publication/330346830_Mangaldas_ni_Haveli-1_Pol_House_Ahmedabad

Parameter	Case 1	Case 2	Case 3	Case 4	Inference
Rise	 Haveli	 Pell house 1	 Pell house 2	 Row house	
Connectivity 	Interconnection of spaces 	Linear connection 	Linear connection 	Connection from a common point 	The efficiency of connection of spaces increased, due to direct linkage
Spaces used by women 	Kitchen, common hall 	Kitchen, entry, stair 	Entry, parlor, kitchen, entry, stair 	Bedroom, kitchen, living room 	The spaces which were limited to women, began to expand to most of the house
Placement of toilet 	Attached to entrance 	Near entry 	Near entry 	Attached to bedroom 	Increasing privacy of bathroom
Movement through spaces  Movement	Easy movement to necessary spaces 	Easy movement 	Utility facilities from across 	Searchy spaces without much hindrance 	Ease of accessibility
Visibility  Angle of visibility	Restricted visibility to outer spaces, more intimacy 	Linear visibility, lesser intimacy 	Linear visibility 	No visibility, lesser complete privacy 	Visibility reduced, but privacy increased
Sense of privacy  Private Semi-private Public	The hierarchy of spaces is clearly from public to private 	Transition of private to public gradually 	Graded transition 	Completely private spaces separated through levels. 	The spaces changed the nature, from public to private to comfort women
Time period	180 years old	158 years old	188 years old	58 years old	

Survey on Necessity Of Hydroponics System For Future Indian Cities (Study on Architectural perspective)

Supriya Santosh More

D Y Pail School of Architecture, Ambi, Talegaon, Pune

Email: moresupriyasantosh@gmail.com.

Abstract: *Hydroponics (Greek word 'hydro' water and 'ponos' labour) is a technique of plants growing without soil using with mineral nutrient solution. In India from past decades, we are practicing open agricultural system, but looking into the current scenario Indian population projected to 2 billion by 2050, at the same time due to rapid urbanization and industrialization as well as impact of global warming, arable land under cultivation is further going to decrease. This review paper focuses on the challenges and possibilities to bring soil less farming in India. In this paper my effort is to put forward understanding types of hydroponic system through literature study.*

Keywords: Urbanization, Arable land, Necessity, Hydroponics, Vertical farming, Survey, Built Acceptance

Introduction

Soil contains all the important components for the growth of plants. However, soils do pose serious limitations for plant growth; presence of disease-causing organisms and nematodes, unsuitable soil reaction, unfavorable soil compaction, poor drainage, degradation due to erosion etc. are some of them. In addition, conventional crop growing in soil (Open Field Agriculture) is somewhat difficult as it involves large space, lot of labour and large volume of water. Moreover, some places like metropolitan areas, soil is not available for crop growing at all, or in some areas, we find scarcity of fertile cultivable arable lands due to their unfavorable geographical or topographical conditions. Of late, another serious problem experienced since is the difficulty to hire labour for conventional open field agriculture. (With increasing occupational shift fewer farmers will be left to cultivate the food on which cities currently do and will depend in the future. "Over the past 40-50 years, the proportion of humans who farm has dropped by 20% to under 45%). Also, with increasing urban sprawl the rural villages are getting converted into urban villages and gentrified in metropolitan cities like Delhi, hence dependency of it on peri-urban areas for food production has increased. Thus, it is quite expected that the supplies service of food production for cities will either have to be sourced from remote surroundings or cities will have to include their own food production. To overcome these problems the new technique hydroponics has been introduced. In India, Hydroponics was introduced in year 1946 by an English scientist, W. J. Shalto Douglas and he established a laboratory in Kalimpong area, West Bengal. During 1980s, many automated and computerized hydroponics farms were

established around the world. Home hydroponics kits became popular during 1990s.

Hydroponics plantation is an advanced form of agriculture which enables the option of exclusive supervision over the distribution and delivery of nutrition among the plants. Based on surveys, the hydroponic groundwork should be easily drained; it must have suitable ventilation power and good ability and capacity to preserve water, and must be free of harmful elements and weeds and also can be provide- able in cheap prices. Additionally, it is recommended to use groundwork with organic source instead of synthetic ones. Hydroponics, in spite of need for adequate expertise and relatively high investment, in comparison with soil-based plantation has a lot of advantages such as high performance, the need for low labor force, simplicity of works.

Review of literature

Large numbers of hydroponic/soil-less culture techniques are available. However, following factors are considered in selecting a technique:

- I.Space and other available resources
- II.Expected productivity
- III.Availability of suitable growing medium
- IV.Expected quality of the produce – color, appearance, free from pesticides, etc.

Techniques of Hydroponics:

It is also known as Liquid Hydroponics method. Plants grown in solution culture have their roots suspended directly in a nutrient solution. It can further be classified into:

- i) Circulating methods (closed system) / Continuous flow solution culture)
 - Nutrient film technique (NFT)
 - Deep flow technique (DFT)
 - Nutrient film technique (NFT): The N.F.T. system is quite popular with home hydroponic growers as well. Mainly because of its fairly simple design, However N.F.T. systems are the best suited for, and most commonly used for growing smaller quick growing plants like different types of lettuce. Along with growing lettuce, some commercial growers also grow different types of herbs and baby greens using N.F.T

Deep flow technique (DFT): These systems are one of the most widely used types of hydroponic systems around the world, both for home Growers as well as commercial growers alike.it won't limit limit your Imagination when u building your system.

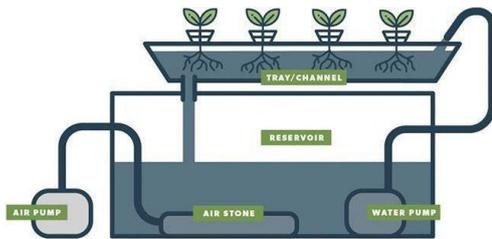
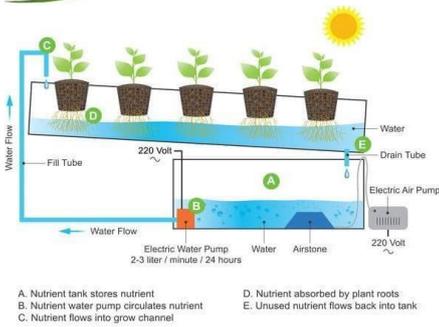


Fig. 1: - N.F.T (Nutrient film technique) Fig.2: - DFT (Deep flow technique)

ii) Non-circulating method (open systems)/ Static solution culture)

- Root dipping technique
- Floating technique

Type of crops	Name of crops
Cereals	Rice, Maize
Fruits	Strawberry
Vegetables	Tomato, chilli, Beet, Cucumber, Cabbage

• Capillary action technique

Leafy Vegetables	Lettuce
Condiments	Mint, oregano
Flower / Ornamental crops	Marigold, Roses
Medicinal Crops	Aloe vera
Fodder crops	Barley, Sorghum

Table no .2: - List of Crops can be grown in hydroponics system.

These maps indicated that Urbanization happening everywhere so all the agricultural land is converted into concrete jungle. With increasing urban sprawl not only agricultural land is getting reduced but also dependency on rural hinterlands for food and other dairy products etc. is increasing which is causing shortage and price fluctuations of vegetables, fruits and other major daily need sources of food. With increasing urban sprawl development around the farmland has increased its price in many folds thus farmers chose to sell

their land to real estate developers than to farm. The problem related to real estate development in India is that there is large amount of investment in plots and housing apartments which

Necessity of Hydroponics system in India: -

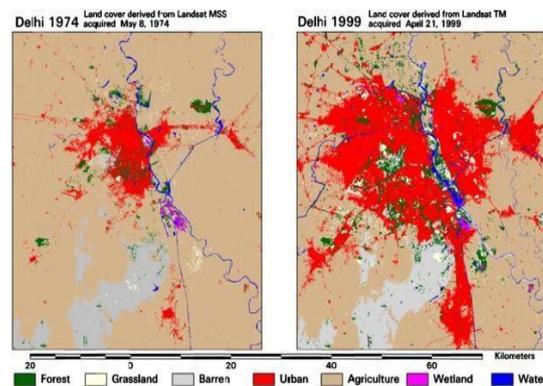


Fig.3. New Delhi 1974-1999, Increase in population of 4.2 million with 60,000 hectares of agricultural land lost.

remain unused as the money which is invested is mostly black money and the property is brought for investment point of view thus, they remain vacant, this large amount of private property can be brought to use for Hydroponics farming.

The major issues: land being seized for private industry; rising debt; increased costs of operation; and decreasing support (and subsidies) from the government. In short, agriculture was simply becoming less and less viable, especially for smaller farmers—and 68 percent of Indian farmers own less than one hectare of land.

Issues



Fig.4. Farmers, particularly in the states of Punjab and Haryana, have protested against the government move

Vertical farming a possible replacement to conventional farming in future: -



Fig.5. A Sky Green farm tower, Singapore

The wealthy island city of Singapore with an area of 710 square km and a population of 5 million, is one of the most densely populated cities in the world. With most parts of the island’s land utilized for urban development, the remaining 250 acres of farmland is hardly sufficient to feed the growing population. The only way out of this problem is to maximize the use of land for food production. For the island of Singapore, where real estate is at a premium and the land rates are exceptionally high, the only viable option is to go vertical to make the island more self-sufficient in food. It is not only lack of open spaces in cities but also lack of awareness and thought among people in India that we do not see urban farming in India in practice.

E.g. - India is a developing country thus lot of construction work in construction of buildings keep on occurring which take a time of about 2- 4 yrs. on average(taking group housing as example) thus if in that period vacant lands where construction has not yet started farming is done it too can contribute to food market . Also, the builders constructing flats give green open spaces in their colony but only consisting of beautified plants. Thus, by giving incentives, raising awareness and promoting interest among people to get engage in urban farming is vital and need for future cities.

Name of crop	Hydroponic/acre	Conventional crop /acre
Tomato	180 tonnes	5-10 tonnes
Cauliflower	30,000lb.	10-1500lb
Lettuce	21,000lb	9,000lb
Cucumber	28,000lb.	7,000lb.
Cabbage	10-12 tonnes	6-7 tonnes
Lady finger	19,000lb.	5-8000 lb.
Peas	14,000lb.	2,000 lb.

Table no .3: - Comparison between Conventional crop method V/S Hydroponic crop method in acre.

Advantages of Hydroponics

There are many advantages of growing plants under soil-less culture over soil-based culture. These methods produce healthy crops with high yield, no chance of soil borne insects and pests; diseases attack or weed infestation. Soil less culture provides organic food and there is no use of pesticides and harmful toxics. It needs less space in consumption to soil garden, as plant with small root can be grown closer to each other.

Crops grow two times faster in hydroponics and yield is doubled leading to more production from same amount of space. No wastage of water as water is reversed used in this technique uses only 1/20th of water to crops compare to traditional farming, requires less labour, no worries of changing seasons, crops can be grown all year around, environment friendly practice, no harm to nature.

Problem Statement

The two major problems have been financial and technological feasibility. Since this method requires contemporary building materials and renewable energy systems such as light shelves, light pipes and fiber optics and skilled workers to run it thus its rate of return does not seem profitable to investors. In spite of this set up requires technical knowledge. Further set up cost is also high, which also require constant supervision. During hydroponics techniques water-based diseases can easily be introduced due to poor handling. Other problems are temperature, humidity and ph.

Possibilities

1. Providing more number of training to farmers
2. Providing them hydroponics system at affordable rates
3. Urban areas should be projected to build hydroponic food park in every city.
4. Agricultural universities and Research institution should work in co-operation with Government of India to perform survey and try to bring these techniques at large scale so that farmers could learn something from it.
5. Farming should give most respected profession in Nation so that young farmers could see his/her future in fields in agriculture working with latest agricultural techniques

Scope for Hydroponics in India Hydroponics is the fastest growing sector of agriculture, and it could very well dominate food production in the future. As population increases and arable land declines due to poor land management, people will turn to new technologies like hydroponics to create additional channels of crop production. Hydroponics also has been used successfully in Israel which has a dry and arid climate. Due to changes in climatic factors and natural disaster like drought and floods, are some of the reasons to switch to new technology, which promises food productions safely. With people’s participation it can also turn out to be an active public space along with enhancing food security in community. Economic benefits are that it enhances the food growing supply, generate income and employment.

Conclusion

The industry is expected to grow exponentially also in future, as conditions of soil growing is becoming difficult. Specially, in a country like India, where urban concrete conglomerate is growing each day, there is no option but adopting soil-less culture to help improve the yield and quality of the produce so that we can ensure food security of our country.

Acknowledgements

I would like to extend my thanks to Prof. Ar. Seemantini Nakil for necessary guidance during the work and shivraj green tech for providing facility and support during preparation.

Note: - All the images are taken from google images.

References

- i. Nisha sharma, Somen Acharya, kaushal Kumar, Narendra Singh and O.P. Chaurasia, "Hydroponics as an advanced technique for vegetable production", *Journal of Soil and Water Conservation* 17(4): 364-371, October-December 2018
- ii. Sagar J. Dholwani, Sagar G. Marwadi, Vandan P. Patel, Vijeta P. Desai, "Introduction of Hydroponic system and it's Methods", 2018 *IJRTI*, Volume 3, Issue 3, ISSN: 2456-3315
- iii. Raneem Gashgari, Khawlah Alharbi, Khadija Mughrbil, Ajwan Jan, Abeer Glolam Department of Industrial Engineering, King Abdulaziz University, "Comparison between Growing Plants in Hydroponic System and Soil Based System", Madrid, Spain – August 16 – 18, 2018 Paper No. ICMIE 131
- iv. Farhat Ali, Chitra Srivastava, "Futuristic Urbanism-An overview of Vertical farming and urban agriculture for future cities in India", *International Journal of Advanced Research in Science, Engineering and Technology* Vol. 4, Issue 4 , April 2017
- v. Ankita Jain, Nidhi Kumari and Vikash Kumar Jha, "A review on hydroponic system: hope and hype".
- vi. Andrius Grigas, Aurelija Kemzūraitė, Dainius Steponavičius, "HYDROPONIC DEVICES FOR GREEN FODDER PRODUCTION: A REVIEW" Article DOI: <http://doi.org/10.15544/RD.2019.003>
- vii. https://avestia.com/MCM2018_Proceedings/files/paper/ICMIE/ICMIE_131.pdf

The Relevance of Cultural Centers in the urban context

Suyash Sherekar

B.Arch. (Pursuing), PIADS, Nagpur

Email: suyasherekar28@gmail.com

1. Abstract: *This paper investigates the role of Urban Cultural centers in the city life of the 21st century. The presentation of arts inside restricted campuses has limited its relationship with the common people and this restricted engagement in-turn does not contribute much to the overall cultural identity of the city. The paper thus reviews the limitations of 'cultural centers' as a typology on design and policy levels. I have also drawn heavily from case studies on how a cultural synergy can be established between art campuses and the surrounding urban life so as they resonate better with each other.*

Keywords: *Cultural Centre, Urban Context, Interaction, cultural synergy*

2. Introduction: Today, we live in the post-information age where our relationships with everything around us are being redefined. The role of 'culture' in shaping humankind was very intimate until the onset of industrialization, followed by European colonization of most of the world. Human settlements in the post-industrialized world tend to fulfil primary needs at the outset, and then maneuver for psychological wants like culture, stability, etc. As the gap between the man struggling to make a living and the collective cultural outcome of the society increased, it also affected the architecture around him - which supported less interaction, collaboration and cultural fulfillment. This gave rise to a new typology of building special 'cultural centers' in the city which allows its residents to interact, gather and carry out cultural pursuits as a society. The typology of 'Cultural Centers' has gained the impetus in societies willing to invest in human capital and thus include an array of activities like auditoriums, public parks, amphitheatres, visual art galleries, studios, etc. – all under a single roof.

However, over the years a trend has been observed that these dynamic cultural centers have restricted themselves to their fences. Their relationship with the city is restricted as they do not cut across the many cross-sections of society. The celebration of art in these restricted areas thus makes it an elitist affair. Thus the need to make art democratic and create a cultural synergy between the art hubs and the urban realm is very much felt. This paper thus studies the relevance of the established idea of cultural centers in the urban context. The intent is to analyse their contribution in the overall cultural upliftment of the society and offer new dimensions on how the typology can resonate better with the urban masses.

When a Cultural Centre becomes an inward-looking campus, the cultural churning inside and life on the streets outside become mutually exclusive sets

3. Limitations of the typology

Cultural centers are characterised by the genesis of cultural activities being performed together by an institution under a closed campus. The typology originated from the need to have a dedicated space for communities to carry out their artistic fulfillment. The design parameters charted to create the cultural centers not only seem to guide the way these centers function internally but also determine how they resonate with the setting. A general observation into the design of cultural centers, art hubs, etc. across the world would help us understand the development of a typical morphology that looks inwards with activities confined inside the walls of the campus. The factors limiting the interaction of these cultural campuses with the city have been discussed below -

3.1 Interaction with the city

The success of any public sector project is determined by its relationship with the local context. Interaction of a cultural centre with the city is determined by daily footfalls, diversity in the range of users, interactive spaces which foster communication, relationship between the laymen and the artists in the centre, etc. The adherence to the context is also governed by the pattern of connectivity with urban elements in the vicinity such as footpaths, roads, public plazas, metro stations and the surrounding residential areas.

With the development of new cultural centers on designated plots in the urban sprawl, it has been observed that the morphology so developed is more inward-looking. The 'All-under-one-roof' character of zoning cultural activities in a controlled atmosphere thus restricts the outward cultural flow towards the city. This hampers the overall participation of members in the public realm in the happenings inside the campus and vice-versa.

3.2 Cultural Identity of the city

Cultural institutions functioning in accordance with the inert socio-cultural fabric of the city impact the lives of its residents on many levels. However, with highly compounded, introvert cultural centers tasked to 'celebrate art' in the city, hardly lend any breathing air for 'live culture' to prosper. In contrast, the rough-and-tumble on a bazaar street, the heritage value of the old building facades, the screech of the shopkeepers and the aroma of local street food – all contribute heavily to the image of the city. It is time to rethink whether our cultural buildings

{ Cultural } { Urban }
{ Centre } { realm }

which talk loud only during the artistic presentations are really shaping the perpetual cultural image of our city and our progress as civilizations as well.

3.3 Classism in art

Most of the cultural institutions hang in today as high-end, state-of-the-art infrastructure projects which facilitate large-scale gatherings and events. The high maintenance costs of managing these centers then translate into higher rents for artists, event companies to spend on. The skyrocketed rental packages cost dear to local, tribal artists. Finally, this results in increased ticket prices for programmes making it difficult for a large cross-section of our society to access these spaces.

Also on a policy level, government-run cultural centers many a time, merely act as training centers for artists disallowing the interaction of common folk and artisans. Keeping aside the subsidies and support provided by cultural organisations, it is also for architecture to recognise this parity and make way for social equity through cost-effective and sustainable design.

3.4 Visual Interconnectivity

While crossing through an Urban Cultural centre one often witnesses passing along unending parking lots or the heightened compound walls which run all across the perimeter of the campus. At times when these campuses abut a busy street, the walls are usually decorated with frescos, richly crafted murals, aesthetic wall paintings and graffiti. While we credit this for the portrayal of art and colourful representation, these walls are actually faux canvases that restrict our visual contact with the happenings inside the cultural centers. The immersive qualities of village fairs, which enable us to have a far sight of the cultural proceedings, make them welcoming to the passers-by. Cultural centers, when they hide inside their compound walls eventually fail to create a regular, destination-centric audience base for themselves.

4. Learning from Case Studies

While investigating the fault lines which have developed during the evolution of cultural centers, it could be observed that the urban surrounding plays an important role in the way they function. Thus, a systematic yet radical shift should be employed in the way/s we understand culture today.

For Cultural dissemination to happen in the city, it is important that the design should cater to the shared goals of the society, so as to bring people together. Intelligent design fostering public participation while breaking away the industrial-era silos of definitive functional planning should make a way in the public policy as well. Following takeaways driven from case studies around the world can help us understand the role of public participation in the cultural process -

4.1 The Idea of Cultural Precincts

Cultural Precincts are a popular concept in the countries of Australia and New Zealand where Cultural hubs are designed taking into consideration the dynamic roles they play in the urban context they lie in.

For the Melbourne Arts Precinct, The Victorian Government has developed an adaptive master plan which aims at connecting the pre-existing cultural buildings with each other. For this, a large public garden holding all the cultural activities together has been proposed with a view to bringing in more people into the precinct. The public garden also expands the creative possibilities of the precinct on a large level.

4.2 Understanding existing cultures

With the great ancient civilizations of the world, the idea of celebrating culture by coming together in public spaces runs through. Central Plazas, Amphitheatres, Temples were cultural magnets that form the identities of the living cultures today. Cultural representations are important in architecture as they address the local understandings of society. It is when the exhibition of local craftsmanship is highlighted through building design, people start developing an intimate relationship with the space.

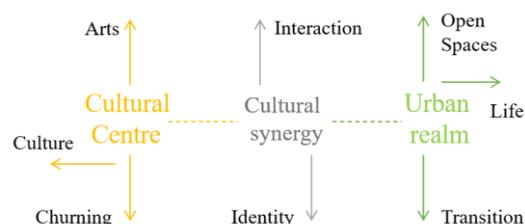
4.3 Developing multi-use activity interfaces

One of the important strategies to bring people together is to develop multi-functional activity zones around cultural centers. While, auditoriums, amphitheatres, Visual arts galleries, etc. perform the primary goals of a cultural centre, it is advisable to plan activities that complement the presentation of arts next to them. Public Libraries, Gardens, spaces for hawkers, etc. not only add to the dynamics of a cultural space but also contribute to the economic process of the system. An active pedestrian life is often desired for the overall well-being of the precinct as well

- Primary users – Artists, audiences
- Secondary users – People participating in the complementary activities
- Tertiary users – Passers-by

4.4 Micro Cultural Precincts

While bringing people to the cultural hotspots should ideally be strategized, the reverse is also true indeed. While a major chunk of our daily lifestyles is characterised by travel, the thankless transition spaces can turn into pockets of cultural representation as well. For example, The Bao'an Public Culture and art centre combines the perks of a metro station and an art centre in a single building. Meanwhile, the Afghan Bazaar Cultural precinct developed in a public square in Melbourne tells us the stories of the Afghan community in more ways than one.



Developing a cultural synergy between the Cultural Centre and the Urban Realm by connecting shared values

5. Conclusion

Cultural Centers can't hang in as islands in a society. At times when the concept of beauty and the definition of what can be termed as 'art' is being democratised, it is also time for the cultural spaces to open up to the people. It can be seen when people become one with the artistic consciousness, it not only contributes to the cultural churning inside the art centers but these centers of cultural excellence render the city with a new identity as well.

6. Acknowledgements

I am obliged to my Thesis guide Prof. Nishant Manapure for adding many new dimensions to the way I think, especially when it comes to Urban Studies. I am also thankful to Prof. Manisha Yelne for her continued support while researching this topic.

7. References

- i. *Montgomery, John (2003) - Cultural Quarters as Mechanisms for Urban Regeneration Part 1 Conceptualising Cultural Quarters*
- ii. http://geoinfo.amu.edu.pl/qg/archives/2012/QG314_063-076.pdf
- iii. *Feizollahzade, Hamide (2013) - Designing a cultural complex with sustainable architecture approach*
- iv. <https://www.ijsr.net/archive/v5i5/21051602.pdf>
- v. *Birgit Eriksson, Camilla Møhring Reestorff & Carsten Stage (2017) - Rethinking Cultural Centers in a European Dimension*
- vi. https://pure.au.dk/portal/files/118639411/RECCORD_Report.pdf
- vii. *iv. Mercer, Colin (2006) - Cultural planning for urban development and creative cities*
- viii. https://www.kulturplan-oresund.dk/pdf/Shanghai_cultural_planning_paper.pdf
- ix. *v. Johnson, Louise (2016) - Cultural Capitals - Revaluing The Arts, Remaking Urban Spaces*
https://www.google.co.in/books/edition/Cultural_Capitals/aAYGDAAAQBAJ?hl=en&gbpv=0&bsq=cultural%20centre%20urban
- x. *vi. Evans, Graeme (2002) - Cultural Planning: An Urban Renaissance?*
- xi. https://www.google.co.in/books/edition/Cultural_Planning/JliGAgAAQBAJ?hl=en
- xii. *vii. Development Victoria – Melbourne Arts Precinct*
- xiii. <https://www.development.vic.gov.au/projects/melbourne-arts-precinct?page=overview>
- xiv. *viii. Mecanoo, Bao'an Public Culture and Art Center*
- xv. <https://www.arch2o.com/baoan-public-culture-art-center-mecanoo/>

The Relevance of Cultural Centers in the urban context

Tanaya Shah, Dr. Sujata Karve

Dr. Bhanubhai Nanavati College of Architecture, Pune
tanayasshah@gmail.com , sujata.karve@bnca.ac.in

Abstract: *Space has been the fundamental aspect of architecture and enhancing the quality of space in the urban fabric is important to improve and develop the place. Throughout the process of development due to economic or social reasons, the spaces around us continuously transform and change. This can result in the creation of leftover spaces which could be termed as Urban voids. Urban voids are spaces which are often forgotten in the eyes of people and are result of designing out of context with the surroundings. Reclaiming these forgotten spaces by interventions could potentially change the perception of these spaces. This paper aims to understand the perception of urban voids by residents and their possibility to be converted into public spaces. The expected outcome is to understand if people are able to identify spaces, their perception as well as identifying simple solutions for the space transformation.*

Keywords— Leftover spaces; Urban Void; Urban fabric; Reclaiming lost spaces; Public Spaces; Public realm

I. INTRODUCTION

Due to the rapid development in the cities, most of the cities face the problem of insufficient place. The space in the urban environment is not used properly because there are underutilized spaces in the urban built environment. From an Architectural point of view, it can be considered as "leftover space " or "Urban Void" in the built environment. Urban voids are spaces which rupture the urban fabric of a city. "Urban voids are undesirable urban areas that are in need of redesign making no positive contribution to the surroundings they are ill-defined, without measurable boundaries and fail to connect elements in coherent way." (Trancik, 1986) "City abundant small spaces have key impact on the quality of life. If those spaces are unattractive and left unattended people will respond and retreat from the city streets and eventually have an adverse effect on city in all aspects" (Whyte W.H.1980)

Urban Voids have huge potential of improving the place and creating a stronger urban fabric of the city. Reclaiming these forgotten spaces by interventions could potentially change the perception of these spaces. Thereby helping to create spaces that can be utilized for imageability. These spaces have a great potential and can be exploited as urban public spaces for activities such as pocket parks or plazas or just place for activities which make people get engaged and enhance the public realm. This paper attempts to focus on the concept of urban voids (leftover spaces), identifying and studying voids in a selected site, analysing the potential and perception of people regarding the spaces.

Basic Classification (Nipesh,2012)-

- i. Planning Voids: Voids created due to inefficient and improper planning processes. These are created due to

planning in isolation without understanding the fabric of the city. These are most visible in our cities also can be perceived using figure ground theory.

- ii. Functional Voids: These are dead vacant spaces in the cities. These occupy precious land in the city and make the environment unpleasant
- iii. Geographical Voids: These area existing geographical features in the city. E.g., river, Nala, etc.

Trying to relate these types of voids to the Indian urban context and considering the concern for the potential of urban voids to contribute to the public realm, lead to devise version of urban void types. The criteria to select these voids were ownership, the role they play in liveliness of the street, and the potential to transform.

Working more on these types, the voids occurring only in the public realm of the city, methods of intervention and change in mind, it was found that there are mainly four types of voids:-

(Aamir Ansari, 2016)

- i. Edge and Buffer Voids
- ii. Infrastructural Voids
- iii. Transportation Voids
- iv. Large Scale Plots

i) Edge and Buffer Voids

Type – Setbacks, Between space, Marginal spaces, Residual spaces

Reason – Indefinite spaces caused by action

Issues – Leftover spaces creating dead spaces, feeling of unsafe spaces, Wasted potential sidewalk.

ii) Infrastructural Voids

Type – Infrastructural void

Reason – Dead spaces in and around public infrastructure

Issues – Waste of usable spaces

iii) Transportation Voids

Type – Oversized street, Oversupplied street

Reason – The street supersized than requirement, Improper distribution of space

Issues – Taking large amount of space, unsafe to cross, unsafe for pedestrians.

iv) Large Scale Plots

Type – Parking lots, Unused Land, Abandoned spaces

Reason – Gap between dpr, Lack of stakeholder meetings

Issues – Creates huge voids in fabric of city, spaces designed for cars not for people. (Aamir Ansari (2016))

II. MATERIAL AND METHODOLOGY

The method used for this research was mapping and surveys. An area along one of the main roads of Pune was identified for the same.

Interviews and Surveys – People were interviewed to understand the following aspects like What does leftover spaces mean, which spaces they considered as leftover spaces, If they know such spaces, their location and how can these spaces be reused or transformed.

The area was mapped to understand the possible potential voids.

Location and context –

The site selected for survey is Karve road, one of the most important roads in Pune. (Figure 01) It is one of longest and busiest roads within the city. It starts at Deccan in the suburb of Shivajinagar. It passes through suburb of Shivajinagar, Erandwane, Kothrud.

A stretch of Karve road of 4.5 km is considered and people’s perception survey is conducted through face-to-face interviews of people.

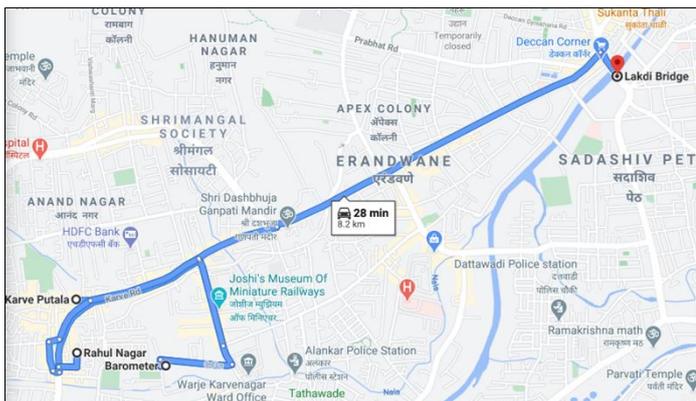


Figure 01 - Map showing stretch of Karve road.

III. RESULTS AND TABLES

Face-to-face interviews of 25 people were taken to understand perception of people and to identify simple solutions for transformation of these spaces.

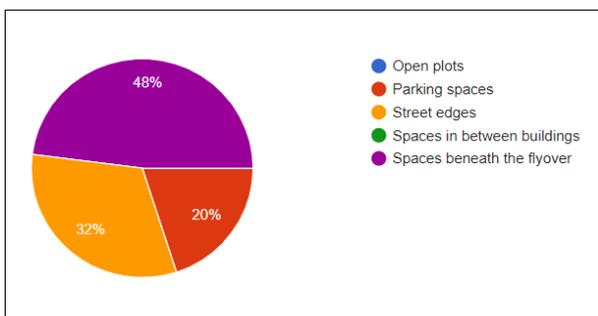


Figure 02 – Spaces considered as leftover spaces according to people

People were asked about which spaces they considered as leftover spaces and positively they were able to identify such spaces in their neighbourhood. (Figure 02) Majorly space beneath the flyover was identified as leftover space. Most of people identified street edges which are dead spaces or simply used for dumping garbage. Vacant plot and the spaces along dividers of road in internal road were used for parking cars.

A few people demarcated them as dead, unused spaces which can be positively transformed into spaces to enhance public realm.

The locations identified by people; the areas were mapped to understand potential voids. (Figure 03)

Infrastructural void – dead spaces beneath the flyover, Edge and buffer void- Street edges, Large scale plots – Parking lots are the potential voids in the area.

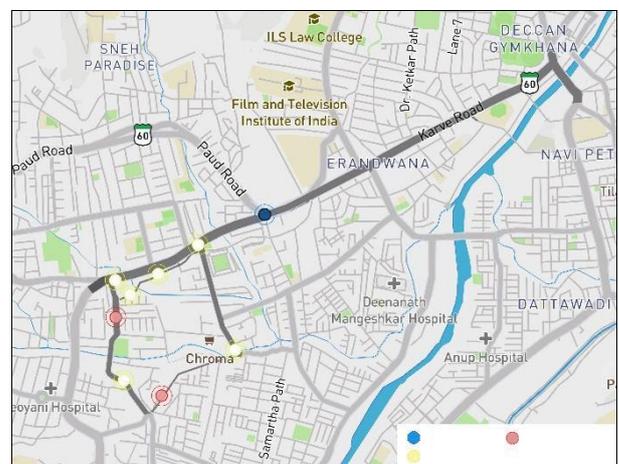


Figure 3 – Locations identified by the people and voids identified

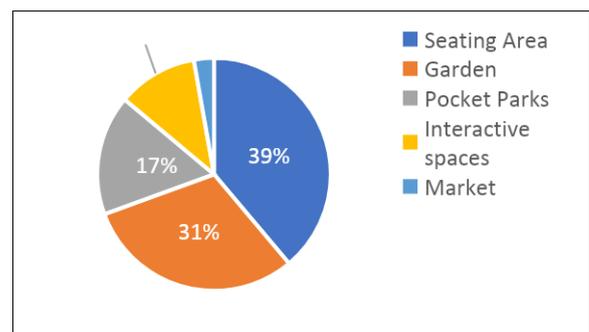


Figure 4 – Possible uses of the spaces suggested by people

People thoughtfully suggested possible uses considering the neighbourhood and ongoing surrounding activities. Interactive seating areas for chitchatting, for activities which make them engaged were suggested by most of them. Gardens, Pocket parks for all ages, small markets were also suggested by people for space transformation.

IV. CONCLUSION

Urban Voids have huge potential of improving the place and creating a stronger urban fabric of the city. Reclaiming the dead spaces by intervening could solve the perception of these spaces and thereby create better shared spaces by increasing

the imagination and comfort. These spaces can be seen as great potential for urban public spaces such as seating areas, gardens, pocket parks or plazas or just place for activities which make people get engaged and enhance the public realm.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Dr. Sujata Karve for her valuable guidance, inspiration and encouragement.

REFERENCES

- i. TRANCIK, finding lost spaces: Theories of Urban design (1986)
- ii. Gehl J Cities for people. Island Press (2010)
- iii. Whyte W.H. The social life of small urban spaces.(1980)
- iv. Rethinking urban voids- innovative ways to revitalize lost spaces (2016) Aamir Ansari/thesis report- CEPT University
- v. Urban voids-adaptive use of public spaces (2016) Keshav Rathi thesis report
- vi. Nipesh (2012). Urban Voids & Shared Spaces: <https://nipppo.wordpress.com/2012/05/07/urban-voids/>
- vii. Azhar, J., & Gjerde, M. (2016). Re-Thinking the role of Urban In-Between Spaces
- viii. Kim, G. (2016). The Public Value of Urban Vacant Land: Social Responses and Ecological Value
- ix. <https://doi.org/10.3390/su8050486>
- x. Lee, S. J., Hwang, S., & Lee, D. (2015). Urban Voids: As a Chance for Sustainable Urban Design.
- xi. Filling an Urban Void by Catalysing Youth (2017)

Digital Tectonics With Brick As A Module

tanesh junawane

aayojan school of architecture and design, pune

email: tanesh77@gmail.com

Abstract: *This research paper talks about how a brick as a module is used for generating fluid or curvilinear forms through parametric design and parametric softwares. This research focuses on how brick as a module with various combinations and techniques can build and design parametric wall. The first part is about the shape grammar and design parametrically by use of understanding and inspiring from the forms of nature and building a parametric wall and its structural and construction techniques related to design using brick. The second part of the research is about designing it with computation method in which explorations are made in Rhino and Grasshopper software which goes in detail about projections of brick, its sizes and the porosity of the wall and the workflow for the same. By studying these aspects, comparative analysis of each aspects is done. The conclusion of the explorations is done by analyzing and comparing the scope and limitations of each exploration.*

Key words – Parametricism, Brick, Parametric Brick wall, Module, Shape Grammar, Rhino, Grasshopper.

INTRODUCTION

The bricks are used by man for building purpose for thousands of years. Bricks were first discovered in southern Turkey in 7000 BC which makes brick as one of the oldest materials. The evidence of this can be seen today at ruins of Harappa Buhen and Mohenjo-Daro civilizations.

The tradition started off as exposing the brick surfaces in the facades later to a technique that use the bricks as ornamental elements by glazing the surfaces of the material. There are two mainly methods of application of exposed bricks: the first is the earlier period examples where surfaces were built in the form of brickworks; and the second is the later period examples where surfaces were built in the form of brick claddings. The bricks are also used as load bearing walls, roofs, arches, buttresses, domes.

Bricks were also used in Roman Vaults, an arched structure, used as ceiling or canopy or as a support for the roof. Masonry walls are composed of wedge-shaped pieces called voussoiring, which are held in place by the pressure of the neighboring pieces. Two-barrel vaults that intersected at right angles formed a groin vault, which, when repeated in series, could span rectangular areas of unlimited length.

For learning how parametric forms are constructed, I started to research from the smaller scale and the smallest was the brick as a module which can be repeated to form curvilinear and free flowing forms. Brick can be also used to build curvilinear forms in a loadbearing way. Thus, the

process of designing and construction can be done by using computation tools and/or by using shape grammar.

USE OF SHAPE GRAMMER (DESIGNING WITHOUT SOFTWARES)

Bricks has many times used for contemporary architectures materials, because the quality and the cost are widely ranged. The brick is a good proportion and can be used as a tool or a scale. It is an expression of itself which is satisfying and allows multiple explorations. The size and its proportions express many forms when one brick as a module comes together. As brick is a great proportion, it can be designed and built in many ways like seating, furniture etc.

To achieve fluid and parametric shapes from brick, organic shapes are inspired by the algorithms of nature which are we surrounded by, for example, shape of banana tree and the banana which grows on it. It is a process of being in search of something and by not thinking about the final product and how to reach it and by just approaching it with the context, what is to be built, site analysis and playing and exploring with the forms. There are so many possibilities and just trying them of and working them functionally.

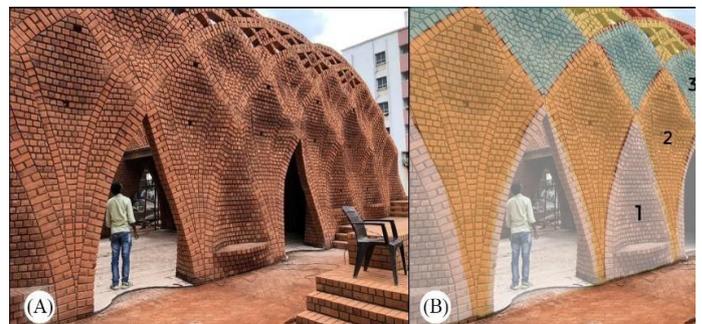


Figure 1 (A): Module of bricks repeated in grid format for a stable structure. (B) Different types of modules are highlighted and shown how they are placed in grid.

To create a module which can repeat itself to make the forms (Figure 1 (A): Module of bricks repeated in grid format for a stable structure. (B) Different types of modules are highlighted and shown how they are placed in grid). Use of geometrical systems. Brick is a module, creating a single module from this brick and repeating itself. By arranging this module in grid or fragmenting it. “Any ratio which is proportional is the golden ratio.” Fibonacci principle.

These brick walls are load bearing walls. First base is constructed according to the effective depth of the wall. Load bearing arches can be created for structural system as a module and then those modules of arches can be repeated.

These arches can be constructed according to the height and span ratio. As the arches have tension forces and the bricks take compression load, reinforcements can be done in the



Figure 2 (A) The grid is divided at the key of the arches, there are two grids of two separate module (Yellow and White). (B) The Reinforcement is done along the arches (Blue Lines) for the tensile forces.

arches for the tensile forces (Figure 2 (A) The grid is divided at the key of the arches, there are two grids of two separate module (Yellow and White). (B) The Reinforcement is done along the arches (Blue Lines) for the tensile forces.). The module can be repeated in grid fashion, for example, the span of the arch can be repeated in the similar manner or the key of the arches aligned in the grid (Figure 2 (A) The grid is divided at the key of the arches, there are two grids of two separate module (Yellow and White). (B) The Reinforcement is done along the arches (Blue Lines) for the tensile forces.). The module which is created can be manipulated a little and changes can be done according to the site condition and the context. But these changes should be very minor and should not be noticeable at the overall glance at the structure.

To understand the people which are going to contribute in this work like masons, contractors, labours, transporter and available material on site. By keeping these things in mind drawings and process are planned.

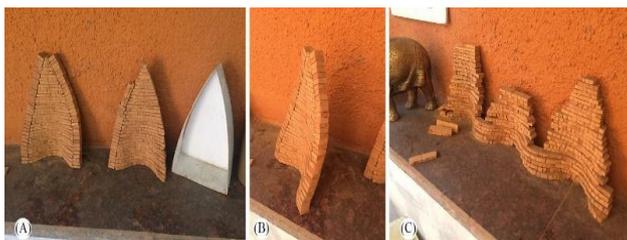


Figure 3 (A) Physical Model of the first module with its scaffolding model. (B) Physical Model of Module1 Arch. (C) Physical Model of the entire wall.

After the concept of being in search of something, basic idea is further proceeded by making on scale models, by arranging the bricks and shaping the bricks (Figure 3 (A) Physical Model of the first module with its scaffolding model. (B) Physical Model of Module1 Arch. (C) Physical Model of the entire wall.). Creating models in SketchUp for understanding of space. It is a TO and FRO process in which space is understood and changes are made. These changes can also be made during construction on site.

Shape grammar of laying of the bricks is, for constructing a curvilinear wall, the courses of wall are designed and drafted accordingly. According to the center of

curve for that course, the bricks can be cut into a tapered shape so that that curve can be achieved accordingly. For each course of bricks, it is repeated by keeping in mind about the curve in the section in similar time.

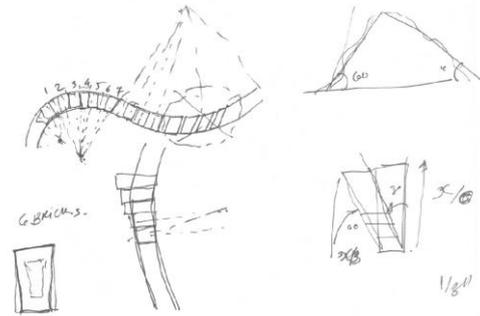


Figure 4 Sketch by the Architect Prasanna More, explaining the Shape Grammar of the Brick Wall.

The curve in the can also have a separate or a common central point. In section, the wall cannot be cantilevered or curved beyond the ratio of 1:3. (Figure 4 Sketch by the Architect Prasanna More, explaining the Shape Grammar of the Brick Wall.).

As the geometry is followed, there is the balance is the structure keeping the basic rules of compression and tension in mind, the module is designed. Before construction and after the final design. The mode is checked in the STAAD software whether it is structurally working or not, and after that it is given to the structural engineer for corrections and advice. Structural engineer will put his own values according to him and his thumb rules in STAAD which may change the design and the form. So, this process is done by the architect. Drawings of each course of bricks are made for the mason to understand and construct. After each 3-4 courses the form and the construction are checked on site, whether it is going according to the drawings or not.

COMPUTATION METHOD (EXPLORATIONS IN SOFTWARES)

In the 3D modelling softwares such as Rhinoceros and Grasshopper, fluid and curvilinear brick walls can be easily formed by using parameters to achieve that curve and the design. Three things were considered for designing:

1. The size of the brick, two cases were considered, constant size of brick 230x110x75 and customized bricks.
2. Projections of the bricks in subsequent courses.
3. The porosity of the wall which depends on the design, function and form of the wall.

Considering these things, explorations were made:

A. EXPLORATION 1:

A.01) Fluid Brick Wall Explorations:

Figure 6 One end straight, another end curve.

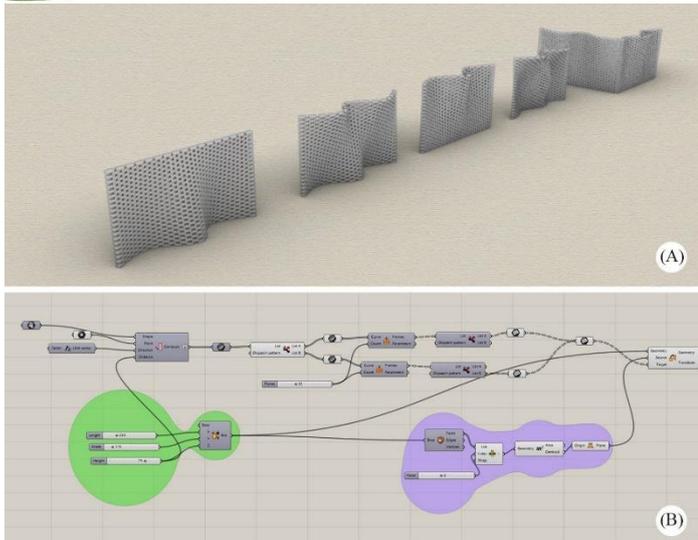
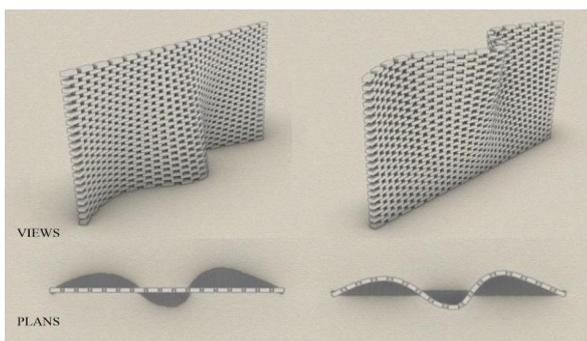


Figure 5 (A) Fluid Brick Wall Explorations. (B) Workflow for these explorations.

These options were explored by using the grasshopper (Figure 5 (A) Fluid Brick Wall Explorations.) A wall of 5m x 3m in elevation was designed of stretcher bond in curve. The second image shows the work flow of the output (Figure 5 (B) Workflow for these explorations.) where the curved surface is contoured in Z-Axis with the distance same as the height of brick between them. The highlighted green group is the dimensions of brick, 230 x 110 x 75 which is kept constant in this exploration. Further the X-Y planes on these contoured lines were placed which distance can be varied with the number of planes slider. These planes were dispatched for alternate courses (odd and even courses), after that it was further dispatched with the planes on those respective courses to get the alternate stacking of the brick. Further the bricks center was marked and then was oriented with the alternate planes. The number of planes slider can be adjusted to vary the spacing between the bricks which can be the design decision of making the bricks porous wall / screen wall or complete enclosed / solid wall.

According to this workflow, the followings options were explored by changing the curve surface and number of bricks if required for the porosity of the wall. This proves that if we set the parameters, we can get so many options within no time and exploration is more which is useful for the design in one way.

A.02) One end straight, another end curve:



In this option, the one end of the wall was kept straight and the other in curve (Figure 6 One end straight, another end curve.). The idea was to slowly convert the stretcher bond to curvilinear form. Here the first option is more stable because it gives a larger surface area at the base. These the brick projection was taken as H/4.

A.03) Curves inverted at bottom and top ends:

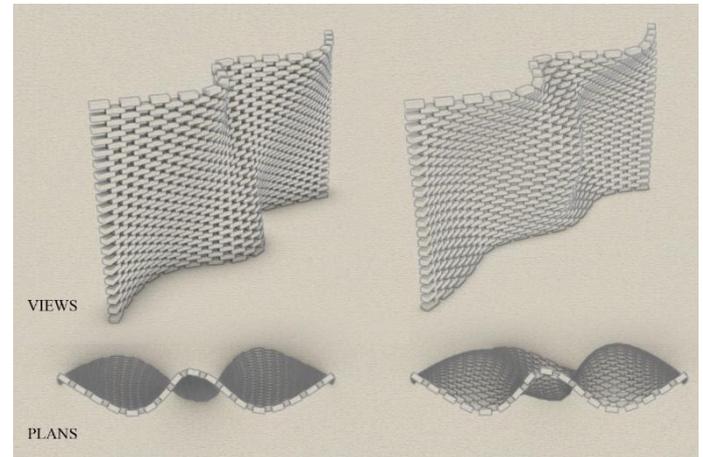


Figure 7 Curves of both the bottom and top ends of the wall are inverted.

In this option (Figure 7), the ends of the wall, top and bottom curves are inverted so that the center of gravity of the wall is maintained and it also gets larger surface area on the bottom. In the second option, it is same as first one, but one more curve is introduced in the center of the wall.

A.04) Corner Junction of Two Walls:

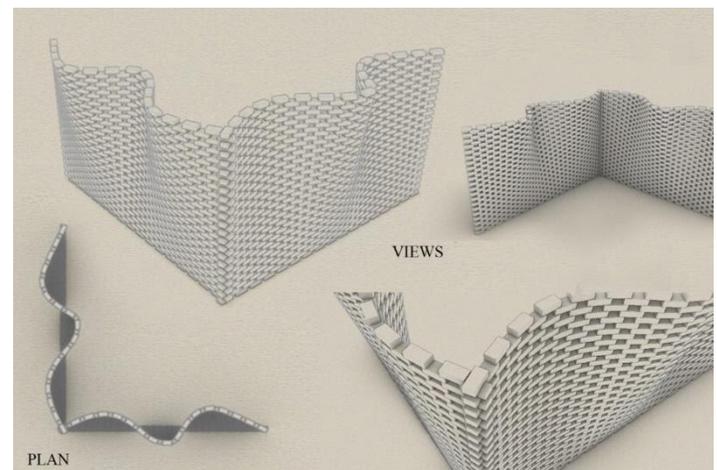


Figure 8 Corner Junction of Two Walls.

In this option, the corner junction is worked out, where the alternate brick courses are overlapped and cantilevered a bit. (Figure 8 Corner Junction of Two Walls.)

B. EXPLORATION 2:

These explorations are done by using Brick Design named plugin in Rhino, which allows to change the brick angle with the gradient in the frozen mode. The wall is of

5m x 3m and the bricks are kept constant of 230 x 110 x 75.

B.01) Parametric Wall using Gradient Curves:

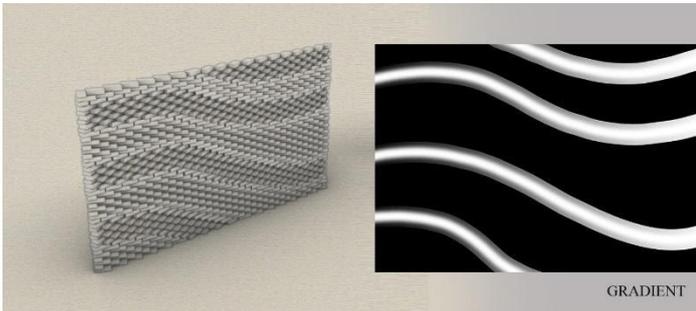


Figure 9 Parametric Wall using Gradient Curves.

In this option, the gradient image allows to change the projection geometry of the bricks. This allows the bricks in the gradient part to rotate, shift in X or Y Axis, roll, pitch. In this case the bricks are rotated at 30 degrees. (Figure 9 Parametric Wall using Gradient Curves.)

B.02) Effect of thickness of curves:

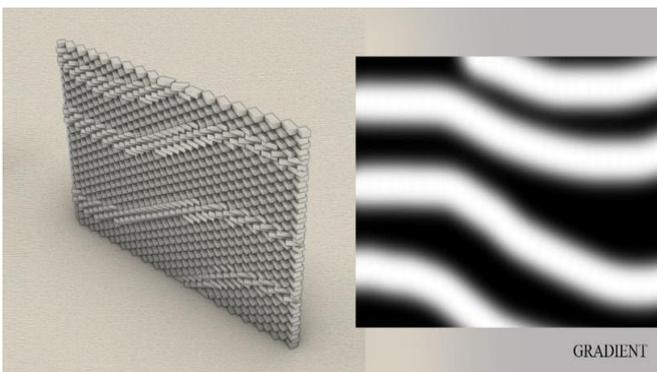


Figure 10 Effect of Thickness of Curves.

In this option, there is change in number of bricks when the thickness of the gradient is increased and the fade is increased. The bricks are rotated at 30 degrees. (Figure 10 Effect of Thickness of Curves.)

B.03) Effect by using Photograph Gradient:



Figure 11 Effect by using Photograph Gradient.

In this option, the photograph of that gradient can be projected or constructed using bricks to create such illusions or representations physically. (Figure 11 Effect by using Photograph Gradient.)

B.04) Effect of Bricks on Points:

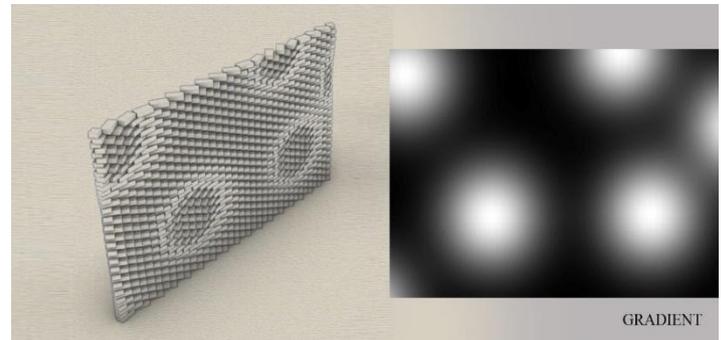


Figure 12 Effect of Bricks on Points.

This is similar to the previous one, but only points are marked on the wall for such pattern. (Figure 12 Effect of Bricks on Points.)

B.05) Effect of force Transformation on the Centre of the Brick Wall:

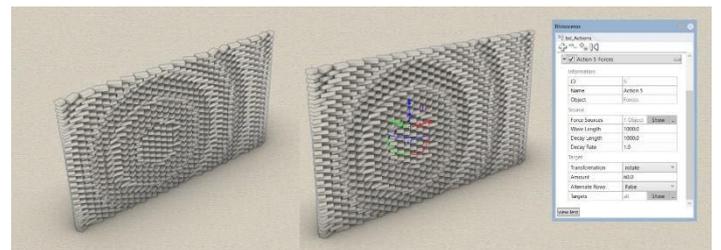


Figure 13 Effect of force Transformation on the Centre of the Brick Wall.

In this option, command forces are used to make the fluid wall, here, center point of the wall is the force source where the force is applied. We can also adjust the wavelength of the force and the transformation of the brick like rotating bricks, shifting the bricks in X or Y Axis, coloring, rolling of the bricks or pitching the bricks. (Figure 13 Effect of force Transformation on the Centre of the Brick Wall.)

C. EXPLORATION 3:

In this exploration, this fluid wall is non-porous at the junctions, and porous at the ends. The brick is not of constant size, the bricks are specially made or cut according to the design per courses. (Figure 14 Exploration 3). This wall is 12m x 4.5m in elevation.

This brick wall is supported by arches as you can see in the front elevation of the above image (Figure 14 Exploration 3 (Red Lines)). These are the arches which are supported on each other. These arches can be also reinforced for the tensional forces acting on the edge of arches in the same way as shown in the figure. There are three modules of courses which are repeated. The first one is orange one numbered as 1, this is normal arch on which the second one, green numbered 2 is supported on the key of number 1 module. Similar with number 3, blue module on the third course. In between the

arches, the wall is slightly curved inside with the courses of the bricks.

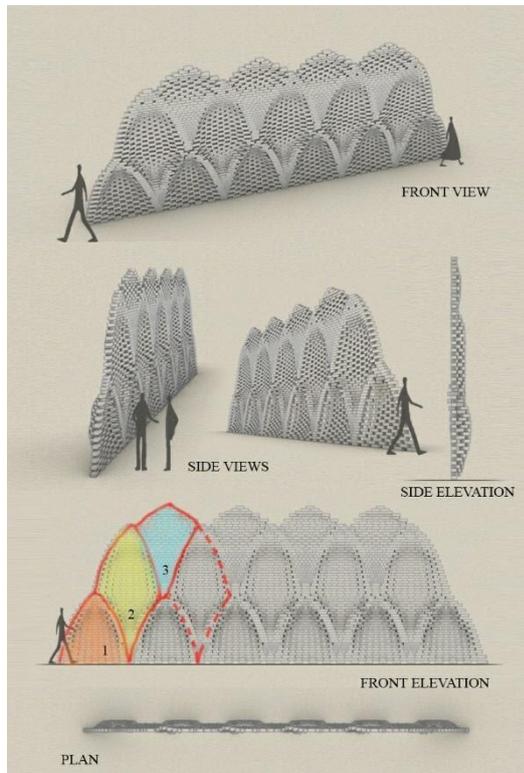


Figure 14 Exploration 3

surface was created in the rhino and with the control points this curve was achieved. where the curved surface is contoured in Z-Axis with the distance same as the height of brick between them. The highlighted green group is the dimensions of brick, 230 x 110 x 75 which is kept constant in this exploration. Further the X-Y planes on these contoured lines were placed which distance can be varied with the number of planes slider. These planes were dispatched for alternate courses (odd and even courses), after that it was further dispatched with the planes on those respective courses to get the alternate stacking of the brick. Further the bricks center was marked and then was oriented with the alternate planes. The number of planes slider can be adjusted to vary the spacing between the bricks which can be the design decision of making the bricks porous wall / screen wall or complete enclosed / solid wall. But as the curve in the arch is pointing and reducing, the spacing between the planes is reduces and bricks overlap over there, so this is worked out but cutting the bricks into customized brick and at those points the brick wall is not porous. In this way, modules are formed by the groups of grasshopper workflow respectively.

D. EXPLORATION 4:

In this exploration, the enclosed space is created where area of 6m x 6m is covered with fluid walls, this wall was created by spline at the bottom and same spline at the 3m, at the top of the wall, these two splines were lofted and then the same workflow was used for the brick distribution in a fluid surface, only the values of number of planes on which bricks will be oriented were change and the porosity was adjusted by changing the number of planes and distance between them. (Figure 16 Exploration 3.)

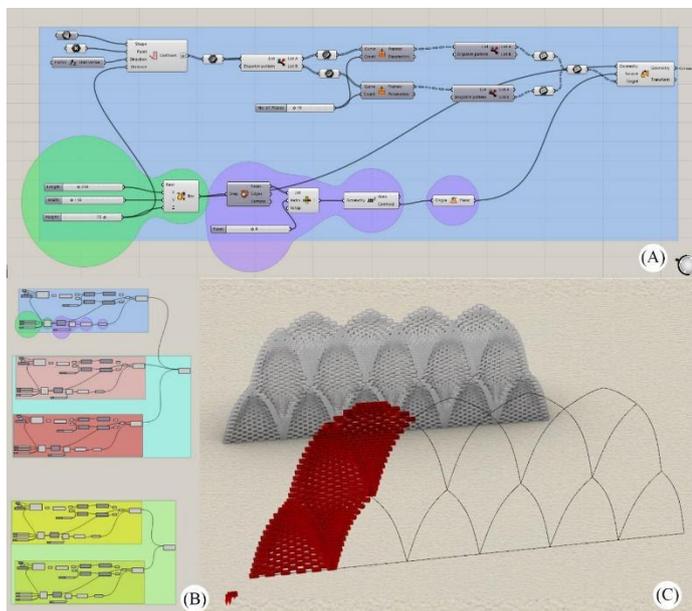


Figure 15 (A) Workflow of one module. (B) Overall workflow of all the modules. (C) Grasshopper output in Rhino.

In the above image (Figure 15), the workflow of the one module is given and it is similarly repeated for all the three modules (Figure 15 (A) Workflow of one module. (B) Overall workflow of all the modules. (C) Grasshopper output in Rhino.). The surface between the arches is slightly curved inside, this

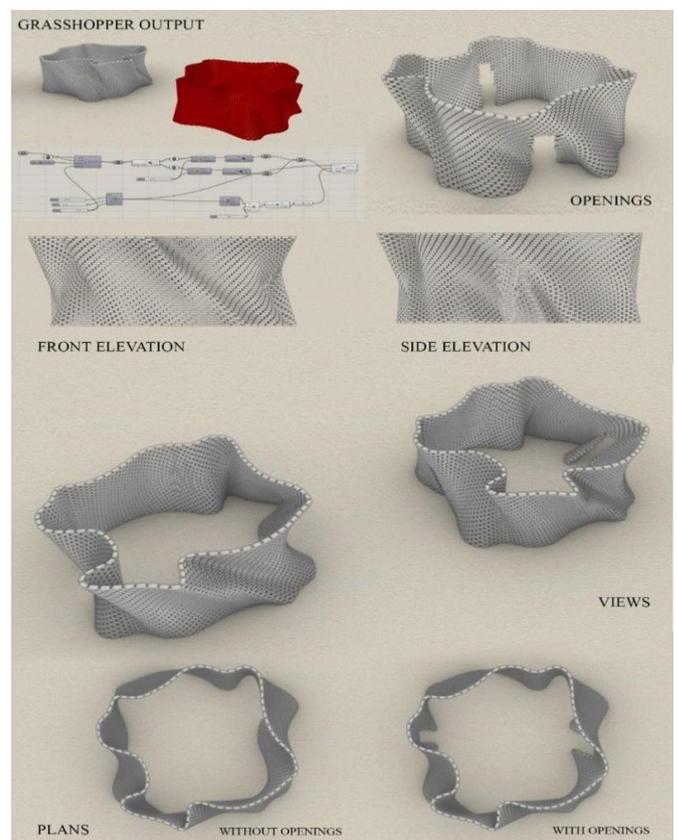


Figure 16 Exploration 3

ANALYSIS AND CONCLUSION

This table is about the analysis and conclusion of the common aspects of the Shape grammar and Computation method.

ASPECTS	K KLUB – Case Study (SHAPE GRAMMAR)	EXPLORATIONS (COMPUTATION METHOD)
1. Concept	Exploring various forms with brick as a module and responding with context and climate.	Form can be responding with the context and climate according to parameters given. So many possibilities in explorations.
2. Use of brick as a module	Creating modules with bricks and repeating them as a pattern in a grid format for a stable structure.	Modules of the brick can be created and repeated easily. The modules can be in grid format and can be also worked out without grid.
3. Design process	Get inspiration from the nature and explore forms by using brick as a module.	Inspirations from the nature can be accurately applied in softwares.
4. Structural	Designing in load-bearing structure by using arches or piers. It can be composite where reinforcement bars can be introduced. Loads are calculated in STAAD.	If there are structural parameters, we can give specific parameters and can design structure according to it.
5. Labour Intensive	Giving a thought about the labour, contractor, material transport etc.	The thought about people who are going to construct this might not be given because of crossing the limits of exploration of forms, specially of labour.
6. Time	The time consumed may	The time consumed is less

	be greater, because the details are to me done manually.	due to parameters feeded in the software by us. Quick and a greater number of outputs at the same time.
--	--	---

This table is about the conclusion of the explorations done with the scope and limitations of each exploration.

EXPLORATIONS	SCOPE	LIMITATIONS
A) Exploration 1 Grasshopper explorations on parametric brick wall using brick as a module.	Any fluid or curvilinear form can be designed. The porosity of the wall can be adjusted with the number of bricks silder in graasshopper, so we can make a complete enclosed wall or a screen wall. The loadbearing wall length can be increased by taking the most stable curves as shown in exploration. <i>(Figure 7 Curves of both the bottom and top ends of the wall are inverted.)</i>	As it is a load bearing wall, the projections of the bricks can go upto H/3, where H is the height of the wall. The porosity of the wall can be adjusted, but for the greater curvers or twists in the wall, if the wall is to be enclosed, gaps between two bricks may come, this can be filled with the special shape brick or mortar.
B) Exploration 2 Rhino, BrickDesign explorations using gradient design options.	Patterns using the gradient can be made. Brick can be tilted at any desired angle, twisted, shifted at X and Y-Axis. Any image converted into gradient can be projected with the bricks. <i>(Figure 11 Effect by</i>	Porosity of the brick wall may not be able to adjust by using this method.

	<i>using Photograph Gradient.)</i>	
C) Exploration 3 K Klub Parametric wall design by using Grasshopper and Rhino.	Introducing structural elements like an arch. The arch or any other form can be given an structural reinforcement for tentional forces and stability. Various types of modules can be formed and repeated.	Whole single brick cannot be used, special cut bricks are needed for each course.
D) Exploration 4 Parametric brick wall used to create enclosed spaces by using Grasshopper and Rhino.	Enclosed structure can be formed. The enclosed structure can be loadbearing itself and can give stability to itself by right curves at the base. Corner joints can be avoided.	The openings of the structre should be taken care of. The wall should not be too steep for openings.

REFERENCES

- i. *BKreative. (2017). Brick Architecture. Retrieved from The History of Bricks and Brickmaking: <https://brickarchitecture.com/about-brick/why-brick/the-history-of-bricks-brickmaking>*
- ii. *Bonwetsch, T., Fabio, D. K., Kohler, M., & Zurich, E. (n.d.). The Informed Wall, applying additive digital fabrication techniques on architecture.*
- iii. *Brick Architecture. (n.d.). Brick Architecture. Retrieved from Brick Architecture: <https://brickarchitecture.com/about-brick/why-brick/the-history-of-bricks-brickmaking>*
- iv. *Group, M. (9/26/2019). (RE)Thinking the Brick. Research, Harvard*
- v. *Indrawan, S. E., & Utomo, T. N. (n.d.). Alternatives Formation of Bricks.*
- vi. *More, A. P. (2020, January). PMA Madhushala. (T. Junawane, Interviewer)*
- vii. *Oliveira, R., & Sousa, J. P. (n.d.). Building Traditions with Digital Research.*
- viii. *Paper, S. a. (December 17, 2016). Parametrics and Parametricism. Space and Paper.*
- ix. *The Editors of Encyclopaedia Britannica. (1998, July 20). Encyclopedia Britannica. Retrieved from Encyclopedia Britannica: <https://www.britannica.com/technology/vault-architecture>*
- x. *YAVUZI, A. Ö., & SAĞIROĞLU, Ö. (2016). Reviewing the Bricks Used in The Traditional Architecture with The Shape Grammar Method. Ankara: ResearchGate.*
- xi. *Zurich, E. (2016, February). Mobile Robotic Brickwork. ResearchGate.*
- xii. *(Brick Architecture, n.d.) (The Editors of Encyclopaedia Britannica, 1998) (Indrawan & Utomo) (YAVUZI & SAĞIROĞLU, 2016) (Paper, December 17, 2016) (BKreative, 2017; Bonwetsch, Fabio, Kohler, & Zurich) (Group, 9/26/2019) (More, 2020)*

These forms explored have the possibilities and limitations as stated in the above table. So, the actual path can be selected or explored during designing. It all depends upon the design and the context; how porous the wall should be or how enclosed the wall should be or how screened the wall should be.

ACKNOWLEDGEMENT

I would like to record my appreciation to all people that involve in writing this report. I would like to thank my guide Ar. Sonal S Nirmal for her valuable guidance and encouragement. I would like to thank Ar. Prasanna Morey, PMA Madhushala for giving me time and sharing knowledge and guiding me about the design process of their firm.

Re-Design of Prison With Respect to Colors In A Therapeutic Manner- Exploring The Co-Relation Between Mind And Architecture.

Author 1 Author 2(Guide)

Tanisha Nair Nilesh Pore

D.Y. Patil School of Architecture, Pune Assistant Professor
tanisha26@gmail.com D.Y. Patil School of Architecture, Pune
nilesh@dypatilarch.com

ABSTRACT

Prison is a state of confinement or captivity. Many prisons have aggravated the purpose by making it an unlivable space. In India recidivism is at a peak hence it is often proposed to accommodate rehabilitation activities. This paper emphasizes on the possibilities and opportunities of creating a 'Catalyst Environment' with colors in the prison changing the outlook of the world by the inmates. The unpredictable human nature often needs a catalyst in order to have a positive life changing process where freedom, creativity, normalization and security could be explored. It is essential to consider prison as a rehabilitation center and creating a link with the psychology of the prisoners to architecture which can result in the betterment of their behavior and mind.

Keyword: **isolation, recidivism, colors, catalyst environment, rehabilitation, prison**

INTRODUCTION

Prison architecture reflects society's changing attitude towards crime. Often due to recidivism, the crime rates tend to increase at an alarming rate. With prison regarded as mere incarceration, it becomes difficult to tackle the vengeance and anger built within the inmates of the prison due to isolation. The fundamental right of a human being is the right to life or right to exist. If this right has to have a purpose and meaning in life then the lime light falls upon the mental health of the person. This possesses as a major concern one's psychology if deeply affected with surrounding of where they complete the punishment. Every prisoner is a human being, with the emotions of joy and sorrow, laughter and tears, hopes and aspirations as any other human being and should be treated with the same dignity, respect and decency as any other human being. Research shows that isolation breeds violence and anger; the more normalized environment is meant to encourage socialization. Certain modifications could be done such as incorporating colors in the cell units.

The very fact that a prisoner has been sentenced to imprisonment once already and has suffered enough physically, mentally and emotionally implies that he is not to be incarcerated through imprisonment once again. Treating prison as rehabilitation center surely doesn't entirely vanish the crime rates but a small difference could be made with such a simple treatment with colors. Colors and mind have a great sense of correlation. It creates a great impact in the minds and helps in initiating much healthier thoughts. Chromotherapy, sometimes called Colour therapy is an alternative medicine method that is considered pseudoscience. Chromotherapist claim to be able to use light in the form of colour to balance "energy" lacking from a person's body,

whether it be on physical, emotional, spiritual, or mental levels. Sense of space, time and emotions are taken to the extreme in colored environment. This therapy has various forms such as emitting colored lights, visual effects and also by just painting the walls with colors. Certain colors have been used to uplift the senses.

Designer Frank Manhke rightly observes that over the last century, several scientific studies, empirical observations and research have proven that the human experience of architectural environment is to a large extent based on our sensory perception of colour. These studies confirm that the human response to colour is total – it influences us psychologically and physiologically.

The general model of colour psychology relies on six basic principles:

- Colour can carry a specific meaning.
- Colour meaning is either based in learned meaning or biologically innate meaning.
- The perception of a colour causes evaluation automatically by the person perceiving.
- The evaluation process forces colour-motivated behaviour.
- Colour usually exerts its influence automatically.
- Colour meaning and effect has to do with context as well.

MATERIAL AND METHODOLOGY

The mind of the prisoners is complex and fragile hence an efficient way of dealing with them is indeed suggested. Architecture sends a silent message to everyone walking into any place. It tells you what to expect and where the limits of behaviour are. Prisons are the same. Design is crucial to creating an environment in which prisoners can live and not become institutionalised.

Some colours have a great impact on one by just looking at it for few minutes! That's the beauty of architecture and mind. Colour psychology suggests that different colours can have an impact on our moods, feelings, and even behaviours

- **Green** is balancing, natural, calm with the message of simplicity, security, balance. The colour green transmits a positive vibe and soothe. It enhances our perspective towards anything and everything. Green symbolises health and new beginning. A colour truly indulged.

- **Yellow** is the colour which signifies wisdom. Colours such Pastel yellow gives the impression of sunny, friendly, soft. The message in the interior space is stimulating, brightness, coziness. Yellow symbolises energy, spontaneity and hope. Often the sun is associated with hope because of the colour, hence imparting a great deal of aspiration
- **White** expresses open, vast, neutral and sterile. The message being purity, emptiness, indecisiveness. White is also described as cold, bland, and sterile. Rooms painted completely white can seem spacious, but empty and unfriendly.
- **Blue** makes you feel safe and relaxed. Blue evokes feelings of calmness and spirituality as well as security and trust. Seeing the colour blue causes the body to create chemicals that are calming.
- **Violet** exhibits Spiritual awareness, containment, vision, luxury, authenticity, truth, quality. One of the soothing colours that heightens deep contemplation and meditation.

THE DOMINANCE OF THE COLOUR PINK

The colour pink represents compassion, nurturing and love. It relates to unconditional love and understanding, and the giving and receiving of nurturing. The deeper the pink, the more passion and energy it exhibits. Pink is a non-threatening colour seeking appreciation, respect and admiration. The colour nurtures the sensitive side of your mind and is indeed a colour one needs to restore humanity. the dominance of the colour pink as a matter of fact very is important in our society as lost touch, wavered mind, and the absurd thought has overpowered our true self, hence reimpose of our naiveté is symbolised by pink. Pink can also remind you of earlier childhood memories, associated with nurturing and comfort from your mother or a mother figure.

Physical Effects-Pink has been definitively linked to toning down aggression, and its use in holding cells for violent criminals has been quite effective. Pink is such an effective mood regulator that too much of it can by physically draining. The pink colour in prison has not only shown success rate in controlling the aggression but also has made profound impact once they are released

CASE STUDY-

1. PROJECT BAKER -MILLER PINK- JAIL IN SWITZERLAND

The colour pink is thought to be a calming colour associated with love, kindness, and femininity. Prisons in Switzerland have been are being painted pink. Thirty cells have been painted pink in an attempt to calm down aggressive inmates. This project has shown a positive result in cooling down Psychologist Daniela Spath said: "Anger levels can reduce in as little as 15 minutes, though we usually confine a convict to a pink cell for two hours." In human psychology, we have come to connect the colour to femininity and its corresponding gender stereotypes: weakness, shyness and tranquility. The wardens were inspired by the results from a series of studies conducted by research scientist Alexander Schauss. he concocted a pink paint colour that he claimed could reduce the physical strength and aggressive tendencies of male inmates. Over the course of her four-year study,

prison guards reported less aggressive behaviour in prisoners who were placed in the pink cells.



2. JAILS IN INDIA- TIHAR JAIL



Tihar jail is situated in Delhi, India. The nation itself being greatly populated; crime rates are bound to occur at a larger scale. Hence accommodation comes in as a great issue. The jail is densely populated as on 31.12.2019 has increased by 11.79% in comparison to the population as on 31.12.2018. the jail has a no proper sanitation and does not provide a right to a humane treatment inside. the jail cells are not maintained hence recidivism becomes one of the main problems to tackle.

RESULT- COMPARATIVE ANALYSIS

After painting the walls pink in Switzerland, drastic changes were seen in the behavior of the prison inmates. It has made them much calmer, composed and corporative. Some inmates took the project 'cool down' in a negative manner as they felt they were in a little girl's bedroom. But apart from that pink color has proven its qualities in a greater manner.

Such overwhelming results are not seen in Tihar jail, as the this is a classic example of the present inhuman nature of society towards the prisoners. Tihar jail is considered to be known as a living hell and often who is locked up in this prison often returns to crime once they are released. Apart from the color pink, there are many options that could be effective such as green, blue and violet.

CONCLUSION

The conventional style of looking at a prison as a incarceration has been proven wrong and a new ray of hope has been given by the jails in Switzerland. Mind and architecture do go hand in hand. Colors provides a new perspective to all thus creating wonder around.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude to my guide Prof. Nilesh Pore for his valuable guidance, inspiration and encouragement and for supporting me at each step. His motivation and indulgence in this paper has helped me to reach my destination.

REFERNCES

- i) [Pink prisons in Switzerland to calm inmates \(telegraph.co.uk\)](http://telegraph.co.uk)
- ii) Christopher day (1999) *places of the soul*, second edition., London: architectural press.
- iii) *psychology, crime and law*,2015, vol.21, No.5
- iv) Psychology of Colour, Frank Mhanke article in Archinect, 2014
- v) https://www.researchgate.net/publication/227909589_A_study_of_colour_emotion_and_colour_preference_Part_I_Colour_emotions_for_single_colours
- vi) https://madoc.bib.uni-mannheim.de/48722/1/Genschow-Noll-W%C3%A4nke-Gersbach_Does%20Baker-Miller%20pink%20reduce_PsychCrimeLaw2015.pdf
- vii) russil durrant (2013) *introduction to criminal psychology*, first edition edn., london: routledge.
- viii) [Do colours really warp our behaviour? - BBC Future](#)
- ix) [Color Therapy - Which Colors Are Beneficial For You? \(aetherius.org\)](#)
- x) [INDIAN PRISON SYSTEM : CASE STUDY OF TIHAR JAIL – RESEARCHERS CLUB \(wordpress.com\)](#)

Retrofitting towards resilience.

(Strategies of resilient houses in Roha (Konkan).

Tanmay Jyoti Pramod Sawant

STES's Sinhgad College of Architecture, Pune - Fourth Year B.Arch.

4.tanmaysawant.14@gmail.com

Abstract - Tropical cyclone Nisaarg struck the coastal belt of Maharashtra in June 2020 and wreaked havoc, leaving severe damage to lifestyle. This paper picks up from Konkan's learning after cyclone, presents the various issues hindering the development of a cyclone-resilient housing stock, and proposes measures to address such. Ground data, obtained from field observations, included structural assessment of houses and informal interviews with home-owners. Pertinent information and demography, obtained and coupled with key informant interviews with relevant technical, and subsequently analyzed. The most evident gaps are economical inadequacies and limited professional help. This study, provides insights on the development of resilient housing for countries of similar context and a springboard towards housing resilience research in different contexts.

KEYWORDS - Retrofitting ; Konkan ; Cyclone ; Resilient ; Sustainability

INTRODUCTION

Amidst the Global Pandemic, earthquake, etc Konkan belt, Maharashtra witnessed one major natural calamity that was "Nisaarg cyclone" on June 2020. The experience post cyclone was devastating. It almost set back the lifestyle and earning of people for 10 years. People affected drastically were of the middle class level to those living below poverty line.

While the economic state of the nation took a back seat, it is the need of the hour to build resilient housing for all irrespective of their economic status. With agriculture as a primary occupation, post cyclone there were no sustainable mode of income. Expectedly, structures that sustained only minimal to moderate damage were rebuilt faster than units that were severely damaged. Repairs are costly, the construction industry is overburdened, and homeowners and landlords face difficulties in obtaining financing for repairs and reconstruction.

Disasters like earthquakes and flood cause enormous loss of lives and property in India frequently. However, during such events change or replacing particular element of houses can prove to be more durable, resilient & economic than reconstruction of damaged property. The shortcoming of vernacular houses can be analyzed with respect to their performance during events such as cyclone and flood and find elements that can be replaced to elements that can be structurally resilient in many aspects of impending disasters in regions distributed within the physiographic regions. Retrofits continues to contribute to the sustainability of residential houses by conserving resources.

The area of study in the research paper, Roha is situated 30 kilometers away from the sea was one of places severely affected. The paper not only studies the shortcoming of the houses in Roha town of Konkan belt but also tries to analyze the reason behind lack of implementation of retrofits. It also

provides justification to retrofit options which can be economic with help of experts' opinion.

LITERATURE REVIEW

There is a wide array of literature regarding vulnerability of structures to severe winds. Although few research suggest the more conventional alternatives to the structure and focusing on the cause of the damage and majorly focusing on the cost and how it can be catered. Like, a study for Making India's Coastal Infrastructure Climate - Resilient: Challenges and Opportunities [Aparna Roy, August 2019] found that knowledge and technology can be vital part in retrofit but involves innovative financing. However the researchers argue on the fact of improvement of the material and construction technologies keeping them more sustainable. While, Strategies For Enhanced Disaster Resistance Of Commonly Used Building Materials [Chintha Jaysinghe, January 2007] concludes that the introduction of cost effective and easy to adopt methods of enhanced disaster resistance will be the key to minimize losses of lives and damages to property while improving the sustainability of the built environments. These recent studies have begun to provide insight into retrofits on vernacular Konkan houses.

MATERIAL & METHODOLOGY

Data and other relevant information were obtained from on ground study of selected area. These data were reinforced with semi-structured interviews with key personnel from the professional practicing in same fields in the field. Field observations were gathered in Asthami area of Roha town, which is situated in northern side of town and was the hardest hit by the cyclone pertaining to large open spaces.

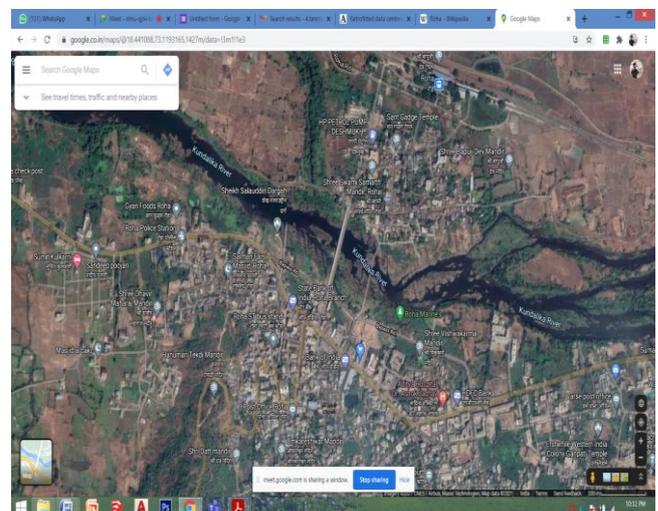
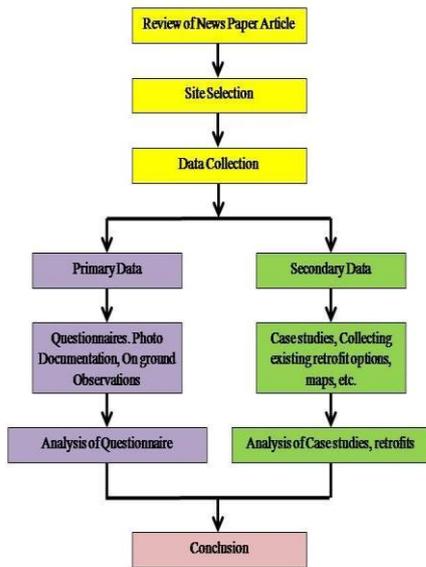


Figure no. 1.1



Flow Chart no. 1.2

RESULTS & TABLES

A. Analysis of Casestudies

Following is the tabular composition of the 5 houses selected from the study area of Asthami from Roha town. The parameters include the style of Architecture, age of the structure, their height and damage done to most vulnerable part of the structure during the cyclone.

Houses					
Style	Vernacular	Vernacular	Composite	Vernacular	Vernacular
Age	50 years above				
Height	G + 1	G + 1	G + 1	G + 1	G + 1
Damage					
Roof	Yes	Yes	Yes	Yes	Yes
Walls	Yes	Yes	Yes	Yes	No
Window/ Doors	Yes	Yes	No	No	No

Table no. 1.1

The conclusions from **Table no 1.1** are :

- i. The houses that were most affected were of Vernacular style with structural age of more than 50 years.
- ii. The most vulnerable part of the structure identified with respect to the cyclone was roof followed by the walls and then door & windows.

B. Interviews with Locals

Interviews of the people living in that area drew the following analysis :

- i. Few modifications were done in the span of 5 years due to heavy monsoons.
- ii. As shown in **figure 1.2**, larger section of people choose reconstruction.

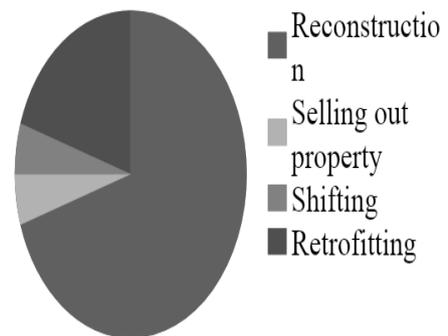


Figure 1.2

- iii. The monetary funds from the authorities do not cover the expenses of fixing of the damages.
- iv. Economical inadequacies & Lack of professional help were identified as prominent reasons while other reasons include little to no help from local bodies, etc. for choosing reconstruction over retrofitting, as shown in **Figure 1.3**

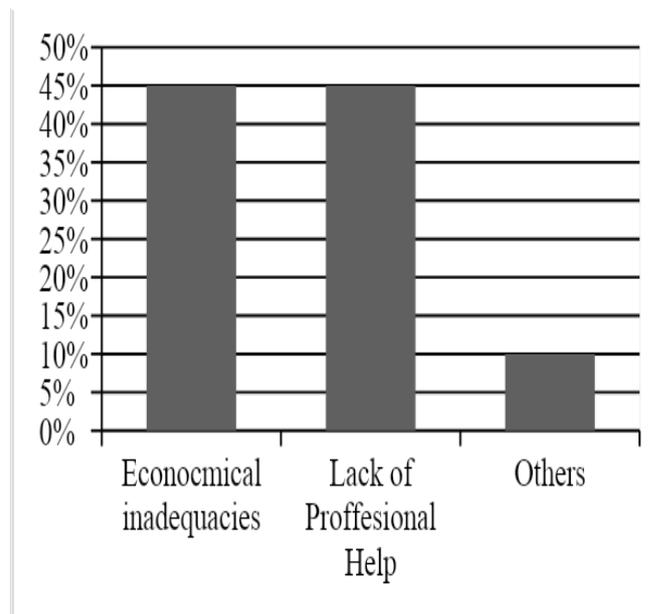


Figure 1.3

C. Interviews with Professional.

Interviews of the professional from the field concludes the following :

- i. Majority of professional identify Retrofitting as the long term solution described in

Figure 1.4.

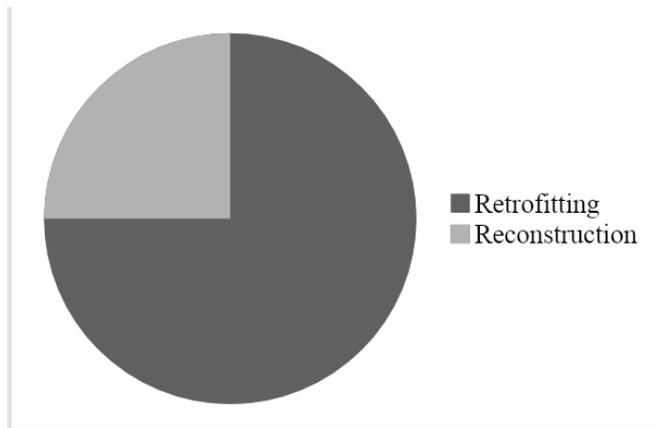


Figure 1.4

- ii. Combination of new technology & material with old technology & material proves better in the situation.
- iii. Economically, retrofitting is more feasible.
- iv. Estimation of retrofitting ranges between 10,000- 50,000 and can go beyond based on the extent of damages, **Figure 1.5**

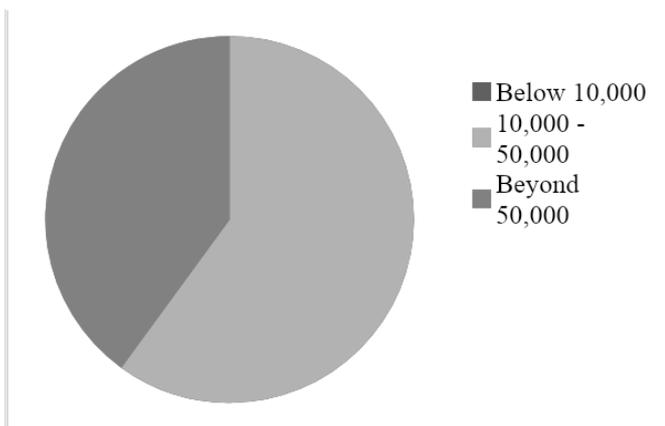
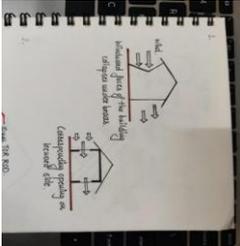
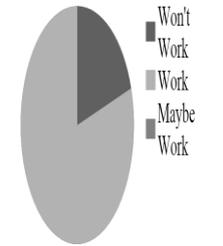
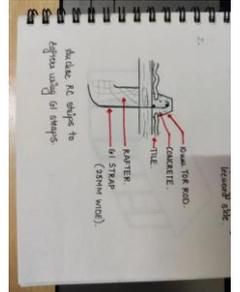
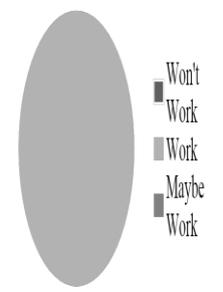
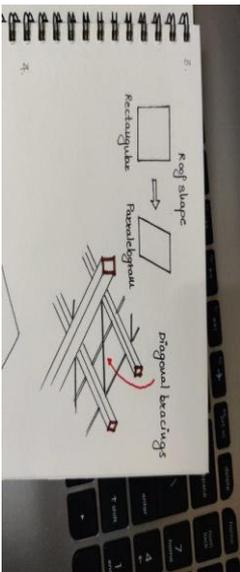
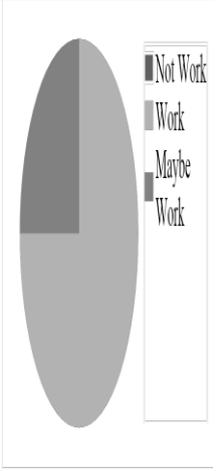


Figure 1.5

- v. The approach should be minimally invasive without diluting the original architectural character and performed only when necessary.
- vi. Retrofitting definitely increases the life of the structure. Ultimately it would protect the elements and the structure from future calamities, retain its character without major alterations or changes and economically benefit the residents as retrofitting would strengthen the structure hence cut down on expenses on repairs , damages etc.

D. Recommended retrofit options by professionals.
The pre-existed retrofits options were analyzed, studied and recommended considering the context, climate and structural need of the houses in the area.
Table no. 1.2 justifies those options with options of the experts in the field.

The suggested retrofit options, are economical and lending support to the most vulnerable parts of the structure during the cyclone reducing the chances of damage making structure resilient.

Element	Schematic sketches	Technical/Architect Opinion	Reasons
Windows - Corresponding Opening on the leeward sides			i. Creating positive load
Roofs - Anchoring roofing tiles, Extra support at end of gable wall			i. byelaws ii. It gives more strength and support. iii. Due to security purposes
Roofs - Diagonal bracings & Pitched roof, Roof Shape change			i. Depending on the extent of damage. Depending on the availability of the materials, use of modern materials as well. ii. Add more strength to

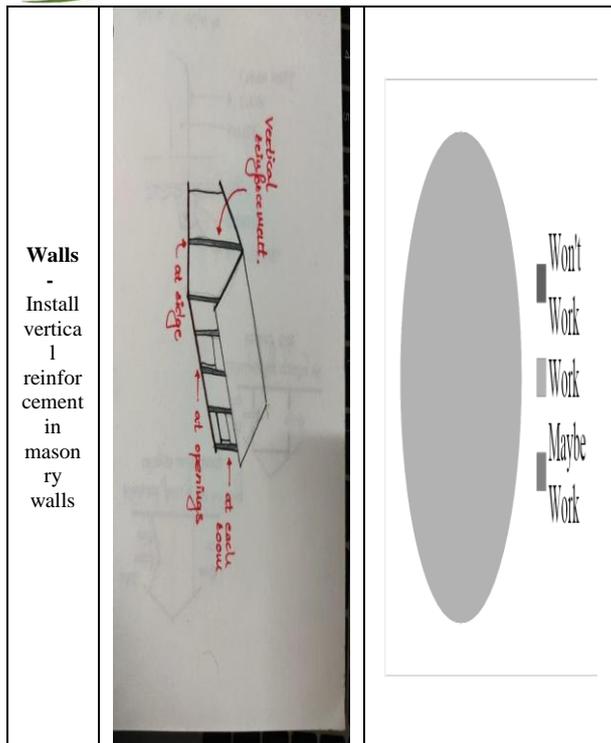


Table no 1.2

DISCUSSION

Secondary research suggests that need of involving new technologies and materials can be more economical whereas the original materials and style can be maintained with retrofits. The study shows that the retrofit options can be economical and have a greater impact on age & stability of structure too.

CONCLUSION

While TC Nisaarg had caused massive devastation in Konkan Belt, the knowledge base generated from such a disaster could be used to involve more retrofits in order for resilient houses. This study also provides basis for future studies regarding retrofits for housing resilience in similar context.

ACKNOWLEDGEMENT

This paper and the research behind it would not have been possible without the exceptional support of my supervisors, Ar. Chitale Ma'am, Ar. Kavathekar Ma'am & Ar. Devi Ma'am. I have deep sense of gratitude for their keen and unflinching indulgence which helped me to infer this work till conclusions.

REFERENCE

- i. A Agarwal, *Cyclone Resistant Building Architecture*, (2007).
- ii. Swati S. Nibhorakar et al (2015) "Advanced Retrofitting Methods and Techniques for RC Building: State of an Art", *IJRET*.
- iii. A Roy, *Making India's Coastal Infrastructure Climate - Resilient: Challenges and Opportunities*, August 2019.
- iv. C Jayshinge, *Strategies For Enhanced Disaster Resistance Of Commonly Used Building Materials*, January 2007.
- v. "Cyclone Fani caused loss of over Rs 9,000 crore in Odisha; 1.6 crore people affected," *Business Today*, June 7, 2019. Accessed on: June 15, 2019. <https://www.businesstoday.in/current/economy-politics/cyclone-fani-news-odisha-fani-cyclone-disaster-total-loss-due-to-cyclone-fani/story/354287.html>
- vi. *National Disaster Management Guidelines, Management of Cyclones*. National Disaster Management Authority, Government of India, 2008. Available at: <https://ndma.gov.in/images/guidelines/cyclones.pdf>
- vii. Anumita Roychowdhury, "Rebuild to tame cyclones," *Down to Earth*, May 06, 2019. Accessed June 02, 2016. <https://www.downtoearth.org.in/blog/natural-disasters/rebuild-to-tame-cyclones-64345>
- viii. Michael Mullan, "Climate-resilient Infrastructure," *OECD Environment Policy Paper No. 14*, 2018
- ix. Kellett, Jan, Alice Caravani, and Florence Pichon, "Financing disaster risk reduction," *Overseas Development Institute and Global Facility for Disaster Reduction and Recovery*(2013).
- x. *Asian Development Bank, Annual Report, ADB Sustainable infrastructure for future needs 2018*, <https://www.adb.org/sites/default/files/institutional-document/411996/adb-annual-report-2017bog.pdf>

Urban equity-Transforming Kumbharwada

Tejas Dipak Dholam, Snehal Gaikwad

Rachana Sansad's Academy of Architecture (Aided), Mumbai (2020-2021)

Emails: tejasd16@aoamumbai.in, snehalg@aoamumbai.in

ABSTRACT

Rapid urbanization has led to increase in deterioration of social fabric creating large fractures in the urban rich and poor. Poverty is one of the foremost problems and it disturbs social structure due to continuous overlooking. Cities with economic, cultural, environmental and political aspects create their own ethnic identity. Unequal distribution of the economy with multiple categories affects the social structure which causes a physical and visual barrier in the urban poor and wealthy class. The research aims to analyse urban poverty based on the social conflict theory and tries to reduce the gap and create equity in urban living.

Keywords: urban poor, social structure, socio-economic equity, community resources, Kumbharwada.

INTRODUCTION

With increasing population, competitions are getting harder and opportunities are getting faded. Research has demonstrated that economic and political inequality between ethnic groups appears to be a major contributing factor to political instability and conflict; the exact mechanisms behind this regularity have so far not been sufficiently probed.

Social conflict can have economic, political, cultural implications affecting the social environment and creating inequality in the society. Karl Marx's theory identifies these gaps in the rich and poor. People having low economy and limited resources are deprived resulting in class divide as lower class, middle class, higher class. This distinct classification redefines people according to their economic status. Intangibly this formed the Dominant group which had major wealth of the city and control of resources and Subordinate group which is middle or lower class group works under dominant group.

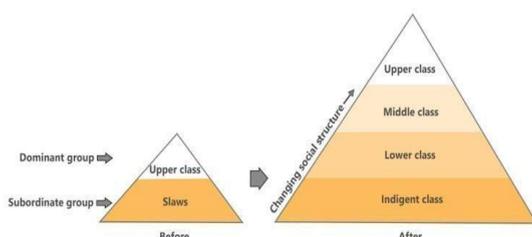


Figure 1: Transformed social structure; source: author

Struggle of this lower economic group is not only because of low income but also due to inaccessibility of resources. Despite having numerous challenges in living, this

class has managed to adapt in many possible ways at personal and community level.

Therefore by recognizing such groups and understanding their living and working pattern for their upliftment and to give equal rights is necessary for an equitable society.

Mumbai has experienced industrialization as well as deindustrialization resulting in increase in urban poor. Large scale impacts of industrialization during the colonial period resulted in a shift of local occupation to a more machine driven occupation which in turn led to migration towards the city. These city dwellers created settlements in and around the city - some formal (Chawls) and some informal (Slums). The trend continued post-independence right up to the new 21st century as cities continued to offer opportunities and livelihood.

As the density and scale of migration grew the living and working conditions of these urban poor started to deteriorate. Within the city these settlements have their social, economic and built character which further divides them into different ethnic groups. This culturally diverse population is a major impacting factor creating the identity of the region in the surrounding neighbourhood. This social conflict can be based on resource sharing, unequal economic growth, cultural issues in community, etc.

Urban poverty can be generalized as a low income group of people who have difficulty sustaining a healthy and comfortable life. Increasing urban poverty in the city may be fuelled by limited access to community resources. According to the type of resource it may be classified as people (leader of community, politician, etc.), physical structure, community service and business. Though all of this is important for making a stronger community, it is very difficult to identify resources and prioritizing it on the basis of community needs. These results in two segments occupying completely different physical and social spaces even as they share geographical territory, and hence it becomes the least homogeneous urban space.

In Mumbai, majority of the poor population cannot afford or rent suitable accommodation, and are compelled to live in illegal or informal settlements. Mumbai has a total population of 12.44 million— 42% of who live in slums (Wilson centre, March 3, 2016). These slums have their own pattern of living with respect to physical, economic and social aspects forming greater impact on the users and the city. Because of insufficient management and control, Mumbai is

housing is potential in economic, cultural, political and environmental aspects hampering the social progress of the city and leading towards social and environmental conflicts.

RESEARCH QUESTION

The brief analysis and review of literature of the social conflict of urban poor in Mumbai raised an enquiry for a better solution to improve the living conditions of the weaker economic group by creating affordable, inclusive and cohesive space.

The study focussed on deliberating on several issues of the current urban poor-factor such as community living, poverty, resources, economic distribution, role of governance and developmental policies.

NEED AND SIGNIFICANCE

Conflicts arise when the core issues are unaddressed or ignored and become the reason for the collapsing social structure. The people having skilled or unskilled work can be categorized in the formal and informal economy. It is therefore important to address the issues of the urban poor and raise their economic and living standards.

AIM & OBJECTIVE

The research aims to assess the reasons/causes for social conflict in weaker economic groups living in Mumbai and propose an integrated solution of housing and community development to improve the living conditions of the urban poor by identifying an area that acts as sample intervention to address the issue.

SCOPE & LIMITATIONS

Scope-

The study focuses on assessing the community's work live conditions and the existing urban policies. A target group of Kumbharwada's existing built, un-built and community spaces are reviewed.

Limitations-

Pandemic situation has limited continual access to the site, therefore data available through online sources are taken into consideration.

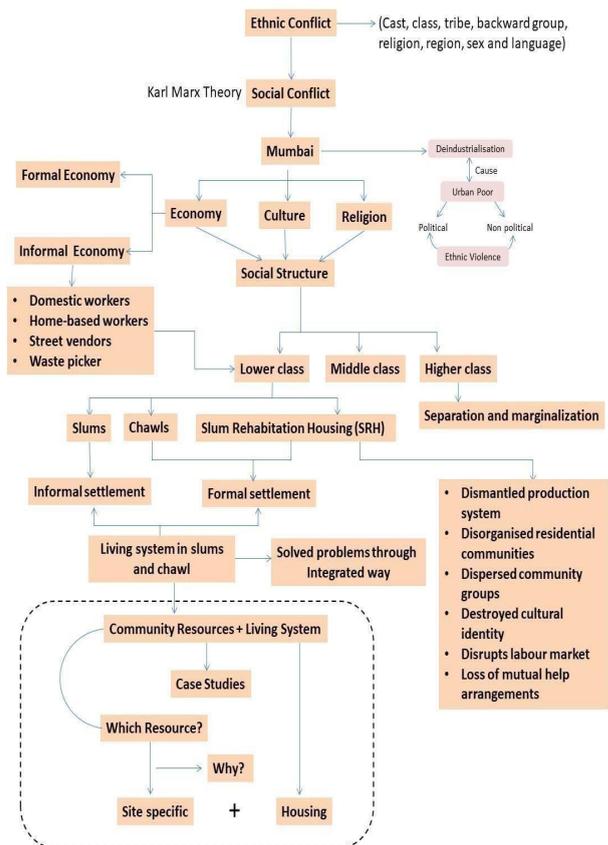
MATERIAL AND METHODOLOGY

The group of urban poor majorly comprises people migrated from nearby areas in search of better job opportunities, health, education, livelihood, etc.. They occupy these informal settlements within the city or at the fringes while allowing them better access to the city. The study it can be identified that:

- Opportunities in the urbanized city attract people from the surrounding, resulting in stresses on services, infrastructure, and resources of the city.

Housing and community resources are the most essential thing to survive in the city and poor areas suffered most for getting the basic needs.

- The disparity between this creates social stress on the social structural system of the city which leads to social conflict.



Flow chart 1: Research process; source: author

- Social conflict in urban poor plays an important role and if issues are not addressed in time, this will drastically affect the weaker economic group.

Kumbharwada, a community of migrants having specialized skills and contributing heavily to the local economy was selected as the focus of intervention after considering several areas of socially and economically deprived groups in Mumbai for further investigation. The research is done in six different stages, where every stage gives direction to make further research.

RESULTS & TABLES

KUMBHARWADA POTTERY COMMUNITY-

Kumbharwada, most dwelling units are used as home and production spaces. The neighbourhood is named after the community of potters, who migrated from India's northwest in the 19th century. Due to the lack of government initiative to improve the condition of the community, people of Kumbharwada have taken upon themselves to make the environment better. Kumbharwada's location, connectivity and its unique character has created a socio-economic buzz in the city acting like a magnet to prime developers as well as attracting local and international tourists.

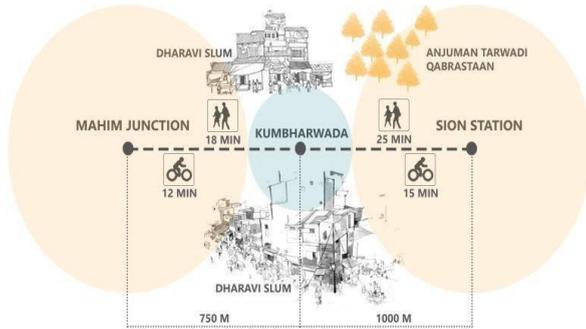


Figure 2: Kumbharwada connectivity mapping; source: author

INCREMENTAL GROWTH WITHIN LIMITED SPACE-

Kumbharwada pottery community is originally from Gujarat. They came to Mumbai in 1890 where they lived in the southern part of Mumbai. In 1933 the British government allocated land to this pottery community in Dharavi on a 999-year lease basis. Incremental growth in limited space resulted in low rise highly dense settlement. From 1933 we can see growth of Kumbharwada in the same boundary. Migration and natural increase (birth rate) are two main reasons for such kind of growth.



Figure 3: Incremental growth of Kumbharwada; source: author

OCCUPATIONAL CONFLICT-

Increasing footprint is creating many challenges of living in terms of density and occupation due to inaccessibility of enough raw material and resources and market for sale.

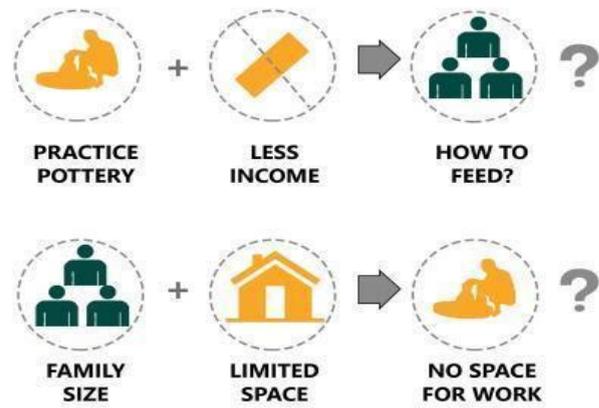


Figure 4: Occupational conflict; source:

SPATIAL CONTEXT-

- Settlement is highly compact and spaces are unorganized but making strong sense of their unique character. Closely packed houses allow living and work facilities within the household. Living areas comprising of multipurpose activities such as living, cooking sleeping spaces all integrated in one open space occupied by one family of 4/5/6 people including women, children and old. Work spaces are an extension of the living spaces. Sanitation facilities are common for a number of households located away from the housing units and shared by about 10/20 units. Unused spaces are usually used for dumping wastes and littering in common passages is observed. Lack of sanitary facilities and waste disposal leads to foul odour and unhygienic conditions. The community has less or no gathering spaces for social interaction leading to isolation and social conflicts.

- High levels of air pollution created due to the noxious smoke let out by the kilns which are closely located to their living areas affect the health of the community and surrounding areas.

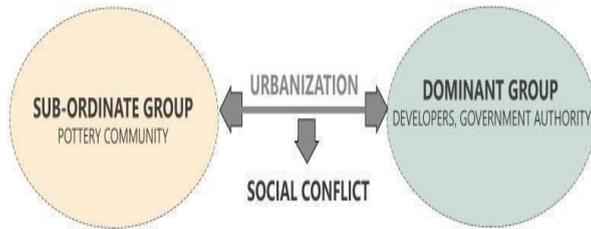
- Income generated through the sale of the products is seasonal and therefore unreliable and insufficient.



Figure 5: Occupational conflict; source: author

REDEVELOPMENT CONCERN-

For a socially just community it is necessary for all stakeholders - Kumbharwada community, private/public developers, and local government - concerning this area to reach a consensus and arrive at a sustainable and equitable solution.



Flow chart 2: Kumbharwada social conflict; source: author

PROPOSAL-

The research suggests a design proposal in ½ of the existing site. The remaining half is considered to be allocated for commercial development developed by private/public/government bodies. The study realises the importance of work live units for this specific community and proposes an improved incremental housing conditions with attached sanitation facilities. The intervention seeks to offer affordable units through sustainable solutions. Solar and electric Kilns are proposed to be located away from the housing units and would be shared by a group of housing units considering the health impacts created due to kilns in the vicinity. Community and gathering spaces to foster communal ties are proposed.

CONCLUSION

Urban poor suffer inequality of livelihood which proves the theory of social conflict and makes a bold reason for addressing such a grave issue. The study suggests an integrated and inclusive approach for sustainable and economic growth of a skilled community. Improvement in work and living conditions can not only boost the local economy and GDP but also ensure social health and cultural cohesiveness.

ACKNOWLEDGEMENT

I would like to express my gratitude to Professor Snehal Gaikwad for her constant motivation and critical guidance throughout the process of this dissertation and to give the right direction.

REFERENCES

- i. -Dr. Claudia ZingerII, Causes of and Solutions to Social Conflicts in Contexts of Weak Public Institutions or State Fragility from <http://www.r4d.c h/modules/social-conflicts>
- ii. -Sajid Ali Hashmi, Types of Ethnic Conflict, March 2018 from https://www.researchgate.net/publication/324039749_Type_s_of_Ethnic_Conflict
- iii. -Communal & Ethnic Conflicts in India, Nov 30, 2017 from <https://www.youtube.com/watch?v=oyjN0H2No7O&feature=youtu.be>

- iv. -Sociology for UPSC : ETHNICITY Based Social Stratification - Chapter 5 - Paper 1- Lecture 18, Sep 6, 2017 from <https://www.youtube.com/watch?v=bzQmhdOi1IE>
- v. -Rahul Bedi, India's 'obscene inequality' may lead to 'social collapse', reportsays, Jan 23, 2019, from <https://www.irishtimes.com/news/world/asia-pacific/indias-obscene-inequality-may-lead-to-social-collapse-report-says-1.3768314>
- vi. -Sandeep Ashar, Mumbai is India's city with the greatest inequalities, Nov 3,2009 from <https://www.dnaindia.com/mumbai/report-mumbai-is-india-s-city-withthe-greatest-inequalities-1306460>
- vii. -Yue Zhang, Building a Slum-Free Mumbai , March 3, 2016 from <https://www.wilsoncenter.org/article/building-slum-free-mumbai>
- viii. -Conflict Theory and Society, <https://courses.lumenlearning.com/alamosociology/chapter/reading-conflict-theory/>
- ix. -URBAN FUTURES, Dharavi redevelopment could create new paradigms in
- x. -Victor S. D'souza, SOCIO-CULTURAL MARGINALITY : A THEORY OFURBAN SLUMS AND POVERTY IN INDIA FROM <https://www.jstor.org/stable/23619350?read-now=1&refreqid=excelsior%3Ae8d560983e0b8d2370b3d54166d08c09&seq=1>
- xi. -Sumita chaudhari, Urban poor, economic opportunities and sustainable development through traditional knowledge and practices, 09 Jun 2015, <https://www.tandfonline.com/doi/full/10.1080/11287462.2015.1037141>
- xii. -Marco Degaetano, Mumbai: formal and informal equilibrium, Jan 26, 2012, https://issuu.com/degamarco/docs/thesis_final_print_small

Biomimicry in Architecture

A case of airport design

Tejasvini¹, Snehal Gaikwad²

Rachna Sansad's Academy of Architecture (Aided)

Email: tejasvini16@aoamumbai.in; snehalg@aoamumbai.in

Abstract - Built environment has a negative impact globally due to its increasing contribution to carbon footprint. One of the ways to tackle this is to integrate nature inspired solutions with built form i.e Biomimetic Architecture which has led to various significant innovations. The study aims at reviewing application of Biomimicry on an energy intensive architectural project. Case studies of various nature inspired architectural projects were conducted and the determinants identified were organism level, behavioral level and ecosystem level. These levels were analysed for form and shape, organisational structure and functioning systems. Of the different building typologies studied, it was inferred that Airports, world over, are the consumers of the highest per unit energy. The HVAC system and artificial lighting system are one of the major energy consumers of this building type. Proposed Airport terminal applies biomimicry principles inspired from animal burrows, through its design and operation, and aims to reduce energy consumption substantially by the designed built form.

Key words : Biomimicry principles, Biomimetic Architecture, Airports, Energy efficiency, Carbon footprint

INTRODUCTION

The two leading problems worldwide caused due to urban development are high carbon emission, making developing countries like India extremely vulnerable to climate change and high consumption of energy of buildings both during construction and in their operational stage.

According to the Carbon Brief profile of India, India is the world's third-largest emitter of greenhouse gases. In 2000, out of the total 2628 million tons of carbon dioxide(CO₂) emitted in India, 99 million tons of CO₂ emission was only from building construction which increased to 190 million tons out of the total of 3630 million tons in the year 2016. The CO₂ emission from construction increased rapidly from 3.7% of the total emission to 5.2%.

Concrete is the most widely and extensively used material and consists of water, aggregate and cement which acts as a binding material for the concrete. Cement industries generate a huge amount of CO₂ every year. According to the Carbon Brief profile of India, India is the second largest consumer of cement after China. In the year 2015, cement industries generated 2.8 billion tonnes of CO₂ which is around 8% of global carbon dioxide emission.

Heat waves caused due to increased temperatures as a result of carbon emissions lead to urban heat island effects. These are observed to have severe health impacts. The most vulnerable to these impacts are those who do not have access to basic energy services or cannot afford it; thus having socio-economic and environmental implications. Nature based solutions through green strategies and interventions can reduce these impacts substantially. Biomimicry is one such solution that can be integrated right from the initiation of the projects to its operation. Biomimicry is the science of taking

inspiration from nature- its models, system, mechanisms, aspects and components.

The concept of biomimicry, in the architectural field in India, is still at its developing stage. The evolution of this concept from imitating the macro element of nature (form from nature) to understanding the micro processes involved in the natural system, (the functional system of nature) has a potential of making a huge difference in application in architecture. Studies are being conducted on architectural products and materials inspired by nature; Self healing concrete, Bio-engineered bricks and Anti-smog facade are some of the many examples.

LITERATURE REVIEW

Janine M. Benyus, in her book, 'Biomimicry : Innovation Inspired by Nature explains the nine principles of biomimicry occurring in nature through interrelationship between sunlight and living organisms; Energy cycles of Nature; Form follows function; Nature recycles everything; Nature rewards cooperation; Diversity ensuring stability; Self healing through local resource management; Regeneration; Creating equilibrium and balance.

Biomimicry uses nature as a model for the solution of its various problems. To tackle the different design problems that exist not just in the field of architecture but in number of other fields too, a biomimicry design tool was developed which is called biomimicry design spiral which uses nature as a inspiration and helps in finding the solution for the various design problems caused in our day to day life. It has 6 stages, First to identify the problem, second to translate those problems into biological solutions, to find out the solution in terms of nature, as how nature is going to solve these problems, third search for models in nature that correspond to the design problem. Discover the strategies that nature uses to perform those functions then to translate those biological strategies discovered back into design elements. Develop those solutions and concepts by mimicking the appropriate element from nature and incorporate them in the architectural design problem, Lastly to compare the design solutions with the nine principles of biomimicry.

These stages can be adapted in a design problem with the help of two approaches: Problem based approach or challenge to biology approach and Solution based approach or biology to design approach. In the problem based approach, the problems, goals and parameters of the design are identified first and then search for the living organism that has solved the similar issues. This approach is effectively led by architects and this approach of designing involves the design spiral of biomimicry from top to bottom. In the solution based approach, the particular feature or behaviour in nature is

identified first and then its translated into a design solution which is also termed as biology to design approach. This approach of designing involves the design spiral of biomimicry from top to bottom

METHODOLOGY

Research highlights that the approach of biomimicry can be applied to an architectural design project at three levels such as organism level, behavioral level and ecosystem level.

Case Studies of various building designs based on the concept of biomimicry have shown a huge difference in their energy consumption and carbon emission. One of the examples for the same is CH2 building in Melbourne, the building's Carbon emission was reduced by 64% when compared to the existing building, electricity consumption by 85%, gas consumption by 87%, water mains supply by 72% and produced only 13% of the carbon emission. Biomimetic architecture helped the city of Lavasa in restoring their forest by reducing the soil erosion caused by the heavy rainfall and built form around the forest. Wuhan energy center in China is also one of the most successful biomimetic architectures. The inspiration of the Calla lily flower was taken and different elements of the flower were used to achieve a sustainable building. The shape of the building helps the building to provide its own shade in the hot summer. The roof of the flower that is the terrace of the building consists of solar panels for generating electricity. The Bowl formed at the top of the building acts as a rainwater collecting system. The central tower is inspired from the stigma of the flower which acts as a solar chimney which expels out the hot air from the building. Lyon Airport in France took inspiration from Human body for its structural system and used the shape of human eyes for the elevation of the airport which helped the airport to reduce the use of artificial lighting throughout the day.

East Gate Building in Zimbabwe, Sahara Forest project in Qatar, Milwaukee Art museum, Esplanade theatres in Singapore, Lotus Temple in India, City of arts and Science in Spain, Cactus building in Qatar, Eden project in England, Beijing National Stadium in China, HSB Turning Torso in Sweden, Taipei 101 in Taiwan, Swiss Re building in London, Beijing National Aquatic Center in China, Waterloo International railway terminal in Canada are some of the many examples of biomimetic architecture.

Identification of building typology for the application of Biomimicry was based on various factors affecting energy consumption in a building and maximum possibilities of application of principles of biomimicry.

During the study of various building typologies, it was found that Airports are the highest consumer of energy per unit area. According to the National Academies of Sciences, Engineering and Medicine small airport terminals consume approximately 597.1 kwh/sqm/year^[1] out of which Approximately 50% of the energy is consumed by HVAC systems, 40 % by artificial lighting and 10% by the other electrical appliances. HVAC systems represent a large amount of energy consumption in an airport terminal. Ahmedabad airport in Gujarat HVAC system is responsible for 66% of the

energy consumption in the terminal building, 80% in Izmir Adnan Menderes Airport in Turkey, 86% in Soekarno-Hatta International Airport in Indonesia.^[11]

The research investigates the potential application of biomimicry principles on an energy intensive project at the Airport aiming at reducing the energy consumption.

AIRPORTS

According to the Airport Authority of India (AAI) annual report of 2018-19, the number of domestic passengers increased by 13.1% over 2017-18 whereas 14.1% increase was recorded in aircraft movements. There are a total of 486 airports in India till 2018/19 out of which 137 airports are managed by the AAI. There are 123 domestic airports and 34 international airports in India and AAI manages 103 Domestic airports, 24 International airports, 10 custom airports and 26 civil enclaves in defense airfields. In May 2016, out of total 486 airports in India, 406 were un-served airports and only 70 were operational for civilians. However, with the implementation of UDAN-RCS, by Dec 2018, the number of operational airports has increased to 150 with regular flights. Many more new airports both international and domestic are coming up in the near future.

Airports are presently classified into 4 major types : Domestic airports which handle all the flights travelling within the country; International Airports which handle all the flights travelling between different countries, these airports have special immigration and cargo facilities for passengers; Custom airports which are airports specially dedicated to cargo facilities for loading and unloading of imported or exported goods and Civil enclaves or joints-use airports which are used for both civil aviation and military aviation.

Airports act as a catalyst within and between the countries. According to the Airport Authority of India the international aircraft movement is estimated to grow at the rate of 6% and the international passenger movement is estimated to grow at the rate of 7% for the next five years and the domestic aircraft movement is estimated to grow at the rate of 8% and domestic passenger movement at the rate of 10% for the next five years, the increasing air and passenger traffic demands growth in transportation facilities. Though the pace of increase in Airports is heartening and welcome, within Airports, world over, are one of the most energy consuming transportation centers.

DESIGN CONSIDERATIONS

Airports are one of the most essential and important transportation infrastructure of a country and the demand for new ones is ever increasing. The Airport planning has to be futuristic and should cater for all possible needs both for the airside as well as landside systems.

The layout of an airport is determined mainly by five factors:-

- The direction of winds
- The size and number of terminal building
- The ground transport system
- Mandatory clearance dimensions between aircrafts and buildings
- Topography and geology

The capacity of an airport is calculated using the following factors:-

- Peak hours activity
- Deplanement
- Enplanement
- Peak 20 min of the day

When these factors are not available EQA methodology can be used. EQA factor helps in determining the number of gates and for sizing the other components of the terminal building such as Ticket counter frontage, departure lounge, arrival lounge, baggage areas etc.

EQA methodology is based on aircraft movements as the primary generator of passenger movement. The magnitude of passenger flow depends on the aircraft seating capacities. This technique provides a common denominator for the calculation of capacities for the airport master planning. For calculation of EQA factor, EQA index is multiplied by the number of aircraft arriving and departing from that airport.

Table 2-1. Equivalent aircraft index.

FAA AIRPLANE DESIGN GROUP (ADG)	TYPICAL SEATS	TYPICAL AIRCRAFT	EQA INDEX
I Small Regional	25	Metro	0.2
II Medium Regional	50	SF340/CRJ	0.4
III Large Regional	75	DHC8/E175	0.5
III Narrowbody	145	A320/B377/MD80	1.0
IIIa B757 (winglets)	185	B757	1.3
IV Widebody	280	B767/MD11	1.9
V Jumbo	400	B747,777,787/A330,340	2.8
VI Super Jumbo	525	A380/B747-8	3.6

Fig 1. Equivalent Aircraft Index (ICAO)

Above all data must include likely increases in the future.

There are 5 common configurations for the concourse layout-Linear, Satellite, Midfield, Transporter and Finger or pier shaped concept. The transporter concept was taken forward for the proposed terminal design. This concept consists of a concourse which is remotely located and is disconnected from the main terminal building. The connection to the terminal building is provided by vehicular transport. One of the advantages of the transporter configuration is the flexibility of additional parking for the aircrafts in case of any change in aircraft schedules or if there is any kind of expansion that happens in the future.

The proposed airport terminal applies biomimicry principles inspired from underground animal burrows in the proposed airport terminal building. The entire terminal building is designed inside the ground keeping the whole airside area on the ground level. The thermal properties of the soil are considered in the design of the building keeping in mind the extreme climatic conditions of the Site. The soil stores energy during the warm season and releases it during the cold season which will help the structure to maintain the internal temperature, keeping the terminal building cool in summers and warm in winters leading to a gradual reduction in HVAC system requirements and hence it will reduce the energy consumption of the terminal building. The animal burrows always have another tunnel opening along with the main entrance which is known as an escape tunnel which is used for escaping the burrows in case of any emergency. The idea of

an escape tunnel is used as an inspiration for the fire exits of the terminal in case of an emergency. Other examples such as spider web for roofing and structural system, skins acting as breathable facades and passive lighting and ventilations are proposed. The project aims to facilitate waste water and solid waste management within the site going zero waste.

CONCLUSION

Application of Biomimicry in Airport Design can significantly reduce energy consumption and carbon emissions. It is therefore highly recommended that building professionals explore the nuances and technicalities of biomimicry to achieve sustainable buildings.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude to my Guide and mentor Professor Snehal Gaikwad for her able guidance and constant motivation.

REFERENCES

- i. http://www.trb.org/acrp/pages/airport_building_eui_chart_s_907.aspx
- ii. www.mdpi.com › pdf
- iii. <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/understand-metrics/what-energy>
- iv. Tavsan, Cengiz, Filiz Tavsan, and Elif Sonmez. 2015. "Biomimicry in Architectural Design Education." *Procedia - Social and Behavioral Sciences* 182: 489–96.
- v. Suresh Petkar, Sanket. 2014. "Environmental Impact Of Construction Materials And Practices." <https://www.researchgate.net/publication/290427381>.
- vi. Singh, Ankita, and Nidhi Nayyar. "Biomimicry-An Alternative Solution to Sustainable Buildings." *Number 2: 96–101*. <http://www.krishisanskriti.org/jceet.html>.
- vii. Milošević, Predrag. *PRINCIPLES OF BIOMIMICRY IN ARCHITECTURAL DESIGN TO ENHANCE THE SUSTAINABILITY Byzantine Theory of Architecture View Project Sustainable Architecture and Urban Planning View Project*. <https://www.researchgate.net/publication/332189237>.
- viii. Mckosky, Margaret. *Graphic Design + Biomimicry*. <http://scholarworks.rit.edu/theses>.
- ix. Mazur, Bartosz. 2019. "Review of Extravagant Projects by Santiago Calatrava." *In IOP Conference Series: Materials Science and Engineering*, Institute of Physics Publishing.
- x. Makram, Abeer, Tarek Abou Ouf, and Abou Ouf. *Biomimetic and Biophilic Design as an Approach to the Innovative Sustainable Architectural Design Architecture Design View Project Architecture & Urbanism... A Smart Outlook*. <https://www.researchgate.net/publication/336832615>.
- xi. Maglic, Michael J. 2012. *Biomimicry: Using Nature as a Model for Design*.
- xii. Abaeian, H, R Madani, and A Bahramian. 2016. "Ecosystem Biomimicry: A Way to Achieve Thermal Comfort in Architecture." *Int. J. Hum. Capital Urban Manage* 1(4): 267–78.
- xiii. Thompson, J. W. 1989. "Airport Planning." *Landscape Architecture* 79(5): 90–91.
- xiv. *Standards, International, Recommended Practices, International Civil Aviation, and Aerodrome Design*. 2013. *I Aerodromes*.

“Artificial Intelligence” In Architecture: Changing Patterns In Architectural Practices.

Author - Tungar Manas

Guide - Divya Mallavarapu, Coordinators - Dr. Vaidehi Lavand, Ar. Ramiya Gopalakrishnan
SMEF'S Brick School of Architecture, Pune
Email: tungarmanas@gmail.com

Abstract: *Considering the design philosophies and ideas of today's Architects it is important to develop tools that aid and help these designs to see the light of day. To cope up with the digital world, knowledge engineering has constantly been helping architecture through multiple platforms like Digital drawing tools, 3-d visualizers, render tools, structural modulators, etc. This has reduced a lot of workload as it has provided us with virtual spaces to shape an architect's imagination and test it to its limits. This research paper studies a sample group of 30 people aging from 20-80 years of age and records their views on how the digital world has affected them as an architect. These recordings were then analysed to determine what could be the future of such tools and their limitations in architecture. This paper helps us understand the need of Artificial Intelligence as well as its limitations in the architectural world.*

Keywords – Artificial Intelligence, Machine Learning, Digital Drawing Tools, Modern Design Philosophies, Architect's Existence.

INTRODUCTION

As Bill Gates said “First the machines will do a lot of jobs for us and not be super intelligent. That should be positive if we manage it well. A few decades after that tough, the intelligence is strong enough to be a concern.”

Tools used to enhance Architectural thinking, designing and conceptualization are an integral part of the Architectural that aid shape one's imagination. These tools include pen, pencil, paper, etc. As the world evolved and dawned into the days of technology every field needed to adapt to certain changes and evolve accordingly. As the architectural world started to cope with the digital world, a need for digital tool sets arose which Aided Architectural thinking. These systems helped architects shape their imagination in a virtual space. Starting with 2-d drafting tools which eventually reduced workload of manual drafting and the manpower needed to do the same. Then we moved to the 3-dimensional world where one could shape-demolish-reshape their designs. Here, the designer got not only a glimpse but a detailed vision of their designs. Clients could now see what their projects would look like even before it was cast into reality. This also reduced the need of molding scaled models in order to elaborate designs as we could visit the designs any time we want in the virtual space. With the 3-D visualizers virtual renderers, material testers, structural testers, climate analyzers, site analyzers also started to aid architects in understanding and shaping their design philosophies, elements in an analytical way. These tools and systems helped reduce man hours required to complete drawings, visualizations, improved clients interactions through better visual communication, helped Architects correct errors and identify them, The main objective of the paper is to understand the evolution of such tools in the architectural industry, their increased usability and the dependency of people on such systems. The paper also aims to

understand the advantages and disadvantages such systems pose to the architectural field in the upcoming future.

LITERATURE REVIEW

Till date, many researchers and programmers have tried to study and apply further development of digital aiding programs in the architecture and design world. This research continues even today as the digital world never stops expanding further.

As stated by authors Imdat As, Siddarth Pal and Prithwish Basu, in their paper Artificial intelligence in architecture: Generating conceptual design via deep learning (2018) tried to understand and apply a graph based machine learning system that deals with 3-dimensional space which is more structured, in order to generate a function-driven deep learning approach to generate conceptual design. They also explored the application of such systems to analyze the existing data and generate entirely new and unique designs based on this data. (imdat As, Siddarth Pal, Pritjwish Basu, 2018)

After the research was complete, they concluded that the new designs generated through the systems however unique were still limited to a particular amount of permutations and combination of the data provided to the system.

While publishing their paper on Artificial intelligence Aided Architectural Design (2018) authors Jan Cudzik and Kacper Radziszewski, studied the influence the design tools have on architectural designs. They also tried to implement Artificial Intelligence algorithms like swarm intelligence, neural network and evolutionary algorithms to simplify an architect's daily work. Such application of intelligence systems would eventually aid Architects with more intuitive and easy to use design tools and simplify their lives.(Jan Cudzik, Kacper Radziszewski, 2018)

The authors concluded that contemporary architecture did not only need systems that were subsidiary to the drawing board but also programs that were self-understanding and self-learning to some extent. A system capable of learning through a pattern of one particular person, in this case an architect and providing them with design solutions matching with their philosophies is a good example of the outline of tools talked about in the research.

METHODOLOGY

As the research progressed methodology was adopted as a survey in order to review the ideology and view of a particular sample group towards such technologies and their advancement. This sample space particularly consisted of people of ages 20-80 years. The sample space selected was very crucial as the aspect of introduction of people to such

technology was of the utmost importance. For these mainly 3 types of sample groups were studied.

1. The architects practicing in this area from a time when the technology was very rare and newly introduced and they could have had a hard time adapting to such evolutions.
2. The generation of architects who were introduced to such systems in their early practice ages.
3. The new generation who have been surrounded and have grown up along with such technology.

Such a spectrum of ages provided a variety of responses and perspectives when subjected to questions depending on 5 parameters particularly:

a. Visualisation

In terms of visualisation questions were framed in order to determine people's preferred design tools and design methods while comparing virtual/digital tools on one side and manual tool sets on the other. The concentrated group was asked to choose between the two methods as their method of designing and representation.

b. Manpower

Next the group was directed to a set of questions which would determine what they think about the change in the manpower that has taken place over the period of time as the technology advanced. This was done in order to determine the number of people required to complete a particular architectural task.

c. Workload

Some questions were also directed towards workload and the frequency at which it has changed. These questions would eventually provide data which would tell us about the intensity of work that was executed by one person and the change that has taken place in the same area. The ease that these design tools provides is directly proportional to the workload that one person has to bear and the amount of time the person takes to do so.

d. Job profiles

As the world has changed so have the job profiles in every field. Same goes for the architectural field. As architects were introduced to new tools there was a need of people specialized in using such tools and understanding them. Such systems also made some jobs faster and without any manual help which eventually led to discarding of some job profiles. The subject group was also challenged to answer questions which would determine the past and the future of such job profiles.

e. Design Satisfaction

One really important aspect while studying such artificial systems is the human sensibility of understanding emotions, apt identification of the requirements for the client. When provided with a choice of artificial design and a human design what a person would choose is also an interesting concept. The preference that people would give to artificial design systems over humans was also recorded in this paper.

The Future

The perspective of people regarding such self-learning systems was also recorded as a means to find the view that they have on the technologies and what they think is the past

the present and the future of such artificial intelligence architectural systems

All of the questions in the survey were presented particularly to judge the impact of these systems on the architects and also see how it has shaped the field in the past, the present and how it will keep doing so in the future.

DATA COLLECTION AND ANALYSIS

The data generated after the surveys were done, reflected that there was no major difference in opinion considering the age groups, included in the sample space. There was a conclusive unanimity in the results.

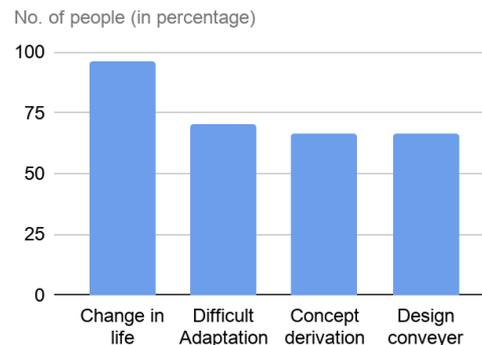


IMAGE 1.1

If we look at the graph (image 1.1) we observe that there is unanimity in thoughts no matter what age group the people who took the survey belonged to. No matter how difficult it would have been for people to adapt to such technological advancement; it shows that these tools have made their jobs a lot easier now. The new tool set is easy to use and design friendly. The availability of such tools has also largely affected the professionals. It has brought drastic change and even if people don't wish to upgrade, adapting to such tools has become a necessity in today's world.

But no matter how advanced or easy the tool set, it is noticed that the group still prefers to use manual tools like pencil and paper to conceptualize, abstract, design and represent their ideas. In the present day, these digital tools still pose limitations and can rarely come close to what a human hand and mind co-ordination can translate on paper.

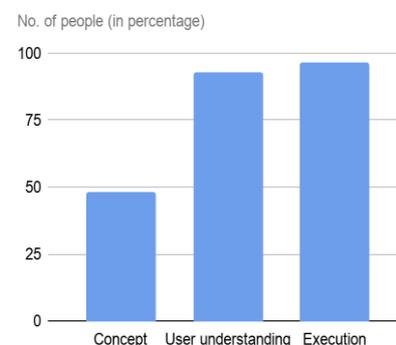


IMAGE 1.2

While measuring the change in quality of work output, the defined parameters were concept abstraction, user understanding and execution (image 1.2). It can be definitely concluded that the systems excel at user understanding and execution processes. The new found data with the help of such digital tools is quite helpful in terms of understanding. These outputs have helped not only architects but also engineers,

clients and construction workers to easily conceive the design and build accordingly.

However, 53% of the sample group thinks that the tool set is a little restrictive when it comes to concept quality, which shows how dependent we are on the human mind to contemplate and execute conceptual parameters of design

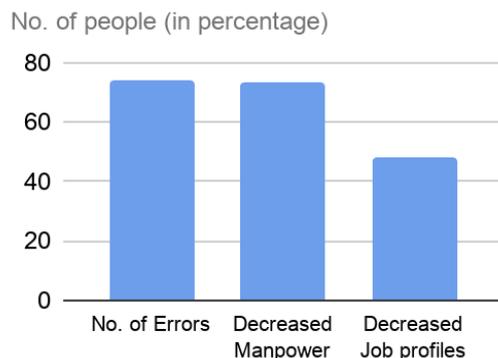


IMAGE 1.3

One of the major factors affecting design and time consumption is the workload and manpower required to execute the idea. Referring to chart (image 1.3) we can say as the virtual revolution has started, however the workload has increased but this is rather a side effect of the technology. The software systems are able to understand data and provide analysis based on it. Therefore, the manpower needed to execute the same analysis manually has been reduced. This has opened up spots for individuals to accept multiple tasks at one time and execute them simultaneously. As manpower has been replaced by artificial networking, the amount of errors has also decreased drastically.

However, this has adversely affected the job profiles that are non-existent today. As we talk to experienced architects they tell us the importance of draftsmen, site surveyors, climate consultants and scaled model makers in their days and age which have been partly replaced today by software like AutoCAD, Revit, Rhino, Grasshopper, Lumion, ArchiCAD, Depthmapx, etc.. This raises a major concern towards the jobs/ profiles that are at the threshold of existence today.

Do you think that self learning self designing artificial architectural programme could exist? If yes how long do you think it will take for such technology to appear in reality?
27 responses

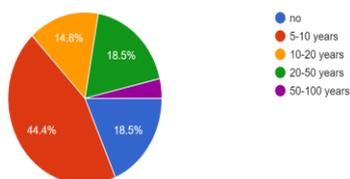


IMAGE 1.4

The readings (image 1.4) clearly indicate that we are not far away from artificial intelligence which would be capable of providing humans with full-fledged project designs based on the parameters and data input. We are certainly moving at an exponential rate while approaching this technology. However, the access to such technology would be restricted first, but will eventually reach the markets and the

common man. Does this mean that the whole architectural world is at the brink of extinction?

When asked for preference, if such technology existed today a larger amount of the group still preferred a human instead of a computer. The major reason was the capability of -"The Human Mind".

3.1 The human Mind

However complex the artificial intelligence system, it is still dependent on the input and data and is always limited to the combinations of it. The system does not possess its own independent mind to provide solutions. There is a reason why people would still prefer humans over machines. No machine can match the way in which a Human mind works,,interprets, memories or emotions , links a feeling with a space and that is the biggest drawback of these tools. The output, hence generated will always have an artificial touch to it. The designs should be user centric and comfortable. These kinds of emotions can only be understood by a person. The innovative limitlessness a human brain possesses could never be programmed into software. Even if developed, the system would still require an architect to understand and fill in the data.

CONCLUSION

While the literature review and the survey data suggest that the evolution of artificial intelligence has been rapid in the architectural field and it has adversely affected and reduced employment in the area of study.

"So is the architect heading to an end?"

According to the survey - The architect's profession doesn't feel endangered by AI yet and treats them purely as digital tools. The same survey also suggests that the network system can never possess the most valued concept of the design world that is the emotional touch. The system will always be limited in one or the other way and would always need human help to upgrade. What the intelligence can design can always be a house but it might never be able to turn it into a home.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude towards my guide and coordinators who have been helping throughout the research in any way possible and their constant encouragement. They never let my spirits down and also helped me reach a maximum sample size. Without their support I wouldn't have been able to conduct and complete such detailed research in every sense possible.

REFERENCES

- i. As. I, Pal. S, Basu. P (2018) *Artificial intelligence in architecture: Generating conceptual design via deep learning*, West Hartford, CT, USA. SAGE
- ii. Maleb J. Ma w. (2019) *Artificial Intelligence in Architecture General Understanding And Prospective Studies*, Shanghai China. (S.J.T University)
- iii. Attar M. A. T (1997) *Application of artificial intelligence in architectural design*, Cairo, Egypt. Al-Azhar University.



- iv. *Quessny Y. A (1987) The impact of introducing artificial intelligence technology to architecture and its leverage on the concept of design automation, Cairo, Egypt. Cairo University.*
- v. *Chaillou S. (2019) AI & Architecture An Experimental Perspective, Cambridge, England. Harvard Graduate School of Design.*
- vi. *J. Cudzik, k. Radziszewski (2018) Artificial intelligence aided architectural design, Gdansk, Poland. Gdansk University of Technology.*

Utilization of Raw Waste Materials from Industry

Author – Ms. Utkarsha Pardeshi (4th Year C div) Co-author- Prof. Mahesh Bangad, Assistant Professor,

Dr. B. N. College of architecture, pune Dr. Bhanuben Nanavati College of Architecture, Pune. Email-
pardeshiutkarsha21@gmail.com , mahesh.bangad@bnca.ac.in

Abstract : The material industries use valuable natural resources for the purpose of manufacturing materials for construction, eventually which are generating solid waste. The industrial system often use the way of dumping the waste into open field. These activities will pose serious detrimental effects on environment. Because of the high demand, the cost of construction materials is also increasing day by day. Therefore, utilising raw materials will be the key to preserve the natural resources. It will also control bad influence on the environment. The research will provide the specific raw materials such as red mud waste of aluminium industries, natural fibre and polymer and analyse their strength, durability as compare to regular materials. The result will show the application of these new materials and the benefits of the utilisation experiment.

Key words- construction materials, environment, utilisation, raw waste materials, red mud, polymer, fibre

Introduction-

As a consequence of the technology and global population growth, the environment is being seriously damaged by different types of waste. The various industries producing large amount of waste and these solid waste are being disposed. Concern about the environmental deterioration is leading to design strategies to remedy the damage caused to some extent, which seek to generate in the population an ecological awareness, aimed at the reduction of utilising of materials that can be reprocessed and the reuse of waste materials before proceeding to final disposal. The use of raw waste materials for the creation of materials to use in the construction area is a topical issue with a promising future and primarily aimed at environmental preservation, but the high production costs of these are leading to develop research aimed at developing composite product that utilised materials.

For the research paper the chosen materials are red mud (from aluminium industries), polymer and natural fibre. The red mud is a by-product arising from caustic, leaching of bauxite during the production of industrial alumina. About 1-2 tons of red mud residues are produced for each ton of alumina and millions of tons of red mud have hitherto been accumulated with most of them being stored or released to the sea. Storage of red mud poses serious environmental issues due to the high alkalinity leading to soil alkalization and water pollution. Red mud is also used as a reinforcing phase in polymeric waste materials. The second raw material is polymer- red mud is incorporated into polymer to improve the mechanical and thermal properties. Our results are positive suggesting an effective way to utilise red mud and alleviate

environment impact. The third raw waste material is natural fibre such as jute, hemp or sisal. The research based on composite of natural fibre reinforced polymer says that Natural fibre reinforced composite is very much essential for its application as a construction material. The main characteristics of natural fibres are low energy consumption, low density, no-abrasive nature, low cost, renewability, biodegradability, easy availability. Although plant fibres are normally rigid, unlike brittle synthetic fibres, they are not fractured during process. The properties of these raw waste materials will increase the strength of the final material. The materials will be as useful as regular materials.

Methodology-

To perform this utilisation experiment, there are some raw materials having good chemical and physical properties have been searched. There are some other experiments on composite of these raw materials which investigated their reaction with each other and physical state of composition. After analysing the research of the properties of these raw waste materials, the experiment is as follows and the material resources are given below,

Materials	Resources
Red mud	Aluminium factories
polymer	epoxy resin
Natural fibre	hemp

The main raw waste material is red mud preferably known as bauxite residue, is an industrial waste generated during the processing of bauxite into alumina using the Bayer process. Due to this high level of production and the materials high alkalinity, it can pose a significant environmental hazard and storage problem. Several studies have been conducted to develop uses of red mud. Red mud used in the production of cement, road construction. The second raw material in mixture is natural fibre hemp. Hemp is a variety of the Cannabis sativa plant species that is grown specifically for industrial use. Hemp is one of the fastest growing plant on earth and it was also one of the first plant to be spun into usable fibre 50,000 years ago. It can be refined into a variety of commercial items as plastic, paint. Another important component is epoxy resin. It also known as Poly epoxide, are class of reactive polymers. Epoxies are known for their

excellent adhesion, chemical and heat resistance and very good electrical insulating properties.

To perform the experiment, collect the raw waste materials from these resources. For red mud, the consistency should be smooth, thin enough and light textured.



The mould of brick or any size of mould can use as a container for composite. Firstly mix the epoxy resin with red mud. Epoxy resin has a beneficial influence on the shear strength of red mud. Then add natural hemp fibre in mixture. Mix it well and infuse it in mould. Keep aside that moulded mixture for 2-3 hours. Then remove the mould and product will be ready.

Result-

The product obtained from experiment has many application which are given in table below,

Final product	Application
Rectangular block	Wall masonry, interior exposed brick wall, paving
Tiles	Interior Flooring, parking flooring
Corrugated sheet	roofing

Since, utilised raw waste materials are having good capability that the achieved product will be as strong as regular materials. Similarly, by selecting other raw waste materials and studying their properties could explore more product which is useful for construction. The utilisation process will reduce the use of natural resources, more than that the waste will not be always get dumped on open field. It will get utilised for specific purpose. The performance of solid waste based construction materials in real construction must also be evaluated prior to setting up secondary industries for recycling and utilising solid wastes.

Conclusion –

There is a tremendous scope for setting up secondary industries for utilising and using such huge quantity of solid wastes as resources. In the production of construction materials, Environment-friendly, energy-efficient, and cost-effective alternative materials produced from solid wastes will show a good market potential.

References-

- i. <https://www.mdpi.com/1996-1944/14/3/511/pdf>
- ii. https://www.researchgate.net/publication/241631931_Processing_and_characterization_of_redmud_filled_sisal_fibre_reinforced_polymer_composite
- iii. <https://www.degruyter.com/document/doi/10.1515/ntrev-2020-0029/html>
- iv. https://www.researchgate.net/publication/336471171_Fiber-Reinforced_Polymer_Composites_Manufacturing_Properties_and_Applications
- v. <https://polymerscience.imedpub.com/research-on-natural-fiber-polymer-composites-the-wayforward.php?aid=8099>
- vi. <https://aip.scitation.org/doi/10.1063/1.5117932>
- vii. https://www.researchgate.net/publication/285853348_Investigations_on_the_mechanical_properties_of_red_mud_filled_sisal_and_banana_fiber_reinforced_polyester_composites
- viii. <https://www.degruyter.com/document/doi/10.1515/secm-2016-0072/html>
- ix. <https://journals.sagepub.com/doi/full/10.1155/2012/354547>
- x. <https://www.hindawi.com/journals/ijps/2015/243947/>

To Study The Rebound Phenomena In Slum Rehabilitation Project

Author - Vaidehi Pande, Dr.Sujata Karve

Dr. Bhanuben Nanavati College of Architecture, Pune

Email: vaidehipande22@gmail.com

sujata.karve@bnca.ac.in

Abstract: *Affordable housing for the low-income population, who mostly live in slums, is a prevalent challenge for cities in developing countries. As a remedy for the slum-free city, most of the major metropolitan cities are resorting to slum rehabilitation housing. Although this is a development in the living conditions, India has observed a rebound effect on the occupants, where rehabilitated occupants move back to the horizontal slums. Rehabilitation connotes the improved quality of life that provides contentment, yet what entails residential satisfaction in such low-income situations remains a blind spot in literature.*

Keywords: Affordable Housing, Slum Rehabilitation, Rebound phenomena, Homeostasis, Distress, Socio-spatiality.

Literature Review:

Slum rehabilitation and upgradation programs have always been a primary political agenda of the Government of India. These programs are designed in a top-down manner to construct public housing that would improve housing standards and close the housing deficit. However, little is known about the after effects of these policies on the occupants' overall well-being. A common practice in slum rehabilitation projects is that developers promise to construct free slum rehabilitation houses (SRH) by incentivising the floor space index (FSI). It provides them with the more significant advantage of building taller SRH in a smaller portion of the area while maximising occupancy. At the same time, constructing luxury apartment in the rest of the land and selling them in the premium real-estate market of Mumbai. It makes the rehabilitation process entirely market-driven, resulting in sub-standard housing design leading to poor quality of life. A behavioural study by Vaid and Evans (2017) have shown that on moving to formal housing (like the SRH), the slum dwellers felt satisfied and contented with their aspirations. However, owing to poor design and lack of social spaces, their perception of the SRH scheme changes as they move on with their daily life. They feel significant improvements are needed regarding hygiene, cleanliness, safety, comfort levels and indoor air quality. The occupants hope for 'holistic comfort' in their built environment.

The aim of this research is to investigate the cause behind the rebound phenomena based on a theory of homeostasis. The loss of homeostasis refers to, occupant's discomfort and

distress in their built environment. The research gives a scope to compare and analyse the living facilities pre and post slum rehabilitation projects and to investigate

Introduction:

the factors that influence occupant's attitude, emotions and health, in their built environment that regulates their holistic comfort and lack of stress. This study aims to understand the lifestyle of the users and reduce the drastic changes observed in their living conditions after Slum Rehabilitation. To understand and analyse the factors affecting psychological health of inhabitants, a comparative analysis of the current built-environment indicators and liveability status of major informal archetypes will be performed, followed by analysis of the socio-physical problems associated with it. A critical evaluation of the rehabilitation housing highlights the problems caused by the current dense built-environment design.

The expected outcome from this study is to demonstrate the significance of socio-spatiality and to suggest environmentally sustainable indicator-based built-environment recommendations. If these recommendations are implemented in the forthcoming slum rehabilitation projects, it would help in enhancing the well-being and liveability among the low-income sector in future.

Material and Methodology:

The sample case study is a slum rehabilitation project in Pune. The planning of this project started in 2013 and the actual construction started in 2016. The structure has 2 buildings, one with 14 floors and the other one with 15 floors. Each unit is 1BHK with approximate area of 300sq.m. This project was completed in 2020 January and was handed over to the users in March 2020. Amidst the covid-pandemic almost 70% of the occupants shifted in this new project immediately in March, whereas the remaining 30% of the occupants shifted after the lockdown rules were eased out. The main reason behind selecting this project was the availability of two perspectives: Occupants who shifted during the main lockdown period and of those who shifted at a later stage. The type of research is correlational and qualitative. The first part of the research is to analyse the living conditions and facilities through plans and site visits. Analysing different factors of the occupants-physical and psychological aspects through surveys forms the second part of the research. The current pandemic situation

was one of the major limitations that was faced while acquiring the surveys from users of this project.

The first part of the research was a self-analysis based method. This method includes self-analysing the structure of the slum rehabilitation, its plans, and unit sizes. This method helped in understanding the drastic living changes that the occupants must have faced after getting relocated from horizontal living to vertical living.

The second part of the research consists of survey analysis. A total of 37 households surveyed. The survey was divided into four main parts: personal, individual opinionated, facilities provided and comparative. The survey helped in understanding the mental state of occupants, their daily needs, their expectations. The first part acquired basic information of age, gender, family structure, monthly earning source and expenses. These questions helped in understanding and analysing the financial pressure faced after shifting in this slum rehabilitation project. Qualitative and personal opinionated questions were related to their opinion of the units they have been provided, the change observed in their social life, basic hygiene factors such as cleanliness. Understanding the facilities that have been provided in the slum rehabilitation project was a crucial part of the research because it indicated the occupant's level of satisfaction. The last part catered the comparative analysis of horizontal living and vertical living. The questions helped in analysing the difficulties faced, drastic changes observed and the rate of acceptance of the users to adapt to vertical living in the time of urbanization of the slums.

Results and Tables:

The project is a comparatively new project with a new perspective of better and equal lifestyle to all. This project has immensely contributed for the betterment of the society by giving permanent housing to hundreds of people. The units of 300sq.ft area have living room with attached kitchen, one bedroom with one separate washroom and toilet. The units look a little congested with minimum source of natural light, which in turn increases the expenses. One shortcoming in this unit is that no separate space has been allocated for kitchen. Hence some of the occupants have converted the bedroom into kitchen in order to get more space for storage purpose. The corridors on each floor are 2m wide and hence there is constant need of artificial lighting. The site plan has been designed in such a way that it allows ample amount of amenity space, parking space. The front facade of the rectangular building has been rented out for commercial purpose.

Fig.1 Unit 1BHK- 300sq.m

The survey conducted helped in understanding the psychological process each individual had to go through during the transition period of shifting from horizontal living to vertical living. The results indicated that 56.8% of

households have 4-5 members living in one unit, and 21% of households have 6-7 members living in each unit. It was observed that 54.1% of households have 2 members who contribute in the living expenses. Almost 86% of people stated that the idea of having a permanent structure brings satisfaction to them as compared to the earlier conditions of their house where they had a constant feeling of living in a temporary house. The satisfaction of having a permanent house led to acquiring more number of appliances such as fans, toves, fridge etc. whi chhave increased their monthly

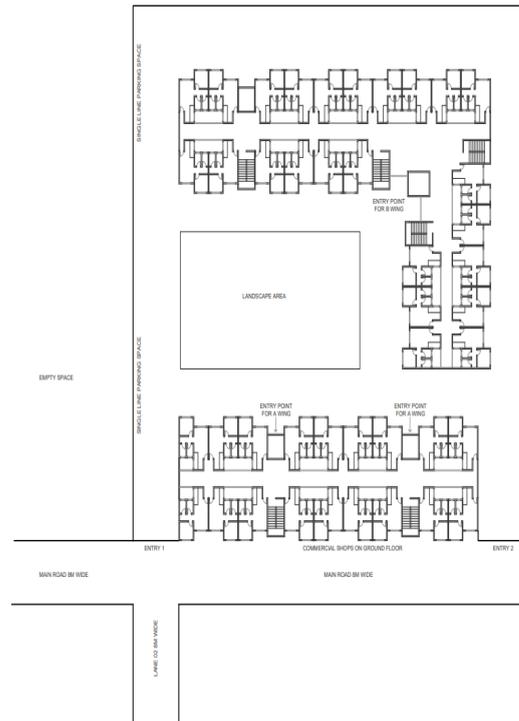


Fig.2 Site Plan



expense by Rs. 2000 to 3000. Analysing the availability of basic facilities such as water supply, electricity and lift was also a very essential part of the survey, which helped in identifying the issue of lift facility mainly for the higher floors. 45.9% of the people have an opinion that their social life is affected due to the vertical living. The main reason behind this is each occupant has had a mental shift from having a transparent living to enclosed privacy driven lifestyle.

The new slum rehabilitation projects have definitely given the users better and clean units to live but the problem of common spaces remains the same as horizontal living. Few issues by the occupants were lack of hygiene awareness leading to unclean common spaces. Many of occupants stated their wish to educate occupants regarding cleanliness drives. The last part of the survey consisted of a comparative analysis.

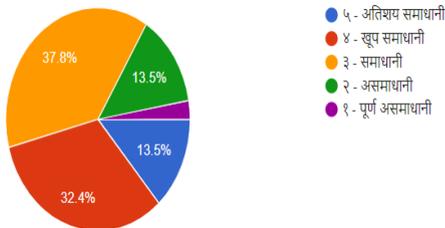
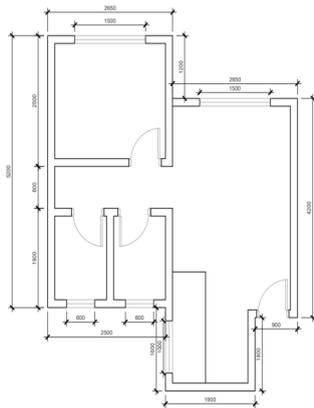


Table. 1

* 5- Extremely satisfied 4- Very Satisfied 3- Satisfied 2- No Satisfied 1- Dissatisfied

The above figure states that majority of the occupants are satisfied with the slum rehabilitation project.

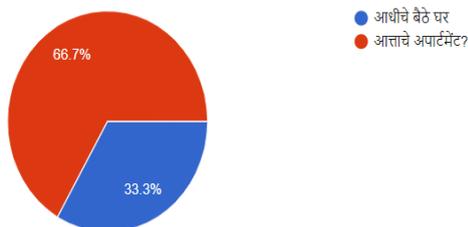


Table.2

The following figure explains the users comparative analysis between horizontal living and vertical living. 66.7 % occupants prefer to live in this new slum rehabilitation project.

Conclusion:

Though the hypothesis states the rebound phenomenon in slum rehabilitation projects, the survey analysis indicates that the occupants living in horizontal slums feel the need to have a better future and hence are ready to adapt themselves in this new style of vertical and secure lifestyle.

Acknowledgment:

I would like to thank my guide Dr. Sujata Karve for guiding and supporting me throughout. Her valuable inputs helped me in understanding a broader perspective. I would also like to thank the occupants and managing committee of

the selected case study for helping me in giving the surveys with utmost honesty.

References:

- i. Factors Affecting Residential Satisfaction in Slum Rehabilitation Housing in Mumbai - Bangkim Kshetrimayum
<https://www.mdpi.com/2071-1050/12/6/2344>
- ii. Analysing outdoor airflow and pollution as a parameter to assess the compatibility of mass-scale low-cost residential development. - Arnab Jana, Ronita Bardhan
<https://doi.org/10.1016/j.landusepol.2020.105052>
- iii. Indoor air quality among Mumbai's resettled populations: Comparing Dharavi slum to nearby rehabilitation sites – Ahana Sarkar, Ronita Bardhan
<https://doi.org/10.1016/j.buildenv.2019.106419>
- iv. Slums and Urban Development: Questions on Society and Globalisation – Jean Claude Bolay
<https://doi.org/10.1080/09578810600709492>
- v. Housing Quality and Health: An Evaluation of Slum Rehabilitation in India – Uchita Vaid, Gary W.Evans
<https://doi.org/10.1177%2F0013916516667975>
- vi. Rhetoric of the 'slum'- Rethinking urban poverty – Pushpa Arabindoo
<https://doi.org/10.1080/13604813.2011.609002>
- vii. Enabling Slum Redevelopment in Mumbai: Policy Paradox in Practice - Vinit Mukhija
<https://doi.org/10.1080/02673030120090548>
- ix. How does slum rehabilitation influence appliance ownership? A structural model of non-income drivers – Ramit Debnath, Ronita Bardhan, Minna Sunikka Blank.



- x. Dwellers' Satisfaction on Slum Rehabilitation Scheme and its Affecting Factors in Mumbai, India - Sayeda Saika Binte ALAM, Mihoko MATSUYUKI
<https://doi.org/10.14398/urpr.5.67>

- xi. Low-income housing layouts under socio-architectural complexities: A parametric study for sustainable slum rehabilitation - Jeetika Malik, Ronita Bardhan, Ramit Debnath
<https://doi.org/10.1016/j.scs.2018.04.038>

Impact of Architectural Environment in Enhancing the Comfortable Conditions for Pets In Shelter Homes : A Case Study on Dogs.

Vaishnavi Vinay Gokhale, Dr. Avanti Bambawale, Ar. Shobhan Kelkar

Smt. Kashibai Navale College of Architecture

Email- vaishnavigokhale22499@gmail.com

ABSTRACT : *The bond between pets and their owners is not always so similar to the relationships humans have with each other. Pets need their owners for basic needs of food, water, shelter, and welfare. But, humans can gain a different kind of wellbeing from their companion animals. The health benefits of owning and interacting with companion animals are making major impacts in the lives of people. In many parts of the world, animal shelters form major efforts to manage free- roaming, unwanted and abandoned animals, with cats and dogs making up a substantial portion of shelter intake. In spite of its importance, poor animal housing has been observed in shelters, one that has a substantially negative impact on both health and well being. With reference to the literature review it is gathered that the well being of pets for human companions is more than only a necessity in the global scenario. Hence through my research I wish to understand the psychology behind the relationship and the role of architectural spaces for their well being and comfortable living conditions in the shelter homes.*

Keywords- Animal shelter, Shelter homes, stray animals, pets, street animals

INTRODUCTION

The bond between pets and their owners is not always so similar to the relationships humans have with each other. The ways in which pets interact with their owners on a daily basis show what important positions they hold, and how today, people treat their pets the way they might treat another person. According to Army Medical Department Journal (AMDJ), these animals not only provided protection, they also could offer stress relief and a sense of pride to their human counterparts. Pets need their owners to meet their basic needs of food, water, shelter, and welfare. But, humans can gain a different kind of wellbeing from their animal companions. Many researches show that pets can lower blood pressure, reduce stress, raise blood oxytocin levels, and, in some cases, may reduce direct pain. As the human-animal bond has evolved throughout time, it makes sense to think that it will continue to develop. The health benefits of owning companion

animals and interacting with different types of animals are making major impacts in the lives of many people.

The scope of the stray dog problem in many parts of the world is unimaginable. Street and village dogs have always been part of the developing world's landscape. The World Health Organization (WHO) estimates that there are more than 200 million stray who need protection from health hazards which might affect humans directly. At the same time, animal shelters and dog rescue groups are springing up throughout the world. In some countries including India private citizens have formed humane societies and loose-knit groups of volunteers to care for rescued dogs.

India's streets are home to roughly 35 million dogs, a number that's grown by 17 percent since 2016. The majority of these dogs live tough life scavenging for food in garbage, and possibly spreading diseases. Most are native Indian breeds.

In many parts of the world, animal shelters form major efforts to manage free- roaming, unwanted and abandoned companion animals, with cats and dogs making up a substantial portion of shelter intake. The quality of housing can be a serious matter of life and death for a cat or dog entering a shelter. In spite of its importance, poor animal housing has been identified as one of the greatest shortcomings observed in shelters, one that has a substantially negative impact on both health and well being. All too often, housing in shelter still consists of small, stainless steel, single compartment caging. Such caging also remains common in many veterinary clinics. Conversely, just as poor housing can greatly compromise welfare; good housing can be a powerful tool in promoting positive welfare and happy living.

The literature survey was done to understand the present scenario pertaining to the issues with pets and their required environment. various research papers and case studies were studied online to acquire the knowledge and find the research gap. to establish the facts from existing cases and analyse to know the merits and demerits for the research work.

CASE STUDIES

DOGITECTURE

Architects- [we architecture](#)

Project- year 2018

[We architecture](#) has completed a proposal for a “dog center” in [Moscow](#) that challenges traditional notions of animal shelters. the firm notes that the courtyards, which provide enclosed outdoor space for dogs, allow the centre to avoid the ‘jail- like’ fencing which is often associated with dog shelters. Extensive outdoor seating space bleeds into greenery inviting the both human and animal recreation.



HOTEL FOR CATS AND DOGS, PORTUGAL



A canine and feline hotel is accommodation for [pets](#) in [Parada, Portugal](#), built on an old vineyard by local studio Raulino Silva Arquitecto. It includes a grooming parlour and pet pool with a veterinarian office alongside the grooming rooms. Dogs and cats are kept separate to minimize antagonism and noise. The kennels lead to an indoor play area for dogs; an internal corridor, blocking the dogs across the corridor from each other's views. All the rooms have big glass windows facing towards the garden. The garden area is secured by a net fence strung on granite posts. Floors are made of epoxy; a coating applied to concrete that creates a seamless finish.

Opinions from online case study-

1. Doesn't seem to be any solar protection/blinds in the windows. It'll be scorching hot in the summer.
2. Animal pens have them facing each other. Pets with their owner away do not want to be facing other animals. It doesn't make them 'feel better'. It only builds up the stress.
3. Well done. Our best friends deserve a nice place to stay at while mommy and daddy are away. I wish more businesses would allow our pets to accompany us when we go shopping, dining or just walking around in city parks.

GROOMING SALON FOR PETS, CHINA



A grooming [salon](#) for [pets](#) in [Hangzhou](#), China called nova pets, the 450 square-metre space provides a grooming service and areas for owners and their furry friends to socialise with others. It includes a sunken cafe, playground and a paddling pool where pets can dip their paws. Yellow, black and grey are used as a colour theme as these are the main colours dogs can see in their daily life. Exposed brick and concrete surfaces

are resistant to animal wear and tear and all the openings are at animal's eye level.

Opinions from online case study- 'So modern minimal and hi-tech.' words of appreciation by a pet owner.

ANALYSIS- The above online case studies indicate the positive environment at various pet related architectural built-unbuilt spaces.

RESEARCH QUESTION

What kind of architectural spaces are contributive for the well being, happiness and good health of animals in a shelter home?

AIM

- To study the contributive environment for pets at shelter home towards health and well being of pets, and their owner satisfaction.

OBJECTIVES

- To learn and understand the relation between pets and humans.
- To understand the impact of the architectural environment upon pets and their behavior.

SCOPE AND LIMITATIONS

The study shall be limited dogs. Other pets shall not be discussed in this paper.

The psychology of pets and humans is limited to the reactions of pets to different spaces, environment and happenings

The findings shall be based on an online survey due to the pandemic situation, otherwise there would have been scope to observe and analyse.

METHODOLOGY

The methodology adopted in this research is through telephonic interviews to the experts in the field of shelter homes, pet owners, pet owners related to the field of designing, pet sellers. Apart from this the additional information acquired from online available surveys and opinions as well as the opinions and surveys online due to the pandemic situation. For this telephonic survey the questionnaire was formed as a tool for telephonic interview.

SAMPLING

The samples selected for telephonic interview are the pet owners who are the designers/ would be architect of the environment

QUESTIONNAIRE AS RESEARCH TOOL

1. What is the routine of a pet?

(This question was specifically devised in the tool of questionnaire to understand the various activities performed in related spaces and the psychology behind it and hence the similar spaces and environment could be expected by the owner from the shelter homes)

2. According to the routine of your pet what kind of activity spaces other than his compartment would you prefer?

- Covered/ enclosed (indoor environment)
- Semi-open/ semi-enclosed (transition space)
- Open to sky with transparent enclosure

3. How does the pet react to different spaces (indoor/ outdoor) in the routine?

4. Does the pet desire to be with human companions around?

5. Any particular requirement about the temperature (warmth / cool) for a particular breed of dogs?

6. What facilities do you expect from the shelter homes for your pet?

7. Are there any facilities upto your expectations in and around Pune for your pet and have you ever chosen the facility for your pet? If no, why?

8. How do pets react to the difference in environment from their routine homes to that of shelter homes?

Table of reactions from the samples through telephonic interview

SAMPLES	SAMPLE NO.1 (pet owner)	SAMPLE NO.2 (an architect and pet owner)
Activity spaces	Open space	Like to play on open grounds, lobbies or big open spaces
Indoor/ outdoor	Mostly outdoor	outdoor

Like human companions nearby?	yes	yes
Temperature requirement (warm/ cool)	cool	Preferably cool
Expected facilities in shelter homes	People in the shelter home should be well trained as well as the environment should be healthy just like home.	Should be more animal- friendly rather than just business minded.
Are the desired facilities available in Pune	No	No, many of the shelter homes as well as veterinary hospitals have got simple steel cages.
Are the above facilities used?	No, cannot trust the shelter homes	No, shelter homes does not have home- like environment
Psychology of pets in homes	Like to be around human companions	Like cosy spaces to sleep, like to play with human companions
Psychology of pets in shelter homes	Should have a home- like environment.	When the pet is away from home and the owner he needs some distraction like open activity spaces, lobbies, big open spaces and a home-like environment.

RESULTS

As per the survey conducted both with online opinions and telephonic interviews, following points could be considered for a comfortable and contributive built/ unbuilt environment at pet centers.

1. The living space should be more than provision of steel cage, with natural view around.
2. More open and green spaces should be designed as, unbuilt environment for dogs to play with trained care takers.
3. Protection from natural climatic factors as extreme cold and heat should be dealt with in design through provision of shady areas, transition spaces, and if not possible naturally, the spaces should be mechanically cooled/ heated to create the recommended living spaces at home.

4. Pets get companionship or view of humans more than other pets and so the living spaces need to prevent view of compartments of other pets.

CONCLUSION

Through this research, the author learnt and wished to bring forth the audience that pets are true companions and a wonderful emotional support at all times, hence the pets as our extended family also need love, care and attention through architecturally designed spaces for their health, happiness and well being. Hence special care should be taken to design, construct and select materials favourable for the pets which in totality makes the environment contributive at pet care centres or shelter homes in turn satisfying the pet owners.

ACKNOWLEDGEMENT

I thank my institute and research faculty for the motivation to participate as well as guidance throughout the process of writing the paper.

REFERENCES

- Emily Lenhard (December 2018) "The Human-Animal Bond throughout Time." The College of Veterinary Medicine at Michigan State University, cvm.msu.edu/news/perspectives-magazine/perspectives-fall-2018/the-human-animal-bond-throughout-time#:~:text=Pets, humans, and their health together&text=Research shows that pets can,to die from heart disease.*
- Coppola, Crista L., et al. "Noise in the Animal Shelter Environment: Building Design and the Effects of Daily Noise Exposure." Journal of Applied Animal Welfare Science, vol. 9, no. 1, 2006, pp. 1–7., doi:10.1207/s15327604jaws0901_1.*
- Ghatak, S., and B.b. Singh. "Veterinary Public Health in India: Current Status and Future Needs." Revue Scientifique Et Technique De L'OIE, vol. 34, no. 3, 2015, pp. 713–727., doi:10.20506/rst.34.3.2391.*
- Wagner, Denae, et al. "Shelter Housing for Cats: Principles of Design for Health, Welfare and Rehoming." Journal of Feline Medicine and Surgery, vol. 20, no. 7, 2018, pp. 635–642., doi:10.1177/1098612x18781388.*
- Yiğit, Ali, et al. "Türkiye'De Sahipsiz Hayvan Barınakları Ve Barınak Hekimliği Üzerine Bir Değerlendirme." Kafkas Universitesi Veteriner*
- Patti Strand (November 2011), The Global Stray Dog Crisis-<http://www.naiaonline.org/articles/article/the-global-stray-dog-population-crisis-and-humane-relocation#sthash.TjF3u1XN.V3w1FzBd.dpbs>*

- vii. Deepa Lakshmin (April 2020), 'The new cool': Adopting street dogs is gaining popularity in India-
<https://www.nationalgeographic.com/animals/article/street-dogs-indies-india-pets>
- viii. OVRS staff (November 2019), Common challenges with shelter pets- <https://www.ovrs.com/blog/challenges-with-shelter-pets/>
- ix. Dezeen Awards 2021 (October 2020), Raulino Silva Arquitecto design a hotel for cats and dogs in Portugal-
<https://www.dezeen.com/2020/10/11/raulino-silva-arquitecto-designs-a-hotel-for-cats-and-dogs-in-portugal/>
- x. Ali Morris (January 2020), Hangzhou's Nova pet is a grooming parlour where pets can hangout with their owners-
<https://www.dezeen.com/2020/10/11/raulino-silva-arquitecto-designs-a-hotel-for-cats-and-dogs-in-portugal/>
- xi. Ella Comberg, Dogchitecture: WE Architecture Designs a Center That Challenges Traditional Animal Shelters-
<https://www.archdaily.com/894254/dogchitecture-we-architecture-designs-a-center-that-challenges-traditional-animal-shelters>
- xii. World Health Organization-
<http://www.who.int/mediacentre/factsheets/fs099/en/index.html>

Green spaces in drug rehabilitation centre

Vandana Sharma

Bharati Vidyapeeth College of Architecture, Pune
(2020-21)

vandanasharma1998@gmail.com

Guided by: Ar. Mukta Latkar Talwalkar

Professor at Bharati Vidyapeeth Deemed to be University, College of Architecture, Pune

Abstract: *Green spaces and open spaces or the outdoor scenery from a window is something that is immediately associated with a calming effect for many people. Spending time with nature gives us peace and relaxing mood. In drug rehabilitation centre gardens and parks are spaces, where people do more than receive medical treatment, they can relax surrounded by nature, engage in physical activities and rest without taking into account one's social status, age, gender, nationality, political views and religion. It is important for the environment of drug rehab centres to be friendly, because they are designed to help all the social groups and individuals. Spending time around nature has long been recommended to everyone, from kids to adults, but now especially to people in recovery from drugs and alcohol by the doctors. The link between green and open spaces results in fast recovery of the patients. The link between green spaces and mental health is undeniable. Green space is an umbrella term for either maintained or unmaintained environmental areas such as parks, nature preserves, and parks. Drug rehabilitation is the process of medical or psychotherapeutic treatment for dependency or addiction of alcohol, prescription drugs, and street drugs such as cannabis, cocaine, heroin or amphetamines, which can be reduced or help them to recover fast by interacting with green spaces and doing outdoor activities. Green spaces and parks beautify the community, create a pleasant environment for the people and protect the natural environment. This research study will tell the importance of open and green spaces.*

Key words:

Green spaces, open spaces, nature, gardens, rehabilitation, health

I. INTRODUCTION

Addiction comes in many forms, and so does recovery. "Rehab" is a general term for intensive, supervised programs designed to help people stop using drugs or alcohol and give them the tools they need to live a healthy life. Rate of Substance abuse is escalating alarmingly in the modern world and India too has a significant share in it. Rehabilitation Center for Substance Use Disorder has increasing social relevance and is becoming a fundamental need of Indian society. Green and open spaces play an important role in drug rehabilitation centre. In the world today green spaces and parks are part of our daily life; they affect our moods and behaviors psychologically, and they create another environment for us. Basic principles of garden design should

cover not only esthetically enjoyable natural landscapes but also tangible things and things to be felt by soul. Patients exposed to green spaces have less stress, anxiety and illness. By working together in the rehabilitation garden and on building its architecture people have an opportunity to set their minds easier, communicate with each other and participate in creation of their own lives. Green spaces and parks are the backbone of sustainable and high-quality urban environment. They provide places for recreation, leisure and entertainment and they have positive effects on community health. They create suitable environment for various plants and animals as well. Moreover, green spaces and parks are necessary to have better climatic conditions. From past researches green spaces and parks have effectively reduced the high rate of obesity in a community. Shows that a community with vegetation and water surroundings (natural environment) helps the mind to feel relaxed and stress less than a place with no vegetation. From parks in an environment helps provide the community with a sense of peacefulness and enriches the city dwellers. Green areas and parks provide a pleasant environment for the community, which distracts them from the chaos community. People, exhausted from pain and suffering, go to rehabilitation centers, which serve as the only hope for them in situations where there is no reason to count on medical help; the last thing that remains – to count on the experience, sensitivity, sympathy of people working in rehabilitation centers and on the healing power of nature. Silence, presence of the sea or any other water reservoir, mighty rustle of pines, sandy beach, mineral waters and unique mud heal human being physically and mentally.

AIM

- To study the positive impact of green spaces on drug addicted patients that help them to recover fast.
- To understand the design of some open space which welcomes people to stay around the area because of the beauty of the parks or the way it was the design

OBJECTIVE

The present paper constitutes following objectives:

- To identify green spaces and open spaces in rehabilitation centre.
- To examine how green spaces and open spaces effect the patients and staff.
- To study and evaluate maintenance and management of green spaces and open spaces in rehabilitation centre.

SCOPE

- To cover definition of terms such as green spaces, parks and other related terms.
- This research paper covers how green spaces can be effectively used, managed and created for the patients, which should help in creating another environment for relaxation and other activities outdoor, so that the patients can recover fast.
- Green areas help to improve the life style of the people physically and health wise, they provide a place for recreation e.g., jogging, walking, cycling, meeting people and also, they help reduce the stress of the patients from the chaos going inside their mind.
- Green and open areas can also be defined as an area which provides direct sunlight, air, relaxation and recreational space, which are generally utilized and used by the people to provide landscape features and add up to benefit the users.
- Green area may include these features such as lawn, planting, and recreational areas including children's playground, landscaped areas, and watercourse (ponds, lakes etc.) to mention and many more.

II. METHODOLOGY

This study is perceived by obtaining reliable information of green spaces in rehabilitation centre related to the topic. The research is based on knowledge of existing works on subject and by formulating a personal understanding on different therapies in open space. The data analysis is done by referring journals and research papers and the outcome is based upon the literature review.

Both the qualitative and quantitative methods are adopted, mapping of the green area and parks, pictorial and chart analysis have been used, and questionnaires has been distributed to areas with and without green spaces to see how effective green spaces are to the patients, the retrieved data would be quantitatively analyzed, compared and processed. The analysis of historic materials was carried out. When analyzed we came across the functional quality of rehabilitation garden, worldwide studies on results of interaction between human being and environment have been taken into consideration; on the basis of them the concept of universal garden and park design will develop historically.

The pictures of open and green spaces of different rehab centre are compared and then then analyzed how much should be the size and what kind of open space need to be created which would give them relaxing environment

The observations are done related to what will be the impact of green spaces and open spaces on the patients and how will it help them in healing and recover fast. The research also took into account factors other than green space and open that might affect the design such as age, gender and type of drug addiction patient.

The survey was done online by putting a questionnaire and getting reviews from everyone. The survey link was shared through social media platforms and answering it was not mandatory nor in exchange of any money or service.

-Studying the relationship between the open space and the human response and the factors that lead to the variations in response.

- Analysis of existing behavior setting in terms of user response to already designed space

- Identification of features of a space that hinder or facilitates user response
- Conclusive statements to the realization of the study.

LITERATURE STUDY

RESEARCH PAPER A

People with different kinds of addictions are given an opportunity to regain their reason to live and willingness to live through work and prayers to God in the gardens. By working together in the rehabilitation garden and on building its architecture people have an opportunity to set their minds easier, communicate with each other and participate in creation of their own lives.

Rehabilitation gardens incorporate the needs of different patients worldwide by providing a space for various activities to improve health in the open and green spaces. The only difference in a sensory garden is that all these components (hard landscaping, soft landscaping, colors, textures and wildlife) must be carefully chosen and designed to appeal to the senses in such a way that they provide maximum sensory stimulation.

Example –Vaivari rehabilitation garden

The majority of people who visit rehabilitation centers, where gardens and parks are places where they should feel comfortable in outdoor environment and receive valuable attitude from the surrounding people. It also should not be forgotten than none of us is protected from physical injuries that may cause movement disorders.



Source: L. Balode's private archive, 2014

RESEARCH PAPER B

The buildings of rehabilitation centers usually are of big size and painted in light colors. They often prevail over the rest of the rehabilitation landscape. In the survey, the majority of respondents replied that the landscape design of rehab centers needs to be interesting. Physical activities in fresh air are supplemented by badminton, Frisbee, played on the grass in open space which creates positive environment, or even a walk in a green space reduces stress and helps in relaxing our mind.

The benefits of being outside and seeing green space are extremely helpful, even if it's just a short amount of time per day. Green spaces can help to alleviate some of the symptoms associated with these mental health disorders while helping to alleviate cravings that mental health disorders can create. By green space lessening the frequency and intensity of cravings for drugs, alcohol, nicotine, and junk food it allows people to not give up one harmful addiction for another.

The big trees make a perfect habitat for birds, squirrels and insects. An important moment is the exposition of distant views, so that it would be possible to enjoy the distant landscape perspectives of fields. There is also the opportunity

of mutual communication between nature and people assisting in the rehabilitation process.

RESEARCH PAPER C

Case Study

For example -: In the alpha healing there are different open and green spaces which they have provided for patients with different purposes which help them to reduce their stress.

Landscape areas-

1. Entrance landscape
2. Dense plantation
3. Water scape
4. Existing plantation
5. Lawn area
6. Organic plantation
7. Yoga pavilion
8. Outdoor dining
9. Pool deck landscape
10. Separate research paper



Master Plan
Drawing: Courtesy of Art & Architecture Associates

Master plan of Alpha healing centre



In the rehabilitation garden of the Brukna Manor, through prayers for God's blessing and mutual social communication between patients, assistance is provided to people who have lost hope and any the reason of living, have fallen into drug addiction, alcohol or other addictions. Nature, season change, rhythm of liturgical time, prayers, field works, care of reconstruction and maintaining of the Brukna Manor give an opportunity to people to purify themselves, both physically and mentally, and return to normal life.

ANALYSIS

By carrying out the inspections of rehabilitation centers in nature, I got acquainted with the current situation in the landscape accessibility and usability. The quality of

rehabilitation centre paths and economical aspect make it impossible to stay freely in nature for every man, also using a wheelchair, and for the patients to socialize with each other. It was concluded that the major part of the landscapes of these centers are old-fashioned and essentially limit freedom of movement and relaxation for majority of people.

Due to the economic reasons, the rehabilitation centers are being renewed and modernized very slowly. Initially the reconstruction is made in the building interior and only then attention is paid to the surrounding landscape.

The newly established Latvian rehabilitation centres – rehabilitation centre in the Brukna Manor, Davinu Parish, and rehabilitation centre Dujas in Kalna Parish are incorporated organically in the natural landscape. There are several landscapes developed in the rehabilitation centre Dujas with a playground, water landscape, decorative plantation, beds of herbs and relaxation zone with distant views on landscape meadows. Preservation of big trees in the landscape, where the sunbeams, wind and shadows can play, is an important feature.

During the inspection it was found out that the rehabilitation centres mostly lack separate, confined relax zones, pergolas near buildings, where patients could have opportunities to spend time of their own without any disturbance or together with their relatives.

In the future, there is a need for more in-depth study of the Latvian suitable plants, roads and square's structure and other elements to facilitate therapy and use of the garden according to local climatic conditions. To achieve the goal, it is necessary to absorb the international experiences and exchange best practices, innovative solutions and adapt the advanced rehabilitation center area landscape for individual needs

Here are some vegetation and their purpose which can be used in green spaces for drug rehabilitation centre and can help patients to remove their stress-

To welcome birds		MANGO TREE Scientific name- mangifera indica Height of tree- 80-90 ft Canopy- 12 m
For dust filtration		STROEMIA SPECIOSA Common name- pride of india Height of tree- 20 m Canopy- 20- 25 m
For aesthetics		BAHAVA TREE Common name- golden shower Height of tree- 10-20 m Canopy- 20m
For shading purpose		BANYAN TREE Scientific name- ficus benghalensis Height of tree- 100 ft Canopy- 30 m

The green spaces can be used for different activities such as –



FINDINGS

A significant part of the respondents revealed that they would like to have chairs for sunbathing in the rehabilitation gardens and parks; they assessed the architecture of gardens and parks as outdated. People wish modern and contemporary lighting elements, outdoor fitness equipment, open-air cinema and sensor feeling gardens, where an opportunity could be provided to enjoy nature with all five senses.

The majority of pieces of art in these gardens are of dynamic character. Swings, little bridges, sundials, wind dials, belvederes for bird-watching and raised planting beds for people with movement disorders are set up in the gardens. Attention has to be paid to attraction of birds, fish and other animals. Interesting sounds come also from wind, wooden or clay bells can attract the people. Parks are even for the visitors or patient family members who visit the rehab Centre. They can interact and spend time in a beautiful lawn with green and open spaces.



III. CONCLUSION

The landscape design of the rehabilitation center most directly influences the way a person feels and lives in the landscape. It creates not only the material quality of the environment, but also improves opportunities for people to communicate.

During the recovery for any person his/her communication with their relatives and surrounding people is substantial. On the basis of examining the aesthetic and functional environment, there is totality of the whole system in which various types of environmental expressions transform in one.

In rehabilitation centre gardens should provide a multifunctional landscape space that allows for any individual to find the most appropriate for themselves. It may be quiet, separate space in rehabilitation center's landscape for sitting alone, for reflection and meditation, or another space in landscape for communication with others, the relatives.

While planning and designing the rehabilitation gardens and parks, the free choice principle has to be taken into account by letting to choose opportunities for walking, relaxing or outdoor activities, suitable to everyone's needs. It is important for the environment of Latvian rehabilitation institutions to be friendly.

In rehabilitation gardens and parks is to be understood as ensuring of sufficient environment information and accessibility of physical environment to all patients and visitors. Patients have to be provided with an opportunity to move freely in wheelchairs, prams, by ensuring visitors of rehabilitation gardens and parks with road surface of good quality, ramps with appropriate inclination, railing, appropriate door size and elevators. Surface has to be of high quality and appropriate in order not to cause opportunity to stumble or slip for people with injured leg, crutches or using wheelchair.

IV. ACKNOWLEDGEMENT

I would like to express my gratitude to my supervisor Ar. Mukta Latkar Talwalkar, for her valuable guidance, inspiration and encouragement throughout the research.

REFERENCES

- i. Alreck, P.; Settle, R. 2003. *Survey research handbook*. 3rd edition. New York: McGraw-Hill/Irwin, 116–120.
- ii. Balode, L. 2013b. *The health gardens development plan in Latvia, in 1st National Conference on Family Medicine and Primary Care and National Consultation on Family Medicine Programme, 20–21 April, 2013, New Delhi, India, New Delhi: Academy of Family Physicians of India. 98 p.*
- iii. Ulrich, R. S. 1999. *Effects of gardens on health outcomes: Theory and research, in Cooper Marcus, C; Barnes, M. (Eds.). Healing gardens: therapeutic benefits and design recommendations. New York: John Wiley, 27–86.*
- iv. <https://www.addictioncenter.com/news/2019/08/exposure-nature-addiction-cravings/>
- v. <https://sustainablehealthcare.org.uk/what-we-do/green-space-health>
- vi. <http://www.stirdesign.in/a-healing-hand/>
- vii. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0203000>
- viii. <https://www.hutton.ac.uk/sites/default/files/files/projects/GreenHealth-Final-Report.pdf>
- ix. https://www.researchgate.net/publication/282331597_Green_Space_and_Mental_Health_Pathways_Impacts_and_Gaps
- x. https://www.academia.edu/Documents/in/Drug_Rehabilitation_Centers

Cultural Hub at Central Pune: Redevelopment of Balagandharva Rangamandir

Vedant S. Vyas

Priyadarshini Institute of Architectural Design and Studies, Nagpur.

Email - vedantvyas40@gmail.com

Abstract - '*Balagandharva Rangamandir*' is a complex of an Auditorium and exhibition hall in the heart of Pune city. It was built in 1968 and since then it is known as the cultural hub of the city of Pune. Recently Pune Municipal Corporation has decided to redevelop the campus of Balagandharva. This paper intends to recommend the designing guidelines to develop the campus of Balagandharva in a way that seamlessly integrates with the surrounding public realm, serves as urban design according to present needs, and keeps the architectural and cultural legacy of Pune alive.

Key words - Cultural hub, Public realm, Urban design, Architectural legacy.

Introduction - Pune is historically a very significant city where the foundation of the Maratha Empire was laid. There had always been royal patronage towards various arts-artists before the independence era and after independence, this tradition was continued by the people of the city. Thus Pune got its cultural identity. Pune in its essence is cultural capital of state of Maharashtra. Culture is just an idea or custom of a particular community and a cultural hub is a place where this culture is socially celebrated together. Balagandharva Rangamandir has been the hub for this culture for the last 50 years though it's just an auditorium and exhibition hall.

Recently Pune Municipal Corporation has decided to redevelop the space due to various reasons. then as a designer, one must study the needs of present times. Pune is a vastly developing city that tops the list of government smart City projects. Considering this aspect, can the cultural hub of the city be merely a performing arts centre or should it become a stimulating urban centre? The location, the surrounding of the site compels designers to design the Balagandharva campus as a public realm, not just a performing centre. The public realm not just increases the value of space but also gives space life and reaches everyone.

Under the smart city mission, there is also a proposal for 'continuous public realm along the river' which suggests the merging of riversides of Mula and public spaces creating a wholesome public realm. Balagandharva is also on the sides of the Mula river so can the public realm be extended to the river creating more opportunities to enliven the campus?

Architecturally speaking Pune is a city of Maratha style architecture where the Wadas and the Mahals were built. At present time the modern architecture and urbanization have put this identity of Pune on verge of extinction but it can be revived and showcased if structures like Balgandharva adopt it. The architectural legacy of Pune is in its historical outlook so though the other small spaces cannot be saved new public spaces can be designed as memorabilia for its architectural heritage.



Figure 1: Architectural heritage of Pune



Figure 2: Site of Balagandharva Rangamandir, Pune

This research paper focuses on the site study and the options designer has to achieve the design that will represent the culture of Pune. This paper is also focused to find out similar projects that can be referred to for understanding the design requirements. This paper also intends to prepare design guidelines that will create a framework for design requirements.

Methodology

A literature study is undertaken to study the actual needs, wants and wishes of users for the understanding of the requirements of the site. A literature study is also used for the understanding of the traditional architectural style of Pune to recommend the guidelines. Various case studies are also used to analyse and study the existing similar projects and how they are dealt with. The tabular comparative analysis of case studies is also used.

Literature study

Maratha Architecture

There are several research papers and data available on the Maratha style of architecture. The prominent structures in Maratha architecture were Wadas and forts, but in the context of Pune city and my study area, the Wada style of architecture is more suitable for its architectural vocabulary. There needs to be a contemporary interpretation of the Wada style of architecture so that it doesn't become a copy-paste architecture but more detail-oriented and revived vernacular design.

Ar. Sushma Dhepe in her paper (1) based on examining the link between contemporary architecture that with the traditional architecture; as architecture and time are considered as two variables studied the impact and design of 'Dhepe Wada' in modern times. where 'Dhepe Wada' is a structure designed on principals of traditional 'Peshwa Architecture'. The paper concludes with the note that the traditional style of architecture can be established by borrowing certain elements and creating facades irrespective of material and construction technologies.

Continuous Public Realm along the river

A detailed report published by Pune Municipal corporation (2) and answers published on the website mentions Riverfront development. In this proposal, there is an initiative for creating the Continuous public realm along the river by creating embankments and adding public spaces along with it. The site of Balagandharva also is on the banks of the Mula River so this can be used for advantage and the site can be designed in collaboration with continuous public realm initiative.

Site study

The site is in the centre of the city and historically speaking keeping the river as a nucleus the city has grown organically around it. Riverside of the Balagandharva is a currently barren

land and has full potential to be stimulating the public realm. The area is covered in canopies of various fully grown trees.

The rear side of the site is on the riverbank which has got a historical character with Temples from Peshwa rule and the Front side comes under the shopping complexes and part of the city with modern architectural character.

The roads in the neighbourhood are the busiest in the city of Pune because it has a culture of shopping, food, Entertainment etc. so this area is heavily crowded. The neighbourhood is the heart of the city its more or less a city or urban hub itself. Many influential zones around the neighbourhood determine the context and importance of the site.

Case studies

- 1) Bharat Bhavan, Bhopal
(3)

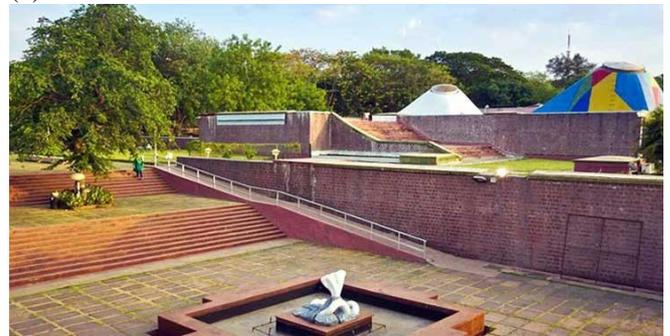


Figure 3: Bharat bhavan, Bhopal

In the late 1970s, the Government of India launched an initiative to build in every state capital an institution to celebrate the cultural and creative output of the nation. Designed by Indian architectural luminary Charles Correa, this multi-arts centre first opened its doors in 1982. More than thirty years later, it continues to house a variety of cultural facilities and play host to a multitude of arts events. The design of the complex is a product of Correa's mission to establish a modern architectural style specific to India and distinct from European Modernism.

- 2) Kala Academy, Goa
(4)



Figure 4 Kala academy, goa

Kala academy in goa is another gem of Ar. Charles Correa. It was Established in 1969 - a prime institution for the promotion of art and culture in Goa. Vibrant representation of the culture and art of the people of Goa is expressed in the staggering amount and variety of cultural programmes held on its premises. It accommodates An auditorium various Open-Air Theatres and various performance centres.

3) Virasat – E – Khalsa, Anandpur, Punjab. (5)

Virasat-E-Kalsa is a Khalsa heritage complex that showcases Punjab’s rich cultural heritage and history to the outside world. Besides major destination, this structure Interprets the traditional fort architecture of Punjab and North India. This complex consists of An auditorium, open-Air theatre, a Heritage museum and various cultural spaces. This structure represents how the contemporary interpretations of traditional architecture can be derived.



Figure 5: Virasat - e - Khalsa, Punjab

Result:

Case studies are analysed based on what Context they were designed. What character they showcase and what choices the designer made to fulfill the requirements.

Table 1: Comparative analysis of the case studies.

SR No.	Parameters	Bharat Bhavan, Bhopal	Kala academy, Goa	Virasat -E- Khalsa, Punjab	Takeaways for Development of Balagandharva
1	Context	-The site is developed under the initiative of a cultural centre for each capital so design principals are for Bhartiya architecture thus named Bharat Bhavan. - The site is	-The site is developed for arts and crafts promotion in the city of Goa and the culture of performing arts are celebrated here so design principles	- The site is developed for Sikh communities heritage preservation and in the vicinity of holy Anandpur gurudwara so design principals are based on Punjab Fortress architecture	- Balagandharva site needs to be developed as the cultural hub of the city, which will represent the architectural heritage of the city and seamlessly integrate with the public realm

	on the side of the lake in Bhopal and the lay of land slopes gradually towards the lake and spaces are designed reciprocating to it.	are to serve the artistic fraternity. - The site is on the banks of the Mandovi river and spaces are designed in a way that the rear side of the structure has more open spaces to enjoy the view of the river.	- The site on the shore of the reflecting pond and elements such as water, exposure to the open sky is well used for implementing the spiritual journey.	around it. - Balagandharva site is on the banks of the Mula river so it also needs to be connected to the site so that the river views and history is celebrated.
--	--	--	--	--

Other examples –

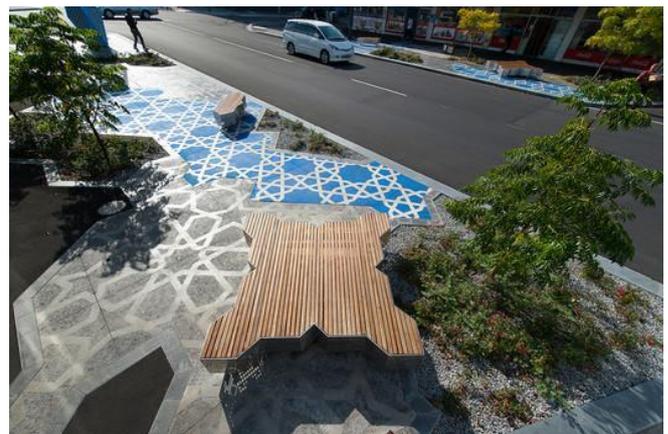


Figure 6: Afghan bazar cultural precinct, Australia

The Afghan Bazaar Cultural Precinct in Australia (6) Dandenong, an outer suburb of Melbourne, Australia. There is an emblematic urban streetscape that is integrated and responsive to the diverse cultures of the local, and broader, Afghan community. It has delivered a distinct visual character that engages and enlivens the street, encouraging community gathering. The custom seating that is designed reinterprets the traditional Arabic ‘suffah’, or dais, for the urban Australian context. This allows the community to socialize in familiar ways and gives small spaces a certain identity and multi-purposes.

Balagandharva campus can use such spaces with traditional Maratha social gathering spaces on campus to invite people and enliven the culture.

There are various urban design ideas can be borrowed from history of Pune to strengthen the social lifestyle and create

urban furniture/seating in campus of Balagandharva to make it stimulating urban space.

SR No	Parameters	Bharat Bhavan, Bhopal	Kala academy, Goa	Virasat -E- Khalsa, Punjab	Takeaways for Development of Balagandharva
2	Character	The character of the design is suggested by the planning principals which is the modern interpretation of the traditional designing principles and courtyard design strategies which gives a vernacular sense to design.	The character of the building is suggested by the form of the structure and artefacts that have been used which gives it an artistic identity that space itself represents.	- The character of the design is suggested by the use of material which is sandstone and the form of building which is related to fortress architecture of Punjab that gives a traditional and spiritual sense.	- Planning of the Balagandharva campus should speak the language of traditional Maratha architecture. - The form of Balagandharva should be interpreted from the architecture of Pune city. - The character for the proposed building must represent the architectural legacy of Pune.
3	Choice	The choices of circulation or so to say use of land is entirely up to user design does not compel you to follow the certain path so free-flowing design.	The spaces that are designed are created engaging by themselves, the artworks are prioritised before architectural elements.	The spiritual activities and concept behind every space which is again spiritual are prioritised before the comfort and ordinary norms.	Every space must be dedicated to the history and glory related to Balagandharva Rangamandir. The design must not compel users to follow a certain path apart from the Main auditorium rest must be public space.

As mentioned in Table no. 1 three case studies were taken similar to the case of redevelopment of Balagandharva Rangamandir, each one of them not only are some performing centres or exhibition centres but they also represent the culture of their respective city.

In the case of Bharat Bhavan, it was built to preserve the culture of the city and very buildings speak the purpose behind it. It represents Indian culture through its architecture and design strategies.

In the case of Kala Academy, the main purpose was to design -a performing arts centre in Goa and design not only is artistic but also speaks the architectural language of goa.

In the case of Virasat -E- Khalsa, It is not only a cultural centre for the Sikh community by purpose but its architectural language tells the story of Sikh heritage in itself.

Balagandharva Rangamandir similarly is not just a performing arts centre but it must represent the city of Pune itself. The architectural language must tell the architectural legacy of Marathas through contemporary means. The campus apart from Auditoriums and exhibition halls can accommodate urban spaces where every young artist can exhibit their art such as Open-air theatre etc. The campus must be free-flowing so that everyone should feel invited to enliven the glory of space itself.

Design Guidelines –

- 1) The proposed design must speak the architectural language of Pune.
- 2) The form of design can be a modern interpretation of the traditional architecture of Pune.
- 3) The proposed design must invite the crowd from all age groups and should be able to enjoy the campus.
- 4) The proposed design should become part of the Continuous Public realm along with the river initiative by Pune Municipal Corporation.
- 5) The proposed design must become a stimulating urban design and should become memorabilia of the history of Pune.
- 6) Various urban furniture must be provided reminiscing the traditional Maratha Lifestyle.
- 7) The connection with the river must be kept throughout the site.
- 8) In process of designing the campus as an Urban centre the main function of performing arts must not be neglected.
- 9) The design should seamlessly integrate with the surrounding and culture of Pune city.
- 10) The design must preserve the identity of Pune as the 'Cultural capital of Maharashtra.

Conclusion:-

After the comparative analysis of various case studies, it is clear that the design of iconic space can achieve cultural, historical, and artistic character. It also concludes that site conditions and adjacent features such as rivers and lakes can create the public domain and enliven the space. Balagandhava can represent the culture of Pune if followed the above-mentioned guidelines. It must be treated as an Urban stimulating centre and not just a performing arts centre that will keep the architectural and cultural legacy of Pune alive.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guides Prof. Manisha Yelne, Prof. Archana Bele and Prof. Kishor Rewatkar for their valuable guidance, inspiration and encouragement. Their keen and indefatigable indulgence in this work helped me to reach an irreproachable destination.

REFERENCES

- i. *Sushma S. Dhepe. Et.al. Int. of engineering Research and application ISSN: 2248-9622, Vol. 7, Issue 3, (Part -1) March 2017, pp. 12-22*
- ii. *https://www.pmc.gov.in/sites/default/files/River-Front/CMP-Report_20160824.pdf*
- iii. *<http://bharatbhawan.org/>*
- iv. *<https://kalaacademygoa.co.in/>*
- v. *<https://en.wikipedia.org/wiki/Virasat-e-Khalsa>*
- vi. *<https://dandenongmarket.com.au/trader/afghan-bazaar/>*

Impact of physical Office Environment on the Productivity of College Teachers

Wrick Ash¹, Ar. Mostafizur Rahman²

¹Student, Lovely School of Architecture and Design, Lovely Professional University, Punjab, India. E-Mail- wrickash.10@gmail.com

²Assistant Professor, Lovely School of Architecture and Design, Lovely Professional University, Punjab, India. E-Mail- mostafizur.19838@lpu.co.in

Abstract: *The success of any product is determined by its popularity and ease of use. For an architectural space to be successful, its success is determined not only by how well the users use the space but also how effectively they achieve the task they perform in the building. A person's emotion in a jail would definitely be different than that in a religious space. This shows that architecture can influence the human mind in a certain way hence with proper research and understanding of particular design element, a space can successfully trigger emotions and influence the productivity of the individual. People in today's era spend most of their time indoors, i.e., either in their house or in office. Specially teachers who take classes of different subject at different time and handle more than 30 students at a time need proper working and resting environment for better productivity and efficiency in their work. Many researches have found different elements of interior/ exterior elements which subconsciously helps the person to function a certain task in better way. This research intends to analyze the parameters that define the quality of indoor environment in terms of psychological aspects which are: Volume, Colour, Light intensity, Sound intensity, Temperature and Odour. These parameters were studied individually which helps us understand the positive and negative influence of each element and hence a standard can be formulated which can guide designers to avoid some mistakes.*

Key words – Office, Staff rooms, productivity, psychology, mental health, indoor environment

INTRODUCTION

Education is one of the key aspects in the life of an individual that helps him/her become a responsible individual. Humans without proper education lack the social and cultural value which directly affects the society in which they live and simultaneously leave an impact of the growth of the country. One of the important members of education is teachers/faculty/ professors. The quality of lectures delivered by them has immediate effect on students. Research shows that the quality office design helps in increasing the productivity of staff members. (El-Zeiny, 2012) Hence it is mandatory to construct a staffroom that would help the faculties to have a better state of mind and hence more productive workflow. Talking about productivity, it is important to understand what is productivity? The following chart represents the core aspects of it. The productivity of a human depends upon four

major factors namely: **social, organizational, personal and environment.**

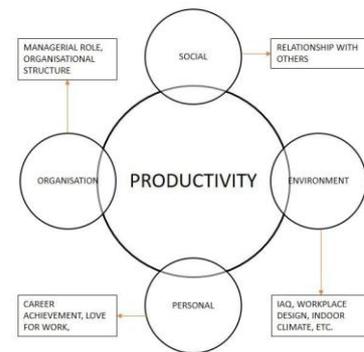


Fig. 1. Factors that affect productivity.
(Clements-Croome, 2000)

The social are the aspects that are concerned with the relationships of the person with the office staff member. If the member has a good social respect in the working environment, the motivation to work automatically comes. The organization deals with the structure of working environment, the hierarchy of workload distribution, the scope of work load distribution and many more. The personal aspects deals with the individual's personal interest with the work, his achievements involved in it and so on. Lastly, the physical office environment also plays an important role in productivity of an individual. The elements used in designing an interior of a space have huge impact on the mind. Hence it is the role of an architect to design an interior in such a way that the space helps in trigger the best of the individual.

As per a research by (JAN DUL, 2011), creative personality leads to a creative performance. This performance is enhanced by the social working environment. One of the main attribute of the social working environment is physical features (Woodman, 1993). The main elements during an event of education are students and teachers. An institution is a place that allows teachers and students to meet and hence education can take place. However, the quality of the environment in which the education takes place leave an impact on the student's academic performance. Most of the academic education takes place indoor and nowadays humans spend more than 50% of their time indoor. (W.A.M. Hansika, 2016). An office environment has a high level of influence on its occupants' productivity (Leaman, 1995). Comfort is defined by an absence of unpleasant sensations, thus

providing positive effects on well-being. It is subjective in nature and varies from person to person. There are different types of comfort in an office environment. It includes physical comfort (air quality, climate and noise), functional comfort (disturbances, interruptions, distance from work, resources) and psychological comfort (privacy, territoriality. (Feige, 2013) It is of prime importance to understand and use the elements of indoor environment that psychologically helps in promoting productive working environment.

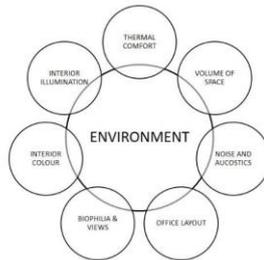


Fig. 2. Factors that affect productivity in interior level. (Al Horr Y, 2016)

From a study it was found the necessary components in the interior level that helps in measuring the productivity of the occupants. The components were: **volume of space, colour of interior, interior illumination, thermal comfort, noise/acoustics, biophilia and views and office layout.** These factors together contribute to the holistic productivity in the employees.

METHODOLOGY

The research is achieved by descriptive research of both primary and secondary data. The objective of the paper is to:

- Understanding the relation of mental health with indoor environment
- Understanding the relation of productivity of teachers with respect to interior design elements.
- Understanding how different interior element trigger different human senses

LITERATURE REVIEW

Physical Factors that affect Productivity

The parameters that define the interior environment were analyzed through study of different research papers and the following parameters were derived. Each of these parameters contributes to different brain stimulus that affect the mood and performance of the occupants.

Volume

Different volumes of cubicles affect different working capability of occupants. Cubicles with high ceiling promotes creativity while ceiling with low height helps in solving mathematical problems. (Wyatt, 2017). It has been observed that there are various brain waves are produced in different types of spaces. The main waves are: Delta Waves, Theta Waves, Alpha waves, Beta Waves and Gamma waves.

Delta Wave:

Frequency Range: 0.5 Hz to 4 Hz

Brainwave Stimulus: Relaxation and stress reduction

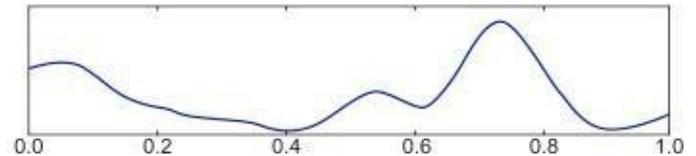


Fig. 3. Delta Wave graph

Theta Wave:

Frequency Range: 4 Hz to 8 Hz

Brainwave Stimulus: Drowsiness

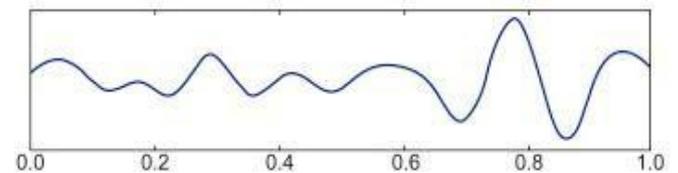


Fig. 4. Theta Wave Graph

Alpha Waves:

Frequency Range: 8 Hz to 12 Hz

Brainwave Stimulus: Reflective Restful

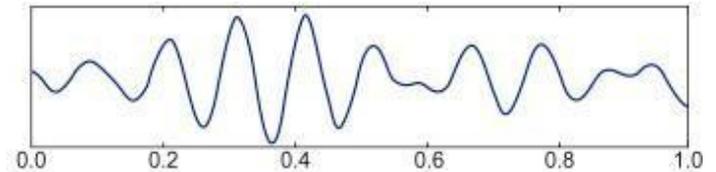


Fig. 5. Alpha Wave Graph

Beta Wave:

Frequency Range: 12 Hz to 40 Hz

Brainwave Stimulus: Cognitive Activity and higher order Tasks

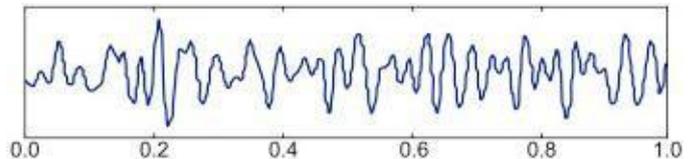


Fig. 6. Alpha Wave Graph

Gamma Wave:

Frequency Range: 40Hz to 100 Hz

Brainwave Stimulus: Cognitive Activity and higher order Tasks

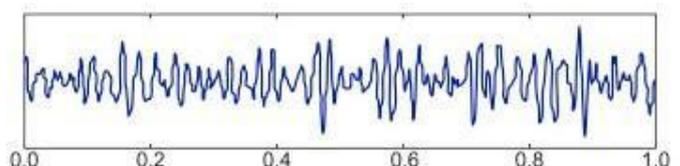


Fig. 7. Alpha Wave Graph

Color

What is color? Color is a visual human perception that helps in creating a more specific information about the object. (Wikipedia contributors, 2019). When light falls on an object, it absorbs some wavelength of light and reflects back the rest. The reflected waves that lie in the visual spectrum of human eye is perceived by the cones cells in human retina. Apart from creating a visual data of the object, colors also help in manipulating the mood of the human being. Thus with proper

selection of colors, architect can help trigger different emotions in a space which can influence the productivity of occupants/ workers. Although colors are rarely connected with productivity, color schemes play a vital role in working environment. (Kamaruzzaman, 2010)According to (Clements-Croome, 2000), productivity depends on four cardinal aspects: personal, social, organizational and environmental.

Color	Wavelength Interval	Frequency Interval
Red	~ 700–635 nm	~ 430–480 THz
Orange	~ 635–590 nm	~ 480–510 THz
Yellow	~ 590–560 nm	~ 510–540 THz
Green	~ 560–520 nm	~ 540–580 THz
Cyan	~ 520–490 nm	~ 580–610 THz
Blue	~ 490–450 nm	~ 610–670 THz
Violet	~ 450–400 nm	~ 670–750 THz

Table 1. Color and its wavelength (Clothiaux, 2006)

HUE	EFFECT
Red	Exciting
Blue	Relaxing,Retiring
Yellow	Cheering Hunger
Green	Relaxing,Retiring
Purple	Subduing
Orange	Stimulating Excitement
Brown	Depressing, Warm
White	Neutralizing
Black	Depressaing
Grey	Neutralizing/ Retiring

Table 1. Colour and its Stimulus (Küller R., 1993), (Kamaruzzaman, 2010)

Light

Nowadays artificial lighting is mostly used in office space. However research shows that natural lighting have better impact on the mood of workers which directly influence the productivity of them. (Knez, 1995).An experiment with indoor lighting by was conducted to demonstrate the effect of different type of artificial lighting in the mood of the occupant. (Leaman, 1995).

Organizations that give importance of day lighting in indoor environment have shown higher occupant productivity in the office(ANDER, 2003).Companies such as VeriFone and Lockheed Martin and have reported a 15% decrease in absenteeism and a 47% increase in attendance, respectively, in buildings designed to provide maximum daylight for their occupants (ROMM, 1994). Natural light has more intensity and compared to artificial electric lighting. They effect melatonin which is a hormone that is responsible for regulating the body's internal clock and functions.(Rea et al., 2002, Van Bommel and Van den Beld, 2004). It relates to the finding that natural light is increases the lazy and monotonous attitude in an office space (Boyce, et al., 2006). These studies shows the importance of natural light for the human body to work efficiently in office. More amount of direct sunlight may also cause visual discomfort while a low level of lighting can lead to ophthalmic discomfort. Thus improper lighting can cause discomfort, hence that range of lighting which is good enough for worker's productivity needs to be obtained.

Sound/Noise

As per World Health Organization, WHO, noise is referred to any unwanted sound. Noise can cause various psychological impact on human productivity. The effects of noise can be described in psychological elements such as irritation, loudness and noisiness (in terms of an auditory response) (BERGLUND, 1996). Acoustic approach depends on two factors: the internal noise level and the external noise level. A building structure should be designed to minimize the disturbance from external noise. (Al Horr Y, 2016)The acoustic design for internal noise in an office depends on the layout of the office, the organizational structure, workforce tasks, and technology. Also comes into account. Depending on a workforce's daily process, an organization may be required to choose between an open-plan and a cellular plan office to manage internal sound levels. Acoustic treatment should be given much importance in office design to achieve maximum productivity of the employees. There are studies that suggest observing and monitoring indoor and outdoor sound levels. It is recommended to compare the observed sound levels to the regional industry standard for an indoor office environment. (Al Horr Y, 2016) Survey can be used to understand the response of the employees for a detailed understanding. There should be an analysis of the recorded range and the actual comfortable range that for better comparison.

Thermal comfort

Research shows that thermal comfort plays an important role in productivity of office occupants. (Al Horr Y, 2016). If occupants aren't in a thermally comfort zone, there may be sign in productivity degradation. (Akimoto) Studies show that temperature change within the range 18°C - 30°C can affect the performance of office employees in activities like typing, problem solving and analytical tasks. The temperature range between 21°C - 25°C is a suitable range of temperature range for better productivity. Researchers have also observed that there is a reduction of occupant's performance by 2% per 1°C increase in temperature in the range of 25°C - 30°C. (SEPPÄNEN, 2006). A research, (FANGER, 1988), focuses on two factors of thermal comfort. First are the tangible conditions whose factors were air temperature, relative humidity and mean radiant temperature. The second is the human aspect which includes, acceptance by human, human sensitivity, and preference towards the thermal state. A thermal state can trigger a various degrees of human stimulus, recapitulating the subjective nature of thermal comfort. The thermal Comfort depends upon the gender, age, activity pattern, clothing metabolic rate, clothing whether of the area. However, there is ample evidence to define a temperature range that is favorable for office employees to perform the majority of tasks efficiently. Research also shows that there is a direct productivity loss due to poor indoor air pollution (FISK, 2000) (WYON, 2004). Some research has been conducted that justifies the quantity of indoor air pollution applicable for a productive work environment (THAM, 2015).

CONCLUSION

Through the following research we understand the design considerations that one must include in their following design strategies for a productive working staff room. The task

carried out by faculty's includes higher cognitive thinking activity.

It has been found that lighter color or white color doesn't strain eyes and is helpful for relaxation and creates a sensation of calmness as compared to other colors. The illumination level at workstation should be around 500 lux while the interior space should be illuminated at around 200 lux. The average internal noise level at the work cabins should be maintained at 35dB to 45dB (should not exceed 50db) and that of the entire room to be around 40 dB to 50 dB. The thermal comfort level depends from person to person, however the indoor air temperature should be maintained at 21^o-25^oC for optimum productivity.

Adding Plantation has proven a better mood changer for the occupants as it maintains a better indoor air quality and also is soothing for the eyes.

ACKNOWLEDGEMENT

It has been a wonderful experience writing this paper and this was not the effort of me alone. I would like to thank my Guide, Ar. Mostafizur Rahman whose valuable insight on this topic helped me complete this paper on time. I would also thank my family and friends whose constant mental support helped me complete this project.

REFERENCES

- i. Akimoto, T. &.i. (n.d.). *hermal comfort and productivity - Evaluation of workplace environment in a task conditioned office. Building and Environment - BLDG ENVIRON*, 45-50.
- ii. Al Horr Y, A. M. (2016). *OCCUPANT PRODUCTIVITY AND OFFICE INDOOR ENVIRONMENT QUALITY: A REVIEW OF THE LITERATURE* . *Building and Environment*.
- iii. ANDER, G. D. (2003). *Daylighting performance and design*. John Wiley & Sons.
- iv. BERGLUND, B. H. (1996). *Sources and effects of low-frequency noise. The Journal of the Acoustical Society of America*, 2985-3002.
- v. Boyce, P., Veitch, J., Newsham, G., Jones, C., Heerwagen, J., Myer, M., & Hunter, C. (2006). *Lighting quality and office work: two field simulation experiments. Lighting Research &Technology*, 191-223.
- vi. Clements-Croome, D. (2000). *Creating the Productive Workplace*.
- vii. Clothiaux, C. F. (2006). *Fundamentals of Atmospheric Radiation: An Introduction with 400 Problems*. Wiley.
- viii. El-Zeiny, R. M. (2012). *The Interior Design of Workplace and its Impact on Employees' Performance: A Case Study of the Private Sector Corporations in Egypt* . *Procedia - Social and Behavioral Sciences*, 746 – 756 .
- ix. Eslam Elbaiuomy, I. H. (2017). *The impact of architectural spaces' geometric forms and construction materials on the users' brainwaves and consciousness statu. InternationalJournalofLow-CarbonTechnologies*, 326-334.
- x. FANGER, P. O. (1988). *Moderate Thermal Environments Determination of the PMV and PPD Indices and Specification of the Conditions for Thermal Comfort. Energy and Buildings*, 1-6.
- xi. Feige, A. W. (2013). *Impact of sustainable office buildings on occupant's comfort and productivity. urnal of Corporate Real Estate*, 7-34.
- xii. FISK, W. J. (2000). *Health and productivity gains from better indoor environments and their relationship with building energy efficiency. Annual Review of Energy and the Environmen*, 537-566.
- xiii. JAN DUL, C. C. (2011). *KNOWLEDGE WORKERS' CREATIVITY AND THE ROLE OF THE PHYSICAL WORK ENVIRONMENT. HUMAN RESOURCE MANAGEMENT*, 715-734.
- xiv. Kamaruzzaman, S. N. (2010). *Influence of Employees' Perceptions of Colour Preferences on Productivity in Malaysian Office Buildings. Journal of Sustainable Development* , 283-293.
- xv. Knez, I. (1995). *Effects of indoor lighting on mood and cognition. urnal of Environmental Psychology - J ENVIRON PSYCHOL*, 201-208.
- xvi. Küller R., M. B. (1993). *Simulated Studies of Color, Arousal, and Comfort*. Springer, Boston, MA.
- xvii. Leaman, A. (1995). *Dissatisfaction and office productivity. Facilities-Vol 13*, 13-19.
- xviii. ROMM, J. &. (1994). *Greening the Building and the Bottom Line - Increasing productivity through energy-efficient design*. Rocky Mountain Institute.
- xix. SEPPÄNEN, O. A. (2006). *Some quantitative relations between indoor environmental quality and work performance or health. Hvac&R Research*, 957-973.
- xx. THAM, K. W. (2015). *Indoor environmental quality, occupant perception, prevalence of sick building syndrome symptoms, and sick leave in a Green Mark Platinumrated versus a non-Green Mark-rated building: A case study. Science and Technology for the Built Environment*, 35-44.
- xxi. W.A.M. Hansika, P. A. (2016). *Impact of Office Design on Employees' Productivity; a Case Study of Banking Organizations of North Western Province in Sri Lanka. 13th International Conference on Business Management 2016* , 622-636.
- xxii. Wikipedia contributors (2019, September 16). *Color*. Retrieved from Wikipedia, *The Free Encyclopedia*: <https://en.wikipedia.org/w/index.php?title=Color&oldid=916027615>
- xxiii. Woodman, R. W. (1993). *Toward a theory of organizational creativity. Academy of Management Review. Academy of management reviews*, 293-321.
- xxiv. Wyatt, S. (2017). *Cubicles don't work. How architectural design affects your brain*. Seattle.
- xxv. WYON, D. (2004). *The effects of indoor air quality on performance and productivity. Indoor air*, 92-101.

Investigation of The Environmental Impacts of Large Scale Hindu Festival Celebrations in Pune in Contemporary Times.

Ar. VaidehiPusadkar, Associate Prof. AditiLanke

BharatiVidyapeeth (Deemed to be University) College of Architecture, Pune

vaidehipusadkar97@gmail.com, avl@bvcoa.in

Abstract - According to census 2001, among the total population of India 80.5% people identify themselves as Hindus (Religion, 2001). Being the largest religion in India, Hinduism will inevitably have a large impact in many aspects in the country. The contemporary celebrations of different Hindu festivals also have a major role to play in the social, cultural and environmental functioning in the country. Paper will present a comprehensive look at the environmental impacts of contemporary celebrations of large scale Hindu festivals. The selected environmental impacts and festival selection are based on literature study.

Keywords – Hindu festival, celebration, environment, pollution, environmental impact

I. Introduction -

India is home to the largest number of Hindus all over the world. Being the oldest religion in the world (Editors, 2017) Hinduism has a history we do yet not know completely about. The fascinating fact is that Hinduism was not established to be a religion but as a mere exploration of truth and a right way of living life, “dharma”. Dharma has made many researchers dive deep into Hinduism.

It is important to know about the history of rituals and festivals and why they were formed, to understand our deviation from the initial intent of these celebrations. As it is known that written language was established much after the civilization was settled, the scriptures were carried through generations via verbal communication called “Shruti” and are authorless viz. Vedas and some were “Smriti” which are a body of Hindu texts usually attributed to an author viz., Ramayana and Mahabharata. These old scriptures became a guiding force for the people in the Indian subcontinent in times of dilemma. With the invasions and migrations of different tribes into the land with their religion and belief systems, Hinduism started to take the form of religion.

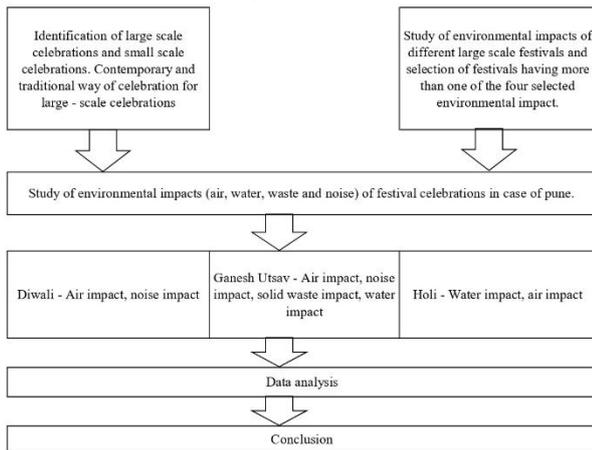
With the powerful Islamic invasions, that the Indians were never seen before, much of the Holy Scriptures, art, and culture demolished. Villages and cities were looted and many were forced to change their religion. As these scriptures were known only to a part of the society, many of Hinduism’s core teachings were stunted only to one class of people.

With the intent of educating the common people about the teachings of their religion, few saints tried to take this knowledge to the grass-root level but saw it difficult to make people understand the language they had never known and hence started a rendition of stories and “rituals” for the understanding and beneficial practices for the commoners. Some of them started merely as a celebration of natural changes like MakarSankranti, some deliberately started by saints for a reason, like Vatpournima, Nagpanchami, and some became a celebration of auspicious days from Mahabharata and Ramayana, and other religious “Smritis”, and some for the birth of gods and goddesses.

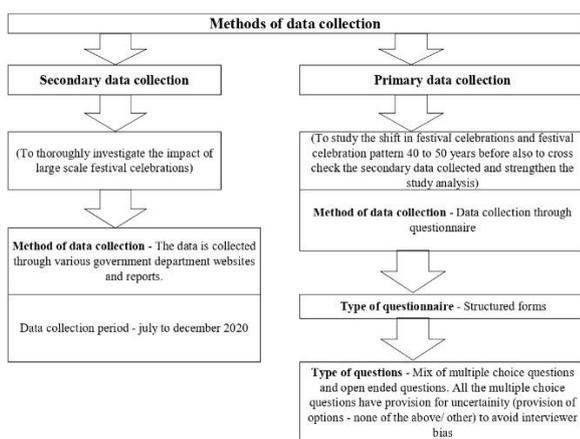
Though these rituals were born and developed and modified at different times, the meaning and purpose behind them and Hinduism’s core philosophy seem lost today. The celebration has become a bigger part than rituals in festivals and thus has become a concern for the government authorities. The topics like noise and air pollution in Diwali, water pollution in Ganesh Utsav, are not alien today. The existing environmental problems soar in festivals. This study will briefly investigate the environmental problems that rose due to contemporary methods of festival celebration.

II. Material and Methodology -

Firstly the various Hindu festivals were categorized on large and small scale and then traditional and contemporary methods of large-scale celebrations were studied. Further, based on literature, festivals having more than one environmental impact were selected. Namely, Ganesh Utsav, Diwali, and Holi. Various environmental impact of these festival’s contemporary celebrations were studied based on secondary data, and questionnaire. Secondary data were referred from various government reports. The sample selected is people of age 50 or more to get a clearer picture of festival celebrations in past and present.



Flow chart-1 Research study methodology



Flow chart-2 Data collection methodology

Through the literature study, various large-scale and small-scale festivals were categorized, and traditional and contemporary ways for large-scale were studied. From the literature study from various reports, newspapers, of large-scale festival's contemporary celebrations following are the environmental impacts derived for the respective festivals through literature study –

Ganesh Utsav – Water, noise, air, solid waste impact

Navratri – noise pollution

Diwali – Air and noise impact

Holi – Air and water impact

Festival celebrations having more than one impact were selected for the study. Following are the literature for environmental impacts of these festival celebrations –

The major pollutants released as vehicle/fuel emissions are, carbon monoxide (CO), nitrogen oxides (NO_x), photochemical oxidants, air toxics, namely benzene (C₆H₆), aldehydes, 1,3 butadiene (C₄H₆), lead (Pb), particulate matter (PM), hydrocarbon (HC), oxides of sulphur (SO₂) and

polycyclic aromatic hydrocarbons (PAHs). While the predominant pollutants in petrol/gasoline driven vehicles are hydrocarbons and carbon monoxide (CO), the predominant pollutants from

SR. NO.	MARATHI MONTHS	LARGE SCALE CELEBRATIONS	ENVIRONMENTAL IMPACTS			
			INCREASE IN SOLID WASTE GENERATION	INCREASE IN WASTE WATER GENERATION	NOISE POLLUTION	AIR POLLUTION
1	SHRAVAN	RAKSHA BANDHAN	–	–	–	–
2	BHADRAPAD	GANESH UTSAV - GANESH CHATURTHI AND ANANTA CHATURDASHI	✓	✓	✓	✓
3	ASHVIN AND KARTIK	NAVRATRI	–	–	✓	–
4	ASHVIN AND KARTIK	DASSHERA	–	–	–	–
5	ASHVIN AND KARTIK	LAKSHMI PUJAN, BHAIUBU (DOWALI)	–	–	✓	✓
6	MARGASHIRSHA TO FALGUN	MAKAR SANKRANTI	–	–	–	–
7	FALGUN MARGASHIRSHA TO FALGUN	HOLIKA DAHAN, DHULIWANDAN/ RANGAPANCHAMI	–	✓	–	✓

Figure- 1 Environmental impacts of festivals

the diesel based vehicles are Oxides of nitrogen and particulates (NO_x). (Status of the vehicular pollution control programme in india, 2010)When burned, the firecrackers emit toxic pollutants, particularly, Sulphur dioxide (SO₂), carbon dioxide (CO₂), carbon monoxide (CO), and particulate matter (PM) along with several metallic compounds. Gunpowder that fuels the flight of a noisy rocket to the metal that gives out the colourful sparkles during the fireworks, everything releases a large amount of harmful air pollutants.(singh, 2017).

For the study of water impact of Ganesh Utsav, the water quality report by MPCB during Ganesh Utsav for the years 2014, 2015, and 2016 were studied. Through these reports, water quality data for the given monitoring points, for pre, post, and during Ganesh Utsav is referred. The data is compared with CPCB standards. For noise impact study of Ganesh Utsav and Diwali MPCB reports are referred. For solid waste impact data various news articles and PMC report is referred. For air impact of the three festivals CPCB national air quality index website is referred for 2018 and 2019.

III. Results and Tables –

Ganesh Utsav – Water impact: The difference between pre and post pH levels has decreased from 2014 to 2016 which suggest the lowering of idol immersion in these water bodies and decrease in POP idols Heavy metal levels are higher in the post Utsav samples than the pre-Ganesh Utsav samples, suggesting the presence of chemical paint in the water. Lowering of heavy metal quantity can be seen from 2014 to 2016.

(MPCB, Water quality on Gnaesh utsav, 2016)(CPCB, Water Quality Requirement for Different Uses, n.d.)

Ganesh Utsav – Noise impact: From (fig 3), the decibel levels for the first, fifth, and last day has decreased from 2016 to 2018, Noise levels at all monitoring points are higher than standard permissible levels.

	pH (max)	D.O. (mg/l) min	B.O.D. (mg/l) (max)	Conductivity (microsemen /cm) (max)	turbidity (NTU) (Desirable - Permissible)	TDS (mg/l) (max)	iron (mg/l) (max)	zinc (mg/l) (max)	copper (mg/l) (max)
class A drinking water	6.5 - 8.5	6 or more	2	—	5 TO 10 (CPCB)	500	0.3	15	1.5
class B outdoor and bathing	6.5 - 8.5	5 or more	3	—	—	—	—	—	—
class C drinking water source after conventional treatment and disinfection	6.0-9.0	4 or more	3	—	—	1500	0.5	15	1.5
class D Propagation of Wild life and Fisheries	6.5 - 8.5	4 or more	2	—	—	—	—	—	—
class E irrigation, Industrial Cooling, Controlled Waste disposal	6 - 8.5	—	—	2250	—	2100	—	—	—
mula river aumdi pre	7.6	5.6	4.8	711.5	1.85	462	0.31	0.05	BDL
mula river aumdi post	7.5	4.7	9.8	501.9	1.4	342	0.92	0.0294	0.01
mula river deccan pre	7.3	1	14	475	12.5	308	0.02	0.02	BDL
mula river deccan post	7.4	1.5	28	598.2	5.7	408	1.45	0.2306	0.05
mula river vitthalwadi pre	7.2	1.3	26	453.5	21.1	294	0.32	0.07	BDL
mula river vitthalwadi post	7.3	1.9	25	593	4.3	402	1.47	0.2	0.06
mula river bundgarden pre	7.4	3	9.5	385.5	1.87	250	0.29	0.04	0.01
mula river bundgarden post	7.4	3.9	11.5	452.2	2.4	308	1.01	0.29	0.03
mula river sainath temple pre	7.1	2.9	4.2	403	1.4	262	0.3	0.03	BDL
mula river sainath temple post	7	1.2	25	301	2.3	206	2.1	0.2	0
mula river holkar bridge pre	7.1	3	5.4	418	1.5	270	0.3	0.03	BDL
mula river holkar bridge post	7	1.8	24	323	18.7	220	3.9	0.1	0

Figure- 2 water quality at various monitoring points in 2016

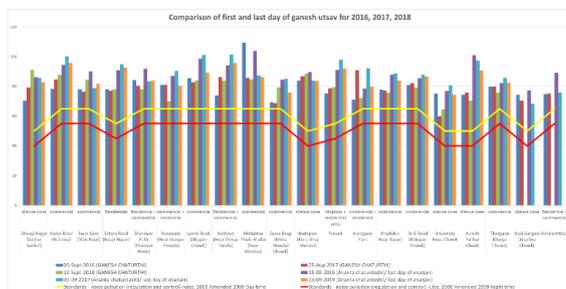


Figure 3 Noise pollution data during Ganesh Utsav for given monitoring points

Ganesh Utsav – Air impact:

From the chart, (refer fig. 4), it can be also seen that the overall pollution level in 2019 has decreased, compared to 2018. The major pollutants have also changed from PM2.5 and PM10 in 2018 to SO2 in 2019, which points towards more vehicular pollution in 2019. **Ganesh Utsav - Solid waste impact:**Idol immersion in the natural water body is declining, but the progress is dawdling. The quantity of wet waste -2018 – 100 to 150 MT per day for 10 days approximately 1000 to 1500 MT (solid waste management office, PMC, pune)2019 – 996 MT (The indian express, 2019)

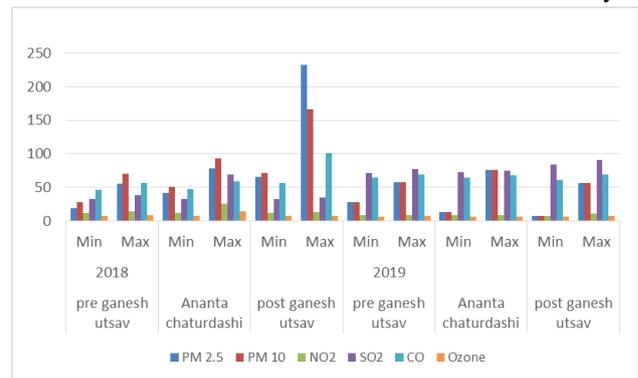


Figure- 4 Air pollutant levels during Ganesh utsav 2018, 2019

Table- 1 Idol immersion in artificial tank and natural water body

Year	Idol immersion in artificial tank
2016	200698
2017	222164
2018	247345
2019	259406
Year	Idol immersion in natural water body
2019	2,70,703
2018	2,83,762

(The indian express, 2019)

As per the survey conducted, shows that the prominent colours on murti are yellow and golden, which has a high content of heavy metals. Idol immersion and nirmalya were disposed of off in rivers by the majority of people in the past whereas today, the majority prefer artificial tanks, Wooden makhar was highly used in the past and the decoration was not changed often, whereas today artificial flowers and fabric decoration has taken precedence with the majority changing the decoration every couple of years. **Diwali – Air impact:**The table 2 shows the overall scenario of Diwali 2018 and 2019. It is quite evident from the data that the air quality in 2019 has improved compared to 2018 with a considerable presence of vehicle pollutants on NarkaChaturdashi and Bhaubijin 2019, and PM2.5, and PM10 being the major pollutant on Laxmi Pujan in both the years.

Table -2 Air quality during DIwali (2018, 2019)

Day	AQI	Major pollutant
NarkaChaturdashi 2018	100 : satisfactory	SO2, PM2.5
Laxmipujan 2018	144 : moderate	PM2.5, PM10

Bhaubij 2018	129 : moderate	PM2.5, SO2
NarkaChaturdashi 2019	83 : satisfactory	SO2, CO
Laxmipujan 2019	91 : moderate	PM2.5, PM10
Bhaubij 2019	101 : moderate	SO2, CO

(CPCB, CPCB, n.d.)

Diwali – Noise impact:

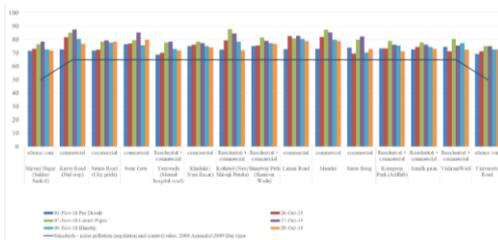


Figure- 5 Noise levels during Diwali 2018 and 2019

(MPCB, Noise level monitoring during Diwali festival period 2019 with comparison of 2018 monitoring), (Noise Pollution (Regulation & Control) Rules 2000 amendment dated 21st april , 2009)

From the figure (fig 5), the noise levels in pre, post, and Diwali day are all above permissible limits even the silence zones. Survey response for Diwali shows that the majority relying on electric lighting today as opposed to oil lamps which were used in past. Flower pot and ground spinner are the most often used firecracker. Flower pot produces high amount of PM 2.5. (Nitnaware, 2019)The use of private vehicles has increased during Bhaubij which is evident through air impact study showing a higher percentage of vehicle pollutants. **Holi – Air impact and water impact:**Holi 2018 and 2019 both had PM10 and PM2.5 as major pollutants. In both years AQI improves from Holika dahan to dhuli wandan. Comparing 2018 and 2019, 2019 AQI is lower. The data regarding Holi water impact was not available in the public domain. As per the survey conducted, the majority of people celebrated Holika dahan with more than 10 families and used cow dung cakes and waste wood. Today as many as 36% of people prefer using wood from the market and the number of groups has increased which increases the number of Holika burned and use of water during holi has increased.

IV. Conclusion –

The above study shows that contemporary celebrations have various environmental impacts on numerous levels and this burdens the already exploited environment. Though people are aware, of the environmental impacts, motivation lacks due to misapprehension of the available data, hence

communicating comprehensive results of this data becomes a key factor.

Acknowledgement:

I would like to express my sincere gratitude to my mentor Associate Prof. Aditi Lanke, my fellow classmates, friends and family for their constant support and motivation.

References

- i. CPCB. (n.d.). CPCB. Retrieved from CPCB air monitoring: https://app.cpcbcr.com/AQI_India/
- ii. CPCB. (n.d.). Water Quality Requirement for Different Uses. Retrieved from Hydrology and Water Resources Information System for India: http://117.252.14.242/rbis/india_information/water%20quality%20standards.htm
- iii. Editors, H. (2017, october 06). history. Retrieved 2020, from history: <https://www.history.com/topics/religion/hinduism>
- iv. MPCB. (2016). Water quality on Gnaesh utsav. MPCB. Retrieved from https://www.mpcb.gov.in/sites/default/files/water-quality/water-quality-status/Revised_Ganesh_Festival_2016_19092018.pdf
- v. MPCB. (n.d.). Noise level monitoring during Diwali festival period 2019 with comparison of 2018 monitoring. Retrieved from https://www.mpcb.gov.in/sites/default/files/whats_new/2019-10/Noise_Level%20Monitoring_Diwali_Festival_2019.pdf
- vi. Nitnaware, H. (2019, october 28). Experts list most polluting crackers. Retrieved from [punemirror.indiatimes.com: https://punemirror.indiatimes.com/pune/civic/experts-list-most-polluting-crackers/articleshow/71788142.cms](https://punemirror.indiatimes.com/pune/civic/experts-list-most-polluting-crackers/articleshow/71788142.cms)
- vii. (2009). Noise Pollution (Regulation & Control) Rules 2000 amendment dated 21st april . Maharashtra government Environment ministry.
- viii. Religion. (2001). Retrieved from CENSUS INDIA: https://censusindia.gov.in/Census_And_You/religion.aspx
- ix. singh, K. (2017, october 20). swacch india. (s. bhaskar, Editor) Retrieved from <https://swachhindia.ndtv.com/diwali-without-crackers-how-different-chemicals-and-metals-in-firecrackers-can-affect-your-health-13725/>
- x. (2010). Status of the vehicular pollution control programme in india. Delhi: CPCB. Retrieved from <http://www.indiaenvironmentportal.org.in/files/status%20of%20the%20vehicular%20pollution.pdf>
- xi. The indian express. (2019, september 14). Retrieved from 12,000 more ganesh idols were immersed in PMC facilities this year: <https://indianexpress.com/article/cities/pune/12000-more-ganesh-idols-were-immersed-in-pmc-facilities-this-year-5993967/>

Aspects of Heritage Management Proposal For M. L. G. Highschool Building In Kolhapur, Maharashtra

Ar. Nandita Shah¹

Allana College of Architecture, Pune, 2nd Year M. Arch. (Construction Management)

Email: shahnandita96@gmail.com

Ar. Naziya Mistry²

Associate Professor at Allana College of Architecture, Pune, M. Arch. (Construction Management)

Email: naziyamistry@gmail.com

Abstract: *Conservationists, Architects, and Project Managers, among others, who are responsible for the preparation of Heritage Management Plans face a real challenge in protecting the built and un-built heritage in order to preserve the architectural and aesthetic qualities of the place for future generations. The Maharani Laxmibai Girls Highschool in Kolhapur, which is listed on the Civic Body of Kolhapur's heritage buildings list, was built in 1881 AD. As a result, it is worth conserving and maintaining because it reflects Kolhapur's rich heritage. This paper would concentrate on different aspects of heritage for taking care of property in good condition in order to prepare a heritage management plan for the built heritage of M. L. G. Highschool. The paper focuses on the unique challenges of project management in heritage conservation.*

Keywords: Built Heritage, Defect Mapping, Conservation, Restoration, Project Management, Heritage Management Proposal

I. Introduction

1. Importance of Heritage Management Plan:

Because of a lack of knowledge, funding, and capability performance, many heritage sites in India have been demolished or are on their way to being demolished. Another explanation is that non-maintenance causes degradation. With careful management and active involvement of stakeholders, the remaining systems can be conserved and preserved in good condition. Heritage sites have a fascinating history and reflect the past culture of countries, towns, and societies. They are what make up an area's architectural heritage. As a result, heritage structures need a critical tool to ensure their preservation. With the right Heritage Management Plan, the obstacles in the conservation process can be solved (HMP). The Heritage Management Plan outlines the Heritage Significance, offers a comprehensive and feasible declaration of Conservation Policy, and delves further into ensuring the item's long-term sustainability and maintenance programmes.

2. Project Management in Heritage Conservation:

The project management method for new construction projects is well understood; however, project management for architectural heritage conservation projects is unique due to the architectural character of each project, the period in which it was designed, and the materials and techniques used. While preserving architectural heritage, historic buildings, and other structures, more time, money, and understanding of how to access their physical condition are needed. Conservation is a time-consuming and costly process that involves a wide range of elements made of various materials as well as a number of conservation conditions.

As a result, the conservation project necessitates a detailed understanding of the structure's and site's features, as well as the approach to designing the intervention, the conservation strategies to be followed, and the various operative procedures to be used. This can be accomplished by multidisciplinary teams working together under the direction of the project manager, using modern methods, procedures, and an effective management strategy.

3. Kolhapur- Heritage Action and Site:

The district of Kolhapur has between 2500 and 3000 heritage sites. As a result, Kolhapur's heritage ideals are enormous. Kolhapur's civic body has identified a number of heritage buildings that will be preserved and conserved with public participation. Heritage sites must be preserved and beautified, according to the KMC's 2006-07 city development plan, in order to communicate Kolhapur's rich past and highlight its importance to visitors.⁽ⁱ⁾ The Juna Rajwada premises are an ancient city townscape, and M. L. G. Highschool is a part of the entire premises that is on the Heritage Buildings to be Conserved list.

II. Location of M. L. G. Highschool

It is located in Kolhapur, Maharashtra, India.

Address: B ward, C ward, Bhavani Mandap, Kolhapur, Maharashtra- 416002

Co-ordinates: 16.7050° N, 74.2433° E



Figure 1: Maps & satellite images showing the Location of M.L.G. Highschool (Source: www.googlemaps.com)

III. History

King Rajaram II of Kolhapur, who reigned from 1866 to 1870, was a modern thinker. He wished to provide educational and medical infrastructure to the residents of Kolhapur state. He intended to begin education for Kolhapur residents as a first step. Major Charles Mant, a British Royal Engineer, was named as the designer. However, King Rajaram died in 1870 AD, before the work could begin. Following him, the construction was carried out by the Regency Council of Kolhapur and British Resident, and the first school constructed was Main Rajaram Highschool for boys, followed by Ahilyabai Girls School for girls in 1881AD. Mr. R. J. Shannon- a contractor, Mr. Fredric Snyder- a political agent, and Mr. Ravbahadur Barve- a palace administrator, were part of his working team. The school was converted into a private high school named Maharani Laxmibai Girls Highschool (M. L. G. Highschool) in 1937 AD.

One new building was added to meet the demand for school facilities, and the Principal residence was later transformed into a G+3 structure, the Primary block.

IV. Architecture

The school is built in the Indo Saracenic Style, which combines vernacular and British Victorian architecture. The entrance to the school leads directly to the main building's arched porch, which is shaped like the English letter "E" with a G+1 frame. The Principal's cabin is located above the porch, with a view of the entire campus. The passage has a plinth 3'6" high and monolithic pillars built out of stone with a sequence of arches, which is the most important characteristic of Maratha architecture. The brick partition walls are plastered with lime stucco. Natural limestone is also used for the flooring. The main building's staircase is made of wood, as is the staircase room's flooring. The windows are French

windows with cast iron jail and



Figure 2,3,4: Images of M. L. G. Highschool (Source: clicked by Author)

MAIN RAJARAM HIGHSCHOOL

timber railings, and the shutters are teakwood louvers, which add to the school's distinctive character. The parapet wall has a traditional Charia feature, which is usually used as the top layer of fortification in Maratha architecture but is used as an



ornamental feature here.

V. Literature Review

The aim of the literature review is to gain a better understanding of the conservation process and to link the project management concept to the activities and phases of heritage building conservation and restoration.



1. Anshul S, Nitesh D, Ashish C, Dr. R. K. Pandit- Techniques and Challenges in construction and project management 2016⁽ⁱⁱ⁾, provides the project management process in the construction work.

2. Aysun G, Gulhan B- Project Management in Conservation and Restoration of Historic Buildings 2019⁽ⁱⁱⁱ⁾, explains the Project Management Process and also about the phases of conservation period.

a. Initiation: project goals and objectives, stakeholders,

- b. Assessment: Appointment of the project manager, documentation
- c. Option: Preparation of different conservation options including time and cost
- d. Project Development: Preparation of drawings of finalized option, work programs
- e. Implementation: Implementation of the work program and controlling of the process
- f. Operation: Preparation of maintenance schedule and recording of the project

3. Davide G, Lucia T- Built Heritage Conservation: A Pilot Site Approach to Designing a Sustainable Process 2019(iv) lays out the phases of the pilot conservation site and their goals.

- a. Phase 1- Condition Survey:
 - Knowledge of site and building characteristics.
 - Knowledge of materials and state of conservation
- b. Phase 2- Assessment of Conservation Treatment:
 - On site testing of conservation treatments
- c. Phase 3- Scale-up for the Executive Project:
 - Definition of conservation methodologies for the intervention

4. Dirk H. R. Spennemann- An Integrated Architecture for Effective Heritage Site Management Planning 2007 ^(v)

The Heritage Management Master plan contains:

- A brief physical description of the place
- A concise contextual history
- A statement of significance
- A management policy that sets out the future use of the place, management objectives, and priorities in case of value conflict

With the adequate and diligent planning, it is possible to manage the Heritage Site efficiently and successfully.

5. INTACH Charter^(vi)

There is an official and legal conservation practice for preserving protected Heritage buildings. Conservation of unprotected heritage, on the other hand, has the potential to support indigenous traditions.

Conservation Ethics:

- a. Treat the conservation as multicultural activity.
- b. Building heritage to be separated in two categories:
 - Buildings/areas protected by ASI/SDA.
 - Other buildings/areas of exemplary significance which, through not protected by ASI/SDA.
- c. Guidelines to be formed to conserve the Authenticity.
- d. Conjectural restoration parameters must be defined through comprehensive urban design studies.
- e. Integrity of the individual building to evolving in response to contemporary needs of local society.

f. In the first attempt conservation must attend minimal intervention.

VI. Issues of the Project Management in the conservation

A close introspection of heritage structure of M. L. G. Highschool reveals that the once landmark of Kolhapur is surviving unattended and without maintained.

The issues in the management are shown in table 1:

VII.Policies regarding the Project Management

Considering the various aspects of the structure and the Project Management in the conservation, the policies for M. L. G. Highschool are:

VIII. Aspects of Heritage Management Proposal for M. L. G. Highschool

Following a review of numerous environmental documents and interviews with conservationists, the following aspects were considered for the management proposal:

1. Initiation:

- a. Defining the project's objectives and goals.
- b. Identifying the Stakeholders: determining the director, project coordinator, advisory authority, government body, and funding sources.

2. Planning/Assessment:

- a. Documentation of the Structure: to learn about the heritage building's history and values.
- b. Grading of the Structure: to list the elements of the structure that are historically significant and prepare a report for grading.
- c. Defect Mapping & Categorization- to identify and categorise defects in the house, such as structural, motif, flooring, and finishing issues.
- d. Researching conservation laws, legislation, and techniques, as prescribed by the Ancient Monument Act, the Archaeological Survey of India, INTACH, and JNNURM.

3. Designing:

- a. Heritage Management Plan Preparation: taking into account all of the above, make a proposal for conservation.
- b. Tendering and estimation method

4. Constructing:

- a. Implementation of the Heritage Management Plan

5. Closure:

- a. Completion of the conservation and heritage management process

6. Repairs and Maintenance

a. Maintenance of the structure- Preparation of the periodic maintenance plan

IX. Conclusion

For more than a century, M. L. G. High School has been educating girls for the benefit of society. Owing to neglect and lack of upkeep, the school's heritage traditions, authenticity, and importance are eroding over time. Following the introduction of a proper heritage management strategy, the school building will once again become a heritage landmark. Within the time frame and budgets allocated for the reason, systematic and scientific project management intervention would aid in sustainable heritage management.

X. Acknowledgement

I am sincerely thankful to D. Y. Patil School of Architecture, Lohegaon, Pune to give me an opportunity to present my research paper in the conference. I am grateful to Ar. Amarja Nimbalkar, Ar. Kiran Kalamdani and Ar. Shilpa Dhawale for sharing the knowledge and guiding me.

XI. References

i. Article- Heritage Panel vows to conserve centuries old structures- April 21, 2015- <https://timesofindia.indiatimes.com>
 ii. Anshul S, Nitesh D, Ashish C, Dr. R. K. Pandit - Journal of Recent Activities in Architectural Sciences 2016, Volume 1, Issue 1, pg.no. 01-11 – <https://www.researchgate.net>
 iii. Aysun G, Gulhan B- SAR Journal 2019, Volume 2, Issue 1, pg.no. 24-30 - <https://www.researchgate.net>
 iv. Davide G, Lucia T- Heritage 2019, Volume 2, pg.no. 797-812- www.mdpi.com/journal/heritage
 v. Dirk H. R. Spennemann- CRM: The Journal of Heritage Stewardship 2007, Volume 4, Number 2 <https://home1.nps.gov/CRMJournal/Summer2007/view2.html>
 vi. INTACH Charter, 2004- Charter for the Conservation of Unprotected Architectural Heritage of India- www.intach.org

The issues in the management are shown in table 1:

ISSUES	IMAGES	POLICIES
Environmental Narrow Approach Road Traffic Congestion No space for Parking		1. Environmental Instead of 2-way, 1-way road has already been planned for traffic to be under control considering the safety of school girls. Providing and designing the parking in nearby barren land
Organizational Structure is under Heritage Action Zone No rights to the school trust for modifications and alterations		2. Organizational Coordination between the Conservationists, Civic body and the school trust Involvement of stakeholders in the conservation process

<p>Architectural</p> <p>Aesthetically unpleasant Entrance Gate</p> <p>Inadequate Space and Infrastructure</p> <p>Unplanned and unorganized extension with visual disharmony between old and new structures</p> <p>No Landscaped Area</p>		<p>3. Architectural</p> <p>Designing the Entrance gate in harmony with the structure without hampering the fabric of the structure</p> <p>Alterations and additions of spaces</p> <p>Minimising the disharmony between old and new structures</p> <p>Designing of toilet block</p> <p>Redesigning the interiors and landscapes</p>
<p>Constructional</p> <p>Lack of Maintenance</p> <p>Broken Shutters of doors & windows</p> <p>Peeling of Plaster and paints</p> <p>Loosely hanging electrical cables</p>		<p>4. Constructional</p> <p>Regular monitoring and maintenance</p> <p>Repairing of broken elements</p> <p>Repainting the structure</p> <p>Providing new concealed wiring system</p> <p>Dismantling of temporary toilet blocks and providing new blocks</p>

Challenges and Strategies of Solid Waste Management during Covid-19 Conditions at Kalaburagi

Ar. Anusha Akki , Ar. Manasi Kulkarni

Bharti Vidyapeeth college of Architecture, Pune, India Email: anusha.akki96@gmail.com

Abstract: This research focuses on the effective management of solid waste by analyzing the challenges faced during the pandemic. It gives information about the impact of pandemic on MSW management and the factors influencing virus transmission through waste handling procedures. Due to rapid urbanization, the waste production has been increased and improper management of waste has led to various environmental problems. This paper includes personnel interviews with health inspector, management workers and residents of the particular ward to know the challenges faced and the changes that have been occurred before and after pandemic. Analyzing these challenges, there are few changes that has been recommended and concludes with the advantages of proper management of municipal waste.

KEYWORDS: Municipal solid waste, municipal solid waste management, sustainable waste management, Hazardous waste, pandemic Situation and Recycle

INTRODUCTION

Solid waste management (SWM) is one of the crucial service in the community. It includes planning, directorial, financial and authorizing functions. The management varies from residential to industrial waste generators and from rural to urban areas.

The prime objective of SWM is to decrease and abolish the terrible impacts of waste on human health and environment. This has to be carried out in the most efficient way.

DEFINITIONS: Municipal Solid Waste (MSW) - is defined as waste collected by the municipality or disposed of at the municipal waste disposal site and includes residential, industrial, institutional, commercial, municipal, and construction and demolition waste (Hoornweg et al., 2015)

Municipal solid waste includes commercial and domestic wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes.

Municipal Solid Waste Management (MSWM) - the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease

Source: https://en.wikipedia.org/wiki/Waste_management

AIM

To study the effective management of solid waste by analyzing the challenges faced during the pandemic in the ward-42, Kalaburagi and recommend effective strategies for MSW management.



Figure-1 Figure showing Sustainable waste management

Source: <https://www.thebalancesmb.com/an-introduction-to-solid-waste-management>

2.0 OBJECTIVES:

- To study the impact of COVID-19 Pandemic on MSW management system.
- To identify the challenges that are faced for waste management.
- To study the factors influencing the virus transmission through MSW handling.
- To develop the effective strategies for sustainable solid waste management during Current pandemic situation.

Table -1 showing research objectives and data collection method

OBJECTIVE	Research questions	Sub-Questions	What data is required to answer these questions	Data Collection methods	Method for analysis
1. To study the impact of COVID-19 Pandemic on MSW management system.	1. what was the normal procedure carried out before the pandemic?	What is MSW?	Definitions	1.Literature Review 2.Questionnaires 3.Online Survey	Briefing the context
	2.What are the changes that have been adopted or seen afterwards the pandemic?	What is MSWM ?	Definitions		
2.To identify the challenges faced for waste management.	What are the problems faced?(Management workers & Residents)	What are the impacts of COVID-19 Pandemic on MSWM	Surveying	1. Questionnaires	Briefing the context
	Impact on workers by handling the MSW				
3. To study the various factors influencing the virus transmission through MSW handling.	Whether they are training the workers in handling the MSW?	How is the waste collected from the hospitals and quarantine centres?	Preventive measures that should be taken by the management workers & Residents to stop the further transmission of virus	1.Literature Review 2. Questionnaires 3.Online Survey	Inference
	Whether they are adopting all the preventive measures that should be taken by the workers like provision of PPE kits, Sanitizers etc?				
4. To develop the effective strategies for sustainable solid waste management during current pandemic situation.	The frequency of waste collection by the municipality before and aftermath of the pandemic?	---	Surveying	1.Literature Review 2. Questionnaires	Inference
	Whether the residents segregate (hazardous domestic waste) before handing it over to the municipality?	---	Surveying		
	Whether there any norms or rules made by the Govt. that should be followed by the residents in handling over waste to municipality?	---	---		

3.0 NEED OF THE RESEARCH:

- To control different types of pollution, i.e., air pollution, soil pollution, water pollution and preserve environment
- To stop the spread of infectious diseases.
- To conserve all our environmental resources, including forest, minerals water etc.;
- To recycle of hazardous wastes for further production.
- To sustainably manage the municipal solid waste.



Figure-2 Figure showing Need of proper waste management

Source: <https://www.linkedin.com/pulse/importance-waste-management-recycling/>

4.0 METHADODOLOGY:

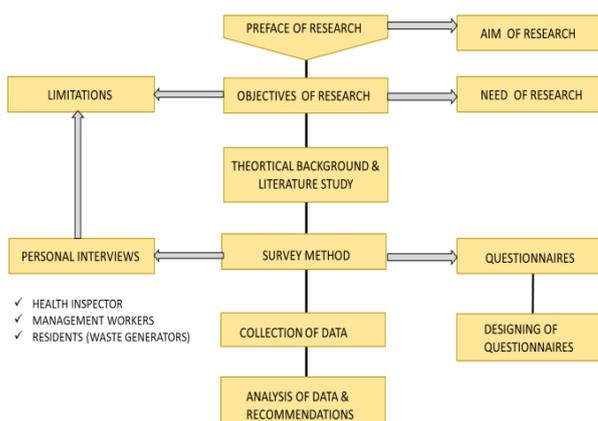


Figure-3 Figure showing Methodology for Research

SCOPE:

- To understand the benefits of proper management of solid waste during the current pandemic situation.
- Opportunities for sustainable MSW management during this pandemic.

LIMITATIONS:

- Limiting it to the waste management carried out in a single ward.
- Limiting it to only the issues faced by workers and public and about proper management.

LITERATURE REVIEW:

The generation of waste increased rapidly with the growth of population. In most of the cities, the final disposal of waste is by burning, dumping into water bodies or open sites. This poor management of waste led to major impact on

environment and human health.

If this waste management is done by all individuals at their own site, can reduce the burden on the municipal solid waste management system and also help to overcome the contamination of environment and impact on human health to a large scale.

Before COVID-19, the waste management sector was trying to attain sustainability by approaching the segregation and recycling and also by reducing the waste generated.

Once COVID-19 was declared as a pandemic, India announced a nationwide lockdown for 21 days, which was further extended to another 19 days.

Now, municipalities are collecting waste at different frequencies. In few areas, the waste is being collected on alternate days, whereas at others, only once a week. Waste that is collected by the municipalities is being disposed of in landfills or dumping yards.

There is no secondary segregation happening because workers are feared of getting infected by the COVID virus. There are no buyers of segregated waste as recycling plants are closed.

Recycling units may not get the required supply of waste material from segregator's and their operational cost may go high. This would make operations less feasible to run.

Domestic hazardous waste (that includes gloves, masks, PPE's, shields, syringe etc.) collection in a isolated way has not been successfully implemented which can be a potential carrier of virus from the quarantine centres and various hospitals.

There are chances of further spread of the coronavirus due to poor waste handling conditions associated with inappropriate use of personal protective equipment and other unfavourable conditions evaluates different aspects of MSW management during pandemics

Presence of any potential source of infection on wastes collected from hospitals and residential premises with COVID-19 positive cases will risk the health of person who is involved in waste management. COVID-19 spreads by droplets of the respiratory system by someone with the virus, which implies that it would spread with higher proximity of people, larger contact networks and lower levels of hygiene

The analysis focuses on various types of waste generated during the COVID-19 outbreak that impact the existing MSW management practices.

There are various guidelines issued by SBM (Swachh Bharat

Mission) and CPCB (Central Pollution Control Board) for ULB's (Urban Local Bodies) like segregating DHW in a yellow coloured bin and then handing it over separately to the municipal authority and also not disposing it the very same day it has been generated, as it can spread the infection.

By overcoming the challenges that are been identified, it eases to handle the current situation properly, stopping the virus spread rapidly and also helps to overcome the impact on human health and environment. According to the 11 March press releases of the State Council's joint prevention and control mechanism in India, the amount of MSW in large and medium sized cities was reduced by 30.00% during the disease outbreak. However, the generation of medical waste (infectious and non-infectious) increased sharply (+370.00%)

(<https://www.downtoearth.org.in/blog/waste/how-china-plans-to-phase-out-single-use-plastics-by-2025-69035>)

(<https://www.youtube.com/watch?v=8XnTZ6ooiro&feature=youtu.be>)

60.00 to 70.00% of the generated waste is transported to landfills, while the remaining 30.00 to 40.00% ends up in rivers, burned or independently managed by the community waste materials generated from households and quarantine facilities with the infected or suspected patients may contain possible SARS-Cov-2 and could be a source of infection for people outside the facility

Managing medical waste from hospitals is a demanding task as residual pathogens have to be destroyed prior to disposal. These wastes are classified before their further processing; the typical composition of healthcare waste is approximately 85.00% general non-infectious, 10.00% infectious/hazardous and 5.00% chemical/radioactive

The effective strategies for sustainable solid waste management during current pandemic situation (Secondary Data)

Temporary waste storage and reduction site

➤ It's a place where waste is stored temporarily. At this stage the waste that has been collected can be treated or reduce the volume before the final disposal.

➤ This solution can be a better strategy of waste management during Covid conditions. The waste that has been collected can be left untouched to about 4-5 days, this helps in killing the virus, if present. Thus, reducing the virus transmission through contact and then further carrying out the treatment of waste or reducing the volume.

➤ Other strategies can be a thermal treatment that is waste to energy conversion. (This can impact on the air quality.). Studies have reported that volume reduction of 80.00 to

95.00% is achievable for generated waste by thermal conversion technologies.

Solid Waste Management Challenges during the COVID-19 Pandemic:

➤ Inappropriate collection, transportation and disposal of infectious MSW may lead to spread of SARS-CoV-2.

➤ The informal workers who would collect the waste, segregate and sell it to the recycling companies are affected by the lockdown and are not in the situation to get PPE kits masks or gloves for themselves in order to avoid the contact with the infectious waste.

➤ The volume of medical waste has increased by up to 40 percent.

➤ As all the recycling companies were stopped during the lockdown, even recyclable material were disposed at the landfills. This led to the increase of waste disposed at the landfill.

The rate of use of SUP (single use plastics) increased after the pandemic due to increased use of PPE kits gloves, masks and disinfectant bottles etc.

Increased generation of municipal waste has made it financially and physically challenging for municipalities to cope.

Source: (Resources, 2020)

DATA COLLECTION:

AREA COVERED:

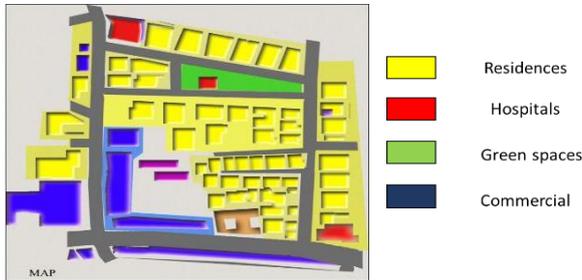


Figure-5 Map showing Area covered for the study.

Source: Google map/Satellite view

- City – Kalaburagi, Karnataka
- Ward no. – 42
- Ward name - Brahmipur
- Total area – 16312.51 Sq.Mts.(1.63 Hectors)
- Perimeter – 510.45 Meters
- Total number of workers - 15 (8males & 7 females)

- Type of collection- Door-to-door collection.
- No. of vehicles assigned -2
- Landfill assigned - Kotnoor area(25 acres) & Udnoor village(28 acres)
- Street sweepers - Alternate day



SL.NO.	SOURCES OF WASTE	NUMBERS	Segregate/No	Type of waste generated	FREQUENCY	INCINERATION
1	Residences(Individual)	46	YES	Kitchen waste, Glass, Paper, Plastic, Metal, Fabric waste	On daily basis	Not Required
2	Apartments		NO			Not Required
A	4					
B	13					
C	12					
3	Commercial Complex		NO	Paper, Plastic, Glass, Metal waste	On daily basis	Not Required
A	12					
B	7					
4	Small Hotels	2	YES	Kitchen waste, Glass, Paper, Plastic	On daily basis	Not Required
5	Street Sweepings			Paper, Plastic, Glass, Metal waste	Once in a week	May Require
A	type roads in KMS		YES			
B	type roads in KMS		YES			
6	Hospitals	3	YES	General waste, infectious waste, Hazardous waste, Radioactive waste	Alternate Days	Required
7	Infected Houses	11	YES	Kitchen waste, Glass, Paper, Plastic, Metal, Fabric waste + Domestic hazardous waste (DHW)	On daily basis	Required

Figure- 6 Map showing the typologies of buildings covered under study.

PRIMARY DATA:

Table-2 showing Typologies of buildings and the waste generated.

NOTE:
No. of houses affected by COVID infection - 8 No.
General waste - Paper, Plastic
Infectious waste -Blood, Human tissue, Contaminated body fluids, PPE Kits, masks etc
Hazardous waste - Sharps, Discarded surgical equipments, some Chemical waste
Radioactive waste - Cancer therapies, Medical equipments that uses nuclear elements
Domestic Hazardous waste (DHW) - PPE Kits, masks, sanitary wastes, Sharps etc

SCENARIO BEFORE COVID CONDITIONS:

- The waste generated is collected with the help of twin bin dumpers, tractors and a compactor. Even tricycles are used where the dumpers cannot access the narrow streets.
- Door-to-door collection is done throughout the city. Intermediate storage depots are absent in the city.
- Once collected, the waste is then dumped into a large vehicle (compactor) where it is then transported to the landfill site located at Udnoor village which is 13kms away from the city centre.

- At landfill, final segregation of the waste will happen further the dry waste will be sent to the recycling companies and wet waste was just dumped there after compaction.
- Separate vehicles have been assigned by common health waste appropriate management plant (CHAMP) facility for collecting bio-medical waste and dumped at a different landfill located at Kotnoor village.
- This NGO handles the collection, transportation, treatment and disposal of healthcare waste from all the healthcare centres.



Figure- 7 Different sources of collection of waste

PROCESS OF MANAGEMENT AFTER COVID:



Figure - 8 Process of solid waste management after Covid for Infectedhouses.

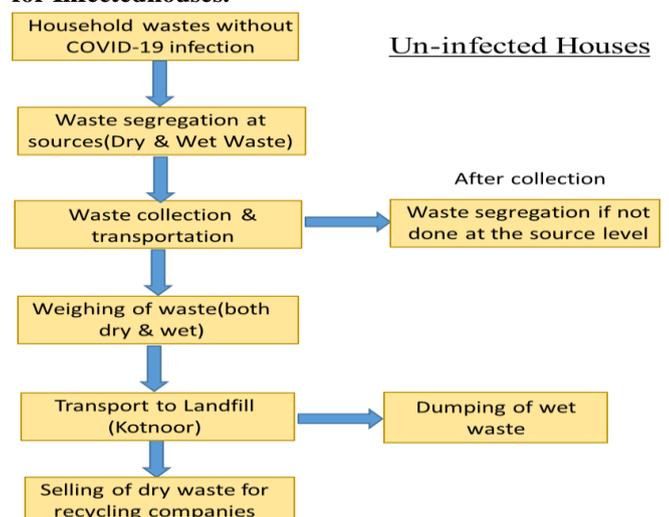


Figure- 9 Process of solid waste management after Covid

NOTE:

- People from District Health office (DHO) inform municipal office about the infected houses so that they can avoid collecting waste from the particular infected houses.
- Separate 6 vehicles are assigned for collecting waste from infected houses and COVID centre's throughout the city.

QUESTIONERIE SURVEY:

A) Health Inspector of the ward

1. What was the normal process carried out for the municipal solid waste management?
2. What are the changes that have been adopted aftermath the pandemic?
3. What are the problems faced?
4. Weather they are training the workers?
5. How many vehicles have been assigned to carry the waste from the ward?
6. Weather they are adopting all the preventive measures like provision of PPE kits etc.?

B) Management workers:

1. Weather they are trained towards handling waste (collection, segregation and its disposal) and if yes what is the training that they are provided for handling?
2. Weather any special rules are framed to follow during COVID Conditions for MSWM
3. Where do they dump the waste collected and what happens further like weather they recycle or just dump it into the landfills?
4. Any other changes that have been implemented after the pandemic arrival?
5. Problems faced by them during the entire process?
6. How is the waste collected from the hospitals and quarantine centres?

C) Residents Of The Ward:

1. The frequency of waste collection by the municipality before and aftermath of the pandemic?
2. Weather they segregate (hazardous domestic waste) before handling it over to the municipality?
3. What are the problems faced at their end?
Weather they follow the rules made by the municipality?

REVIEW OF QUESTIONERIES: (Primary Data)

CHANGES AFTERMATH THE PANDEMIC:

- No major changes have been seen in handling waste before and after COVID.
- Segregation if not done at the source was carried out at the municipal office by the workers before covid.
- This was affected during the lockdown for around 2 months (April & May). Segregation was not done once collected if at all it was not segregated at the source level.

for Un-infected houses

- After lockdown Separate 6 vehicles are assigned for collecting wastes from infected houses and centre's throughout the city.
- Separate land has been assigned within the existing landfill for dumping waste from these infected houses and centres. Other than that all the other process was carried out like before pandemic.
- Awareness was created among the workers.

AWARENESS AMONG MANAGEMENT WORKERS:

- Awareness was created among workers by enacting drama about importance of wearing mask, gloves, gum boots and using sanitizer.
- All the workers were provided with mask, gloves, gum boots and sanitizers.
- They have **NOT** provided any PPT kits for the workers or any other persons handling waste management.
- They were informed not to collect the waste from the COVID infected houses, as a separate 6 vehicles are assigned to the whole district to collect the waste from COVID infected residences and centres.

Management workers:

- There are few instructions given to the management workers regarding collection of the waste aftermath the pandemic like wearing mask, gloves and spectacles etc.
- There is no provision of PPE kits for them.
- They are instructed to provide a yellow bin to the quarantined houses and collect it every alternate days as it needs to be not in contact for at least a day.
- Before pandemic the waste collected used to be dumped and undergoes the segregation process further all the non-recyclable products would be dumped into large dumpingsites located in the outskirts of the city.
- But after the pandemic the waste collected is directly been dumped into the dumping site which is increasing the quantity of dumping waste. This is due to the afraid of spreading infectious covid virus.
- As no proper preventative measures have been taken by the municipality the management workers are under great risk in handling of the waste which in turn is causing improper management of the waste
- The management workers collecting waste from the hospitals and quarantined houses are instructed to wear the PPE kit which needs to be incinerated. The biomedical waste has a separate dumping site away from the city and also the dumping site of other municipal waste which needsto undergo **incineration**.

Residents of the Ward:

- Most of the residents do segregate the dry & wet waste.
- The people from the quarantined houses are instructed to segregate the hazardous and non-hazardous waste. This is termed as domestic hazardous waste (DHW) which is to be dumped in a yellow bin provided by the government and then hand it over to the municipality separately for every alternate days. This waste should not be in contact at least for a day.
- The frequency of collection of municipal waste is on daily basis.
- Before the pandemic the rag pickers would directly purchase the paper, glass waste etc. from the residents and sell it to the recycling units to make some money out of it. By this primary segregation of dry waste and wet waste would happen at the source of waste generated.
- But after the pandemic the rag pickers had stopped coming to collect the dry waste due to risk of spreading virus. Thus leading to lessen the recycling waste and increasing the waste going to dumping sites.

9.0 RECOMMENDATIONS FOR PROPER WASTEMANAGEMENT AFTERMATH PAMDEMIC:

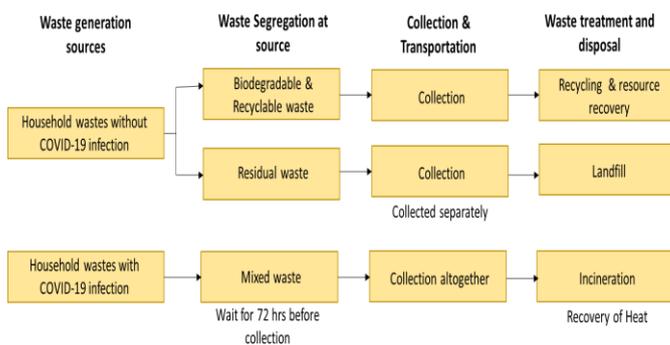


Figure- 10 MSW management recommended aftermath the pandemic

CONCLUSION:

- Creating awareness among the public about merits of proper segregation of dry, wet and domestic hazardous waste (mask, gloves, PPE Kits etc.) at the source level itself which helps the municipal authority in proper treatment of waste.
- Providing all the accessories like PPE Kits, masks, gloves to the management workers and taking all the required preventive measures and creating awareness about using the masks, gloves etc. by enacting drama or any other ways will be helpful.
- Specific colored bags can be provided by the municipality to households for disposal of PPE Kits, masks & gloves in secured bags, which makes them trouble-free for separation and treatment of this waste along with bio-medical waste.
- Collecting it separately along with bio-medical waste helps

to treat it in a proper way which avoids further spreading of virus by least contacting.

- Research on eco-friendly and reusable PPE Kits and their production.
- By upgrading the methods in collection of waste such that there is least contact of human by adopting automatic systems.
- Mobile incineration plants can be adopted at the collection sites of COVID centers or quarantined areas, thus minimizing the risk to workers & public by minimizing the rate of spreading by contact the infectious waste during its transportation and treatment.
- Temporary waste storage and reduction site (TWSRS) are the sites where waste can be stored temporarily. Here the waste is just dumped without contacting it, to about a week. This helps in stopping further spread of infection by not contacting infectious waste for long time. The further process of sorting, shredding and chipping can be carried out later.
- Thermal treatment with energy recovery can be adopted for treating infectious waste.

While solid waste management was already intricate to handle, the invasion of pandemic (SAR-CoV-2) made it more critical. As dependence on single use plastic (SUP) went on increasing during this pandemic, the waste generation also increased compared to the days before pandemic. This waste, besides being increased was also one of the major source of transmission of virus, if not handled properly. Management workers are one of the major community who are affected by improper handling of infected waste. So it becomes important to make them aware about the preventive measure that can be undertaken to avoid from being infected. Few recommendations and guidelines have been discussed above which helps to handle the waste without further transmission of the infection. Solid waste management becomes one of the important sector, because it has adverse effects on human health and environment, if not managed properly.

REFERENCES:

- i. <https://www.thebalancesmb.com/an-introduction-to-solid-waste-management>
- ii. <https://www.britannica.com/technology/solid-waste-management>
- iii. https://en.wikipedia.org/wiki/Waste_management
- iv. <https://www.linkedin.com/pulse/importance-waste-management-recycling-dee-mohammed/>
- v. <https://www.downtoearth.org.in/blog/waste/how-china-plans-to-phase-out-single-use-plastics-by-2025-69035>
- vi. <https://www.google.com/maps/@19.1358029,72.8358029,15z>
- vii. (Bhargavi N. Kulkarni, 2020)
- viii. (Bhatnagar, 2020)
- ix. (COVID-19's Impact on the waste sector, 2020)
- x. (Geeta R, 2017)
- xi. (Krishna Udnoor, 2016)
- xii. (Naik, 2017)
- xiii. (Resources, 2020)
- xiv. (Vanapalli, 2020)

Comparative Analysis of Simulation Tools for Artificial Lighting Design in Office Space

Ar. Akshay A. Jadhav, Ar. Manasi Kulkarni

Bharati Vidyapeeth College of Architecture (Deemed to be University) Pune, India

Email: akshayjadhav118@gmail.com, 1918110010@bvcoa.in; kulkarnimana@gmail.com

Abstract: *Lighting accounts for the second-largest amount of energy consumption in buildings. Lighting simulation tools help in providing optimum solutions for designing efficient fixtures, hence are extensively practised among professionals to achieve energy efficiency. Despite the availability of several lighting simulation tools, ambiguity to select feasible tool is still an apprehension. This research paper compares selected simulation tools namely Dialux, Relux and AGi32 (Elumtools) in terms of simulating artificial lighting in a hypothetical office space on identified parameters. The paper concludes with a comparative analysis of simulation tools and recommends the most favourable to least favourable simulation tool for analysing artificial lighting.*

Keywords: Artificial lighting, Simulation tools, Dialux, Relux, AGi32, ElumTools, Lighting software.

I. Introduction

Energy consumption in buildings contributes about one-third of the world's primary energy. Lighting accounts for 19% of the world's electricity consumption in buildings [i]. In India, Lighting is the second-largest amount of energy consumption sector in buildings that is responsible for about 28% of energy use in residential buildings and 25% in commercial buildings [ii]. According to the State Energy Efficiency Index report, 2018, It is projected that electricity demand in commercial buildings is predicted to rise by three folds by the year 2032 where a significant part of electricity is consumed through electrical lighting thus making indoor artificial lightings a significant contributor in rising energy consumption. As human beings devote most of their time indoors, providing suitable lighting leading to good visual comfort is essential which can be achieved by appropriate light intensity and distribution of artificial lighting in the buildings.

A paper by Liu (2010) stated that "lighting design is considered as one of the essential elements of building design and one of the significant challenges when addressing building sustainability" [iii]. According to the Energy Conservation Building Code (ECBC), it is also extremely important for India to explore new electricity generation alternatives and conserve electricity to manage consumer demands [ii]. Both conserving lighting use and adopting more efficient technologies can yield substantial energy savings.

There is an extensive range of lighting simulation tools available in the industry developed for achieving efficiency goals. A paper by Baloch (2017) discusses that "Simulation allows artificial objects and dynamical roles variations to optimise the maximal use of lighting systems in buildings" [iv].

Simulation tools could benefit from predicting energy savings, thus helping designers in making informed building design decisions to provide an accurate simulation that is perceptually, mathematically and logically correct. These tools can help in choosing the right architectural and technical solutions in achieving a comfortable built environment while reducing energy consumption.

Despite the availability of many lighting simulation tools, ambiguity for the designers to select a suitable simulation tool is still an apprehension and the study of such sophisticated lighting simulation tools in building design practices are currently limited. Hence, a comparative analysis is necessary which will help designers in choosing feasible simulation tool suitable for their requirements.

Objectives for the respective paper are, firstly, studying the guidelines for artificial lighting design by prominent Green Rating Systems in India and identifying parameters for comparative analysis and perform artificial lighting simulation on hypothetical office space by each selected tool. Secondly, perform the comparative analysis of the selected artificial lighting tools and study simulation results. Lastly, discussing and recommending the most favourable to least favourable simulation tool for analysing artificial lighting design.

II. Material and Methodology

Bureau of Energy Efficiency (BEE) has provided approved simulation tools for various requirements in the building industry which only mentions tools that are practised for analysing the 'Whole Building Performance method' and 'Daylighting' only [v]. There is a lack of approved simulation tools identified exclusively for analysing artificial lighting, all though some simulation tools mentioned by BEE for analysis daylighting also perform artificial lighting simulations as well. To fill this gap, three simulation tools were identified for the comparative analysis namely Dialux [vi], Relux [vii] and AGi32 (Elumtools) [viii] which is a plugin for Autodesk Revit by AGi32.

Selected simulation tool’s version:

1. Dialux Evo 9.1
2. Relux 2020.2.5.0
3. AGi32-Elumtools 2020.8 (Revit plugin)

This study examined guidelines for artificial lighting design by Green Rating for Integrated Habitat Assessment (GRIHA), Indian Green Building Council (IGBC) and Leadership in Energy and Environmental Design (LEED); also building regulations like National Building Code (NBC) and Energy Conservation Building Code (ECBC) for identifying primary and secondary parameters for comparative analysis. Primary parameters were depended on simulation tools and secondary parameters were depended on the simulation results of the artificial lighting design.

Case Selection and Description: T

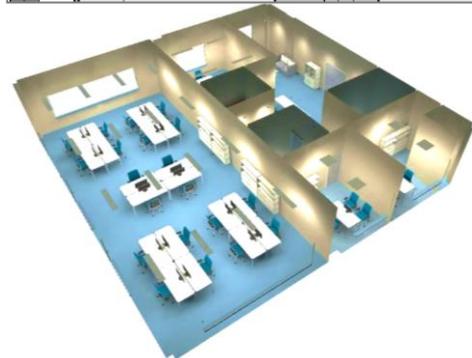
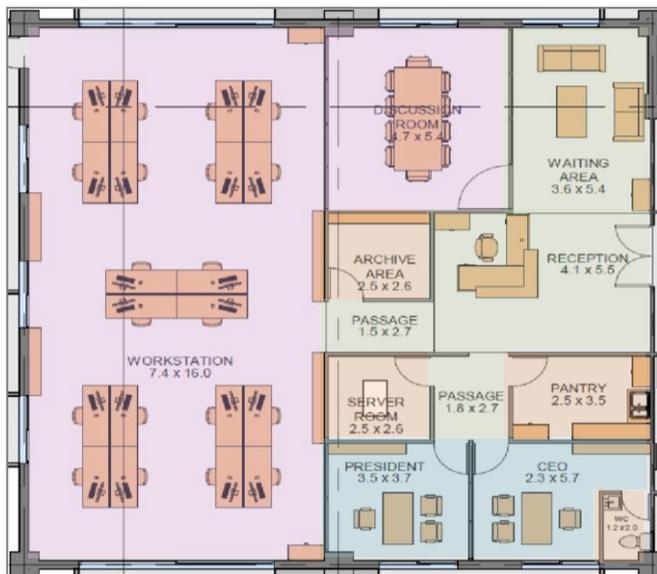


Figure 2: 3 D View of Office Space

The hypothetical office space was considered to be designed as per the requirements of the Information Technology (IT) sector that has a combination of individual cabins, open office workstations and utility areas. Table 1 provides the architectural details defined for the hypothetical office space. Identical Illuminating Engineering Society (IES) Photometric Data Files of the luminaires, provided by the manufacturer [ix]

were used for every simulation case. Table 2 provides the details of the luminaire and their location which were defined in the office space. Figure 1 shows the floor plan of the hypothetical office space designed for the simulation cases and Figure 2 shows a rendered image of the three-dimensional (3D) view of the office.

Table 1: Architectural data of the Office space

Sr. no.	Architectural Data	Description
1	Office dimensions	15.75 m x 15.75 m
2	Floor to floor ht.	3.6 m
3	False ceiling ht.	0.6 m
4	Working plane ht.	0.75 m
5	Surface reflectance	Ceiling - 70%
		Wall/ Partitions - 50%
		Floor - 20%
		Furniture - 25%
6	Activity type	Visual task, high contrast
7	Target illuminance defined	300 Lux (President, CEO, Workstation, Conference & Reception/Waiting area)
		200 Lux (Archive, Server, Pantry & Toilet)

Table 2: Luminaire Details

Sr. No.	Space type	Space name	Luminaire name	3D view
1	Cabin	President’s cabin	RC133V W62L62	
		CEO’s cabin	PSU 1 xLED43S/8 40 OC	
3	Open Office	Conference room	SM480C W24L134 1 xLED40S/9	
		Workstations	40 ACC-MLO	
5	Ancillary area	Reception/Waiting area	DN570B PSE-E 1xLED12S/ 840 C	
7	Utility	Pantry	GD601B 1 xLED27S/9 30 WB	
		Server room		
		Archive area		
9		Toilet		

III. Analysis and Findings

The comparative analysis will concentrate on the tool’s ability to model the scene and the feasibility of simulating artificial lighting in the designed hypothetical office space. The purpose of this testing is not to validate the tool’s accuracy but to highlight any significant difference and similarities between the results produced by them. Before the simulation is performed on any tool, the requirements of the light scene are

matched and kept identical. The existing AutoCAD floor plan was imported in Dialux and Relux for initial referencing from which 3D geometry was constructed. IES photometric data files of the luminaire were imported from the manufacturer's website and kept identical in every simulation tool as mentioned in table no. 2.

Input features: An important characteristic is importing the ability of 2D or 3D models from standard formats like Dwg and Dxf because there is a significant interest found among the users to use models built for other purposes. Differences are found in the importing and management ability of these formats among the tools. Table 3 provides the comparison for input file format respectively.

Table 3: Input File Format Comparison

Sr. no.	File format	Dialux	Relux	AGi32 (ElumTools)
1	Dxf	Yes	Yes	NA
2	Dwg	Yes	-	NA
3	3ds	Yes	Yes	NA

Scene modelling: All simulation tools used in this research are capable of modelling a 3D space. Dialux and Relux provide a built-in library for 3D objects. In some cases, build-in object libraries are an advantage; on the other hand, they can limit the number of polygons and detail definitions. In the case of AGi32 (Elumtools) a wide variety of 3D object can be used as it is powered by the Revit platform which is a complete 3D modelling tool.

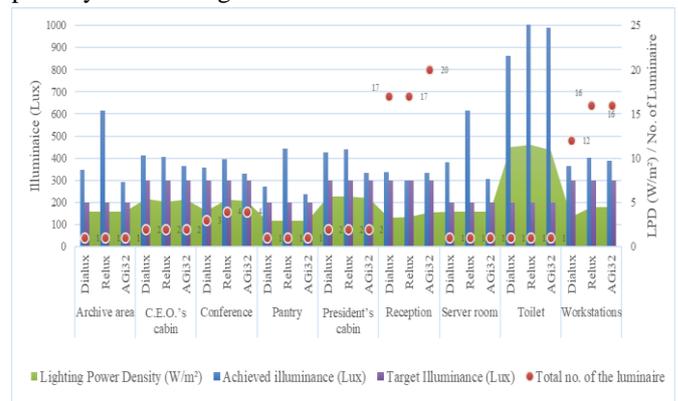
Luminaire Modelling: All three tools assessed in this study accept IES photometric format. Dialux, Relux, and AGi32 (ElumTools) can take luminaire definition in greater detail by downloadable luminaire definitions from the manufacturers. They also provide the opportunity to modify the parameters of luminaire like luminous flux output, lamp colour, the dimension of the luminaire, luminaire arrangement, mounting height, etc.

Importing of IES files having photometric data in both, Dialux and Relux was accomplished without difficulty. In the case of AGi32, the direction of the luminaire was falsely set after importing the IES data file and was corrected manually by editing the luminaire family in the Revit platform. Hence in term of luminaire modelling, Dialux stood first compared to others, Relux was second followed by AGi32 (Elumtools).

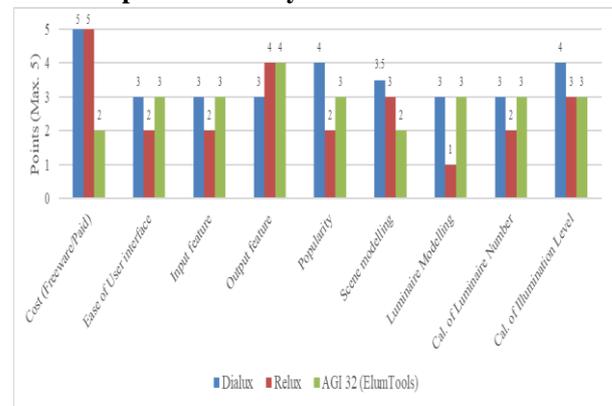
Calculation of Luminaire Number: Dialux, Relux, and AGi32 (ElumTools) are capable of calculating the required number of luminaires for a defined area. Total luminaire calculated in the office scene by Dialux were 40 no., by Relux and AGi32 (ElumTools) were 41 no. The difference in the number of the luminaire can be seen in the Conference room

where Relux and AGi32 calculated 4 no. of luminaire whereas Dialux calculated only 3 no.

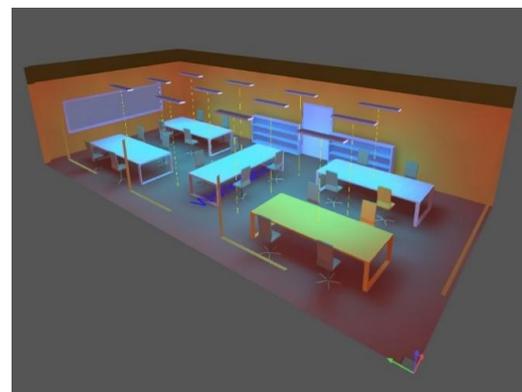
Dialux and Relux were not able to consider the ceiling tile grid when an automated luminaire arrangement was considered. Even though the ability to customise the position of luminaires is available in both, it can raise complexity and include an extended manual arrangement process. AGi32 (ElumTools) considers customised ceiling tile grid arrangements for luminaires. Automated calculation of the required number of luminaires are not always found most energy-efficient but meets uniformity of illuminance criteria. Failure to consider the ceiling tile grid is found to be a primary disadvantage for both Dialux and Relux.



Graph 1: Summary of Simulation Results



Graph 2: Comparison of Simulation Tools



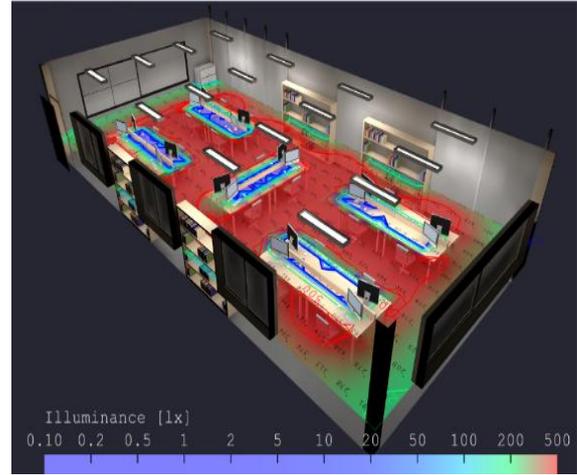
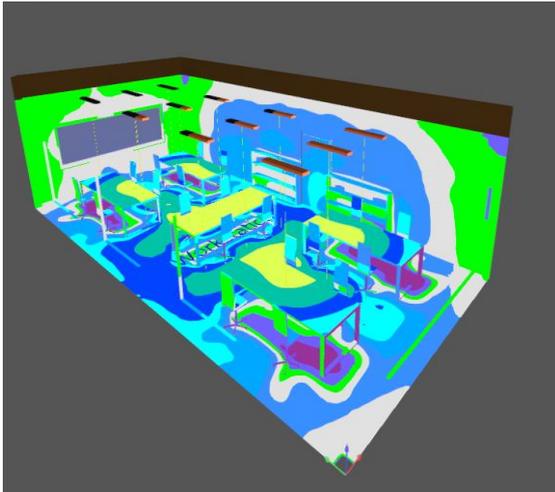


Figure 3: Dialux - Rendered view (left) and pseudo colour view of luminance distribution (right)

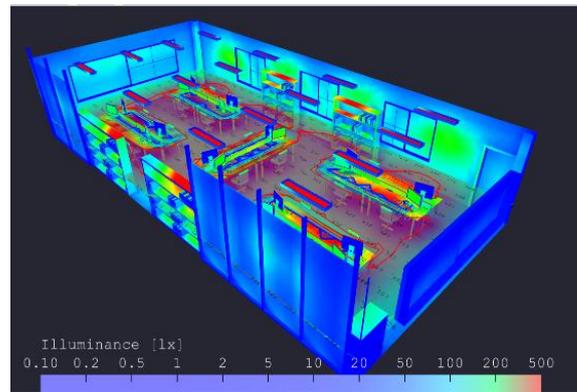
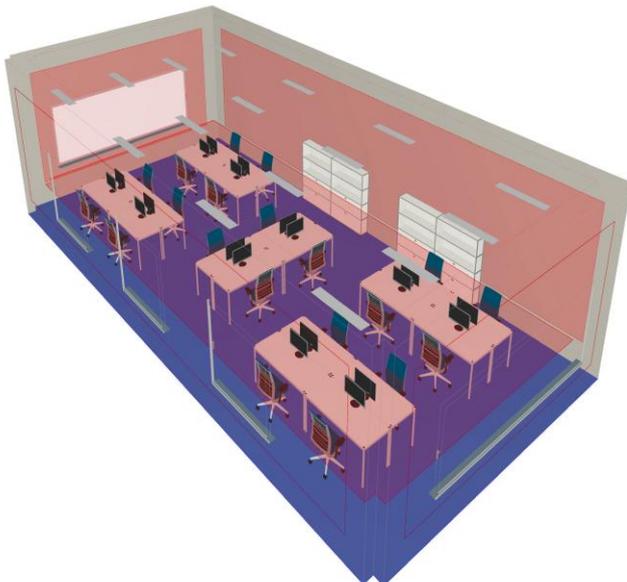


Figure SEQ Figure * ARABIC 5: AGi32 (Elumtools) - Rendered view (left) and pseudo colour view of luminance distribution (right)



Figure 4: Relux - Rendered view (left) and pseudo colour view of luminance distribution (right)

Calculation of Illumination Level: All the simulation tools met the target illuminances by providing an automatic arrangement of luminaires. Graph 1 shows the target illuminances, achieved illuminances and Lighting Power Density (LPD) levels by every simulation tool for different spaces in the office scene respectively.

Output Features: A comparison study of some output features referred from Ashmore & Richens (2011) is given below in table no. 4 which are desired by standard lighting simulation tools that help in artificial lighting design [x].

Table 4: Comparison of Output Features

Sr. no.	File format	Dialux	Relux	AGi32
1	View of the working plane with iso-illuminance contours	Yes	Yes	Yes
2	View iso-illuminance contour in the scene	Yes	Yes	Yes
3	False-colour in the camera view	Yes	Yes	Yes
4	Illuminance at a reference point	Yes	Yes	Yes
5	Photorealistic	Yes	Yes	Yes

	renderings			
6	Luminance at a reference point	Yes	Yes	Yes
7	Virtual Reality Markup Language	-	Yes	-
8	Walkthrough animation (rendered)	-	-	Yes
9	Luminance and illuminance level with pointer scene or camera	-	-	-
10	Simulation data manipulation in the scene	-	-	-
11	Simulation data export	-	-	-

IV. Conclusion

It can be suggested that the output result is mostly dependent on significant physical properties and geometry of space and light source, so it is desirable to gather sufficient and appropriate space definition and calibrate simulation tools before running simulation.

Graph 2 denotes the rating of every parameter marked out of five points which represent the performance of each tool. From the comparative analysis, it can be concluded that Dialux and Relux would be favourable to users who already have two-Dimensional (2D) Computer-aided design (CAD) plans of the prototype for simulating artificial lighting design. Although both simulation tools can construct 3D geometry without 2D CAD references, it might be time-consuming hence, is not recommended. Dialux, when compared to Relux, has a relatively straightforward user interface and has a potentially fewer probability for complexities during a simulation project.

When it comes to AGi32 (ElumTools), as it is a Revit plugin, it requires knowledge and proficiency of the Revit platform, which is not simple for an average user. It has a steep learning curve to further go ahead with the design of artificial lighting. One main drawback with AGi32 (Elumtools) is that it is not a freeware like Dialux and Relux, and has a monthly subscription model. Table 5 represents the overall favourability of tools according to the points achieved.

Table 5: Favourability of the Simulation tools

Favourability of the simulation tool		
Sr.no.	Tools	Rating points
1	Dialux	★★★★☆
2	Relux	★★★★
3	AGi32 (ElumTools)	★★★★

Acknowledgement

I would like to express my deep sense of gratitude sincerely to my guide Asst. Prof. Manasi Kulkarni for her valuable guidance, inspiration and encouragement. Her keen and indefatigable indulgence in this work helped me to reach an irreproachable destination.

References

- i. Nardelli Andrei, Deuschle Eduardo, de Azevedo Leticia Dalpaz, Pessoa João Lorenço Novaes, Ghisi Enedir. "Assessment of light emitting diodes technology for general lighting: a critical review". *Renew Sustain Energy Reviews* 2017;75:368–79. <https://www.sciencedirect.com/science/article/abs/pii/S136403211630781X>
- ii. Handbook: E.C.B.C. Compliance in Indian Cities. https://shaktifoundation.in/wp-content/uploads/2019/11/ECBC_compliance_in_Indian_Cities.pdf
- iii. Liu, G., Nolte, I., Potapova, A., Michel, S., & Ruckert, K. (2010). "Longlife comparison of worldwide certification systems for sustainable building". *Proceedings of the 9th international conference on Sustainable Energy Technologies SET 2010*, p. 7. Retrieved from <https://www.sciencedirect.com/science/article/abs/pii/S1364032117314132?via%3Dihub>
- iv. Baloch, A. (2017). *Simulation tools application for artificial lighting in buildings. Renewable and Sustainable Energy Reviews*. <https://www.sciencedirect.com/science/article/abs/pii/S1364032117314132?via%3Dihub>
- v. Retrieved from Bureau of Energy Efficiency: https://beeindia.gov.in/sites/default/files/BEE_ECBC%202017.pdf
- vi. About Dial. (2020). Retrieved from Dialux: <https://www.dial.de/en/dialux/>
- vii. Retrieved from Reluxnet (2020): <https://reluxnet.relux.com/en/>
- viii. Retrieved from Lightinganalysts (2020): <https://lightinganalysts.com/>
- ix. (2020). Retrieved from Philips lighting: <https://www.lighting.philips.com/main/home>
- x. Ashmore, J. and Richens, P. 2001. "Computer Simulation in Daylight Design: A Comparison." *Architectural Science Review*. 44:1, pp. 33-44. <https://westminsterresearch.westminster.ac.uk/item/99v86/computer-simulation-in-daylight-design-a-comparison>

Ubiquitous City Services for Bio Medical Waste Management Systems In Thane Urban

Ar. Shrutika Keluskar

PG Student (Project Management), CTES College of Architecture, Chembur Mumbai University, Maharashtra, India. shrutika.bawkar@gmail.com

Prof. Pushpagandha Shukla, Prof. Umesh Mallya, Prof. Dhaval Ghare,
CTES College of architecture, Chembur Mumbai University, Maharashtra, India
gandha.shukla@gmail.com, ar.dhaval.ghare@gmail.com, umesh.ctescoa@gmail.com

Abstract : Therefore, an application of robotic systems to segregate the hazardous waste from recyclable waste can be integrated. The conceptual triangle of all management involves manpower, material, equipment, machinery, money, time, and sustainability. A recent addition to it is that of ICT, IOT and the future of it will change the future of all technology. Each era has the emergence of new technologies which have a huge impact on work methods. These technologies improve work efficiencies and contribute greatly to the sustainability aspects. The current challenges of BMW if inappropriately managed can have baleful effects to Human health and environment. It is therefore necessary to integrate BMWMS with the emerging Information and Communication Technology to find smarter, appropriate and intelligent ways of handling waste thus changing the comprehensive system. The research paper is dealing with the project management to be configured with BMW through applications of innovative technologies such as ICT, IOT thus creating Ubiquitous city systems. Things are bound to change further with strategic approaches and use of ICT and IOT in BMWMS as it requires higher systemization and co relation with different systems. The system is made up of people and processes, so they together tell what data is required and the application of ICT and IOT for conventional regulation of healthcare waste from processes like collection, separation, investigation recycling and disposal at the massive level to mini management of Biomedical waste at the hospitals. using the latest technology like ICT and IOT and thus enhance the quality of life and place. The committee comprises of 13 members for BMW for over 30 bed and 2 members for less than 30 bed hospitals. The data thus generated in these hospitals are large and requires proper systems to integrate it at the centralized level. This data is integrated using the latest technology towards building Ubiquitous city services. The 1983 guidelines of BMW by WHO has dictated the management of hospital. World over practices and regional practices within country vary. The Government of India has put down rules of BMW from 1998 to the latest draft amended in 2018. W.H.O. and the health organizations of all countries have issued clear guidelines for the disposal of Biomedical waste, these guidelines are difficult to follow as they are economically and financially burdening and involves different policy makers, governmental and non-governmental agencies. The pandemic has highlighted the existing faults and has raised concerns in larger magnanimity. An implementation of IOT and ICT interface in the form of Robots as application base for BMW can prove effective with regards to minimizing the gaps identified in execution of the Biomedical

Waste for a healthy humans and cleaner environment. The minimal human intervention will improve efficiency and time thus managed will bring huge economic and sustainable advantage in the field of BMWMS.

The research paper researches the three main aspects and hopes to find the breach in the execution process to determine effective implementation of IOT and ICT. The three main aspects are to find significant contributions of ICT, IOT and robotics in BMWMS. Analysis of predefined policies that are there world over and in India. Looking at the implementation process of ICT, IOT towards building U-city.

The research focuses on Thane district having 350 hospitals and 1500 laboratories (source: 2018 survey TMC) Budget allocation for Civic run hospital at Thane is 37 crores. The crucial department like public health department has recorded a meager 15% spending i.e., 2.8 Crores against the sanctioned amount of 37 Crores. The aggregate waste generated in TMC for BMW is 10.5 tons per day. There are gaps identified at the local level in BMWMS wrt conventional manual techniques of handling waste during the processes and imperative commitment wrt resources. The recommendations provided are wrt to the use of latest technologies IOT, ICT and Robotics towards building a future U-city service for Thane District. The purpose of this article is (a) To recognize the BMWMS (b) To perceive the current BMWMS (c) Identify the BMWMS in the advanced countries like USA, UK, Japan, and S. Korea and understand prospects of BMWMS (d) Associate limitations of conventional technology, and propose the appropriate technology for BMW disposal, and potential solutions (e) To provide recommendations of BMWMS towards building Ubiquitous city services for Thane district.

Key words: Information and Communication Technology (ICT), Biomedical Waste Management Systems (BMWMS), Robotics, Internet of things (IOT), Ubiquitous city (U – City)

I. Introduction:

The paper is divided into three major components i.e: Biomedical waste management systems, Information and Communication Technology (ICT), Internet of things and Ubiquitous city services (U – City) Bio medical waste Management has been classified into many different categories by WHO. Developed countries, such as the USA, Canada, and the UK, follow a standard guideline presented by WHO to manage their BMW; they also have standard

legislations in place, as well as strict and regular implementations of these legislations (Mühlich et al., 2003; Windfeld and Brooks, 2015). While Asian developing countries have only fundamental laws and limited regulatory bodies to enforce the management of healthcare waste. Bio Medical Waste generation data is not usually recorded in many hospitals, but a Central Bio Medical management system is highly dependent upon the generation of this data. Waste quantities vary from hospital to hospital, and it also depends upon the type of facility, as well as the economic situation of the region. Bio-Medical Waste (Management and Handling) Rules dated July 20, 1998, by the Government of India in the Ministry of Environment and Forests laid down that BMWs should be collected by “the occupier” that is the institution generating BMWs (health-care facilities) in accordance with standards laid down in the rules, and also described “the authorized person” or the operator authorized to receive, store, transport, treat, and dispose the BMWs in accordance with the prescribed standards mentioned in the rule. The rules also specify the duties of the related union ministries, state governments, central and state pollution control boards, and the local authorities. While the Ministry of Environment, Forest and Climate Change, Government of India, is to make policies, constitute monitoring committees, and develop manuals for trainers, the Central or State Ministry of Health and Family Welfare is to monitor them. Though WHO and the health organizations of all countries have issued clear guidelines for the disposal of hospital and other medical wastes these guidelines are rarely followed. The amount and composition of hospital waste generated in India is approx. 1.5 kg/bed/day as compared to the US is 4.5kg/bed/day. The current BMW systems are unable to efficiently deal with the tons of waste that is generated in every day. India is generating approx. 710 Tones of Bio waste including 101 tones of C-19 waste daily. Usually medical waste is mixed with the municipal waste in the waste bins at the roadside and is disposed off or burnt off thus releasing hazardous pollutants and creating an environmental imbalance. Moreover, workers on the landfill site, collection network, and some incineration plants are working without safety equipment.

Information and communication technologies (ICT's) have occupied their position in knowledge management and are evolving towards the era of self – intelligence. ICT for Urban development and planning are imperative to improve quality of life and place. This includes the management of city waste, electricity, sewerage, water quality, monitoring and conserving the resources,

Coordinating the policies, programs, engineering, government offices and administrators. The aim of the U- city is to create a built environment where any citizen can get services, through any ICT devices. The speeding in ICT development has brought the conventional city in terms of intelligence, innovation and evolution towards building U- city.

This paper takes a case for Thane district having 350 hospitals and 1500 laboratories (source: 2018 survey) generating 10.5 tones of BMW having one Central treatment facility at Chhatrapati Shivaji Hospital, Kalva having a treatment capacity of 1 ton/day. There are gaps identified at the local level in BMWMS wrt conventional manual techniques of handling waste during the processes and the need for commitment wrt resources. This is an occupational hazard of a job of a worker in manual handling of BMW that can have serious consequences over the health of the worker and environment. The recommendations provided are wrt to the use of latest technologies IOT, ICT and Robotics towards building a future Ubiquitous city service for Thane District. This paper takes a case for Thane district having 350 hospitals and 1500 laboratories (source: 2018 survey) generating 10.5 tones of BMW having one Central treatment facility at Chhatrapati Shivaji Hospital, Kalva having a treatment capacity of 1 ton/day. There are gaps identified at the local level in BMWMS wrt conventional manual techniques of handling waste during the processes and the need for commitment wrt resources. This is an occupational hazard of a job of a worker in manual handling of BMW that can have serious consequences over the health of the worker and environment. The recommendations provided are wrt to the use of latest technologies IOT, ICT and Robotics towards building a future Ubiquitous city service for Thane Urban.

Literature Review

In the past several researchers have studied scenario of Hospital Waste Management in different countries, conducted surveys and a Lot of research is being done regarding improvement of the current Biomedical waste management Systems.

The paper by Zeashan Hameed Khan, Afifa Siddique, Chan Won Lee published in 2020 is about the role of Robotics in Healthcare Industry. The gaps identified were scarcity of Data availability publicly on various transmission patterns of the disease. The methodology adopted was to connect the utilisation of different robots in the current Hospital management to maximize the use of robots for various medical procedures and highlight the importance by replacing and sharing the workload of the current medical staff.

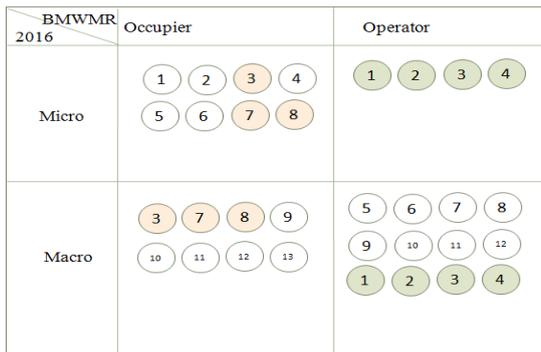
The paper by Dr. Sushma Rudraswamy, Dr. Naganandini Sampath, Dr. Nagabhushan Doggalli in 2013 is about the safety management of the healthcare practices and its importance to environment conservation and health of community. Gaps identified were about lack of waste management plan, funding and procedures in healthcare establishments. This can be accomplished by providing separate and adequate budget for BMW in each country, Proper documentation and analysis of the system.

The paper by Amir Mohammad Rahmani, Nanda Kumar Thanigaivelam, Tuan Nguyen Gia, Behailu Negash, Pasi Liljeberg, Hannu Tenhunen in 2015 is about the advancements in the field of IOT and demand for U-healthcare systems to improve human health and well being. The gap identified are the breach of privacy over reliance of technology. The IOT enables us the projects for better time management, taking responsibility of handling sensor network coping challenges in U- cities such as energy efficiency, scalability and reliability issues.

II. Methodology

Study the Legislative, regulatory and policy aspects of Bio Medical Waste management systems at the Global, National, City and District level. Understanding the existing BMWMS 2016 and drawing vertical comparisons wrt the duties of Occupier, Operator in the micro and macro environment of BMW at Urban level. Deriving Occupier to operator ratio. Understanding the Lifecycle approach of BMWMS the existing duties and policies for its collection, Segregation, Storage Transportation, Treatment, Disposal. Deriving micro to Macro ratio.

Preparing fact sheets and findings and observations for collection, transportation and Treatment on visiting the CBWTF and Hospitals in Thane Urban. Understand the trend followed of the BMW generated from the MPCB Thane urban-1 of the last five years. The table attached here conveys the practice follows to the Rules applied thus identifying the gaps in the system. The identified gaps will lead to proposing IOT, ICT based systems which leads to forming Ubiquitous city services of BMWMS in Thane Urban.



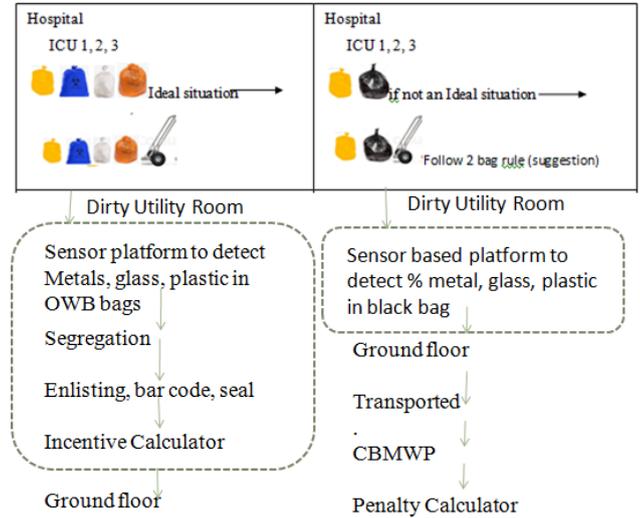
Sr.No	Description	% in 2015	% in 2016	% in 2017	% in 2018	% in 2019
1	Incinerable Waste	51	42.8	21.84	39.32	45.55
2	Recyclable Waste	48.5	57.1	78.15	60.67	54.44
3	Total quantity in Kg	1,81,051	1,77,026	5,90,447	3,79,210	2,99,256

Fig :02

III. Results and Suggestions

The collection of BMW from larger generators and transporting the same to the facility require adequate

infrastructure and managerial efforts There is an urgent need to streamline the collection systems, identifying the generators which are either not sending the waste regularly or not segregating the waste properly. It is observed by the relevant case studies at the CBMWTP and Hospitals that the non collection of the waste from individual Hospitals is causing problems for smooth operation of the facility.



Thus proposing an IOT 1 at the point of collection of BMW at the Hospital level to improve the existing management of handling BMW which is currently handled manually.

inadequate. This hampers the BMW collection. Some facilities have big vehicles like truck or mini- trucks. Big vehicles are not suitable for densely populated areas in the city. The transporters do not keep the records of the waste collected from individual operators as per the category and weight basis. Thus proposing an IOT 2 network to manage the shortest path to lead the vehicles to collect the BMW from the Occupiers and managing the data base to analyze the system for time management.

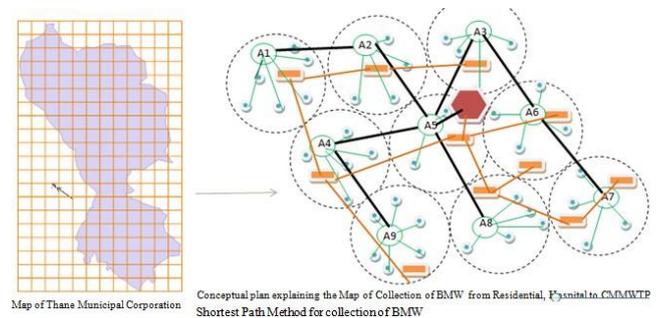


Fig :04

The CBMWTF need to have complete in-house arrangements for collection, transportation and treatment and disposal of BMW. Because of the improper segregation the incinerators tends to emit lot of fumes thus polluting the environment. Handling and storage of waste before treatment is inadequate, Records of waste received and treated are not

maintained. Therefore proposing an IOT3 system to detect, collect, store, maintain records, segregate and lead the material to in build process of Incineration, Autoclaving, Shredding and Recycling thus reducing the time of operation.

IV. Conclusion

The purpose of study is to explore IOT, ICT innovation through its effective utilization in the current BMWMS of Thane Urban for its effective management at the micro and macro level thus reducing its effects on the environment and tackle challenges towards building Ubiquitous city services for Bio medical waste management system in Thane Urban.

Acknowledgement

I would like to express my deep sense of gratitude to my guide Prof. Pushpagandha Shukla, Prof. Umesh Mallya, Prof. Dhaval Ghare, for their valuable guidance which helped me to reach an irreproachable destination.

Reference

i. Yang, G.Z.; Nelson, B.J.; Murphy, R.R.; Choset, H.; Christensen, H.; Collins, S.H.; Dario, P.; Goldberg, K.; Ikuta, K.; Jacobstein, N.; et al. *Combating COVID-19—The role of robotics in managing public health and infectious diseases*. *Sci. Robot*. 2020.

ii. Taylor, R.H.; Menciassi, A.; Fichtinger, G.; Fiorini, P.; Dario, P.; Siciliano, B.; Khatib, O. *Medical Robotics and Computer-Integrated Surgery*; Springer: Berlin, Germany, 2016; pp. 1657–1684.

iii. Zhang, Y.; Lu, M. *A review of recent advancements in soft and flexible robots for medical applications*. *Int. J. Med. Robot. Comput. Assist. Surg.* 2020, 16. *WHO Factsheet on Health Care Waste*. Available from: <http://www.who.int/mediacentre/factsheets/fs253/en/>. [Last accessed on 2018 Feb 08].

iv. *Health Impacts of Health Care Waste*. Available from: [http://](http://www.who.int/water_sanitation_health/medicalwaste/020to030.pdf)

[www.who.int/water_sanitation_health/medicalwaste](http://www.who.int/water_sanitation_health/medicalwaste/020to030.pdf)

[/020to030.pdf](http://www.who.int/water_sanitation_health/medicalwaste/020to030.pdf). [Last accessed on 2018 Feb 08].

v. *Biomedical Waste (Management and Handling) Rules, 1998, Government of India*. Available from: <http://www.moef.nic.in/legis/hsm/biomed.html>. [Last accessed on 2018 Feb 08].

vi. Anonymous (1998). *Biomedical waste (management and handling) rules, The Gazette of India, Extraordinary, Part II, Section 3(ii), dated 27th July, pp. 10-20, 460. Ministry of Environment and Forests, Notification N. S.O.630 (E)*.

vii. Anonymous, (1997) *World Health Organization, Regional Office of South East Asia. Safe Management of Wastes from Health Care Activities*.

viii. Goddu, Vijaya Kumar and Kavita Duvvuri and Vidya Kaumudini Bakki. "A Critical Analysis of Healthcare Waste Management in Developed and Developing Countries: Case Studies from India and England." *International Conference on Sustainable Solid Waste Management*, 5 - 7 September 2007, Chennai, India.

Assessment of Prefabricated Prefinished Volumetric Construction Systems For Micro Housing In Hinjewadi, Pune W.R.T Time And Cost Management

Sneha Chavan

Allana College of Architecture Pune India

Email: archsneha1985@gmail.com

Abstract: PPVC has gained attention due to faster construction speed, better quality control, reduction in work force and construction waste, etc. This innovative technology promotes off-site manufacturing of modular units improving construction efficiency and productivity. This paper highlights logistics as one of the existing challenges of the technology for the implementation for Microhousing in and around Hinjewadi, Pune. Accordingly, application of the technology in Singapore is analyzed in context of transportation and lifting crane capacities. Lightweight steel concrete composite system, JIT, automation technologies are some of the alternatives introduced to increase the financial feasibility of the technology in terms of logistics.

Key words – Modular, Logistics, Transportation, Lifting, Lightweight steel concrete

1. INTRODUCTION

Today across the globe, we are experiencing a rise in densely populated urban areas, along with a lack of land resources to provide sufficient housing for the masses.

1.1 Microhousing and PPVC: The phenomenon has given rise to a new movement of Micro-Housing; the concept of these revolutionary homes focuses primarily on the innovation of maximum functional area in minimum footprint (150-350 sqft), thus redefining the perception of sustainability in urban catchments like Hinjewadi, Pune given the fact that the area has got maximum migrant millennial working professionals.

Microhousing being smaller units, in situ construction can cause dense grids, combined footings, consuming more effective material cross-sectional area which can make it uneconomical while segmental precast has many drawbacks like too many joints, leakages concerns and transportation wastages/damages. Considering current pandemic and thus developed safety concerns, management of labours in controlled factory conditions would be always preferred over that in uncontrolled conditions on the actual construction sites.

1.2 PPVC in Singapore: Prefabricated Prefinished Volumetric Construction (PPVC) is a specific type of modular construction where the internal elements of the module (walls, floors and ceilings etc.) are prefinished before the modules are assembled. In recent years, Singapore Building and

Construction Authority (BCA) has also shown great effort to promote PPVC by making it mandatory in public residential projects. The benefits of PPVC have been proven successful in launching of pioneer Housing PPVC project in Singapore:



Fig1.3 Fit out yard operations



Fig1.1. Tower crane hoisting PPVC Module

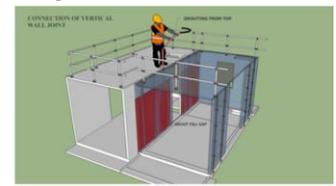


Fig1.2. Grouting between PPVC Module



Fig. 1. Pioneer PPVC project in Singapore - The Cement Canopy executed by Dragages, Singapore (2018-2019)

The project consists of twin towers of 40 storeys each and total of 1866 modular PPVC units, installation of which was completed in one year (7April 2018- 12 April2019)

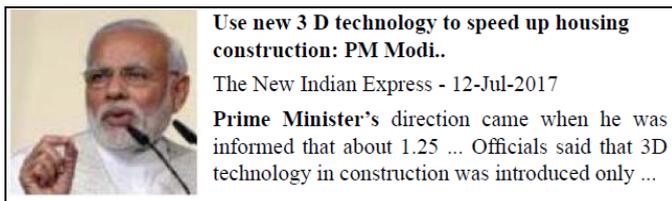
It is reported that project have achieved time savings of up to 6 months, on-site manpower savings of up to 40 % and onsite construction waste reduction by 70%.

Transportation: PPVC modules needed to be transported from Senai, Malaysia for fitting-out, before being transported for on-site installation. Transportation of the modules were based on per trip basis, there were also LTA restrictions with regard to the usage of public roads.

Hoisting: Tower crane with higher capacity was required, with concrete PPVC modules weighing as much as 25 – 30 tonnes. The initial cost and rental of 30-tonnes tower crane was considerably higher than typical capacity tower crane. In

addition, the scarcity of 30-tonnes tower crane in Singapore market pushed the cost up.

1.3 PPVC in India: Hommission, India has applied this to Indian market requirements and cost expectations. A 5-storey building with 20-apartments was manufactured and installed in 33 days using 3D Monolithic concrete technology which was well appreciated and suggested as an alternative for affordable mass housing by the Indian Government (In Reference to the news article followed)



Therefore, this paper highlights the existing challenges in logistics of PPVC modules via road network and provides alternatives to address these challenges.

2. LITERATURE REVIEW

2.1 PPVC CONSIDERATIONS

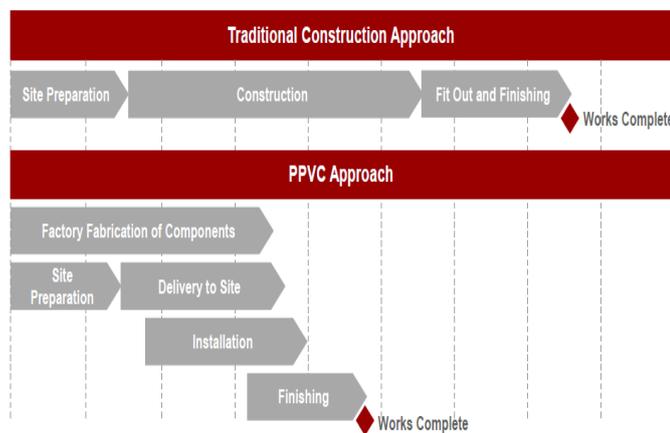


Fig. 2. Traditional v/s PPVC Approach

There are two types of PPVC module systems with different types of load path. Load-bearing wall module are commonly found in concrete building, whereby the concrete walls are used to transfer gravity loads to the foundation, as well as resisting the lateral loads as displayed in Fig.3. On the other hand, Fig. 4 shows corner supported module, which is generally made of steel or steel-concrete composite material, in which the gravity loads are transferred to edge beams to the columns and foundations. Generally, the weight of steel modular unit is about 15 to 20 tonnes, which is relatively lighter than a concrete modular unit with weight of about 20 to 35 tones.

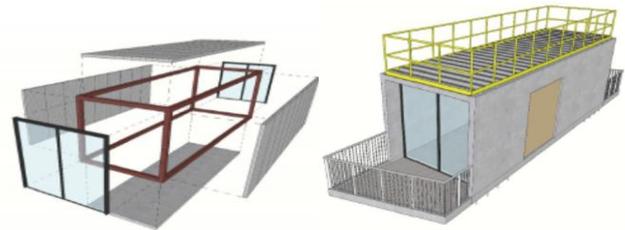


Fig. 3. Reinforced Concrete Fig.4. Steel PPVC Module module

2.2 CHALLENGES IN PPVC

Firstly, the **weight and size** of a module are constrained by the transportation and lifting capacities. Furthermore, **the joint design** is critical to ensure the continuity of the structural modules and one of the prime challenges in India is to eradicate the **fear of generation of unemployment due reduction in site labour**. Accordingly, LOGISTICS parameters are considered -

2.3 LOGISTICS

The success or failure of a PPVC building project is often decided on the logistics approach. The on-time delivery and installation of the modular units is dependent on the considerations such as delivery, crane location and laydown area. The area in and around Hinjewadi, Pune has a road network with varying widths with a good connectivity to MIDC areas of Bhosari and Chakan.

I. Transportation:

As per the national regulations (India) the size of a single module transported via road should be limited to the dimensions allowed without requiring special measures like police escort. In regard to Amend Rule-93 of Central Motor Vehicles Rules 1989, In 2020, The Trailer has been amended to **maximum length of 18.75m, maximum height to 4.0m and overall width of 3.00m**. (200 mm projection on each lateral side permissible in case of the actual width as 2.6-meter)

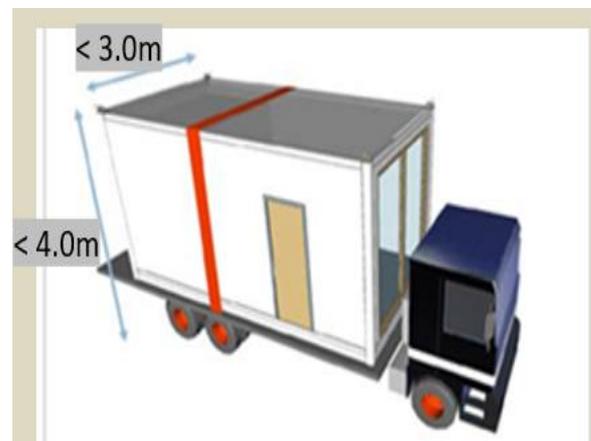


Fig. 5. PPVC module size limit due to transportation truck.

II. Cranes

Modules are generally lifted from their corners ideally using a lifting frame to avoid introducing inward component forces into the module. Sizing and arrangement of cranes on a site will be dictated by the total lift weight of the module, the reach of the crane. Tower cranes are the common type with a limit on the maximum weight at the extension of the reach.



Characteristic of Crane	Tower crane	Mobile crane	Crawler crane
Crane Capacity	50 tons	700 tons	500 tons
Lifting Capacity	25 tons – 40 tons	25 tons – 40 tons	25 tons – 40 tons
Height of Equipment	120m	40m	80m
Radius of work	40m	40m	40m

Fig. 6. Different types of Cranes with their characteristics for PPVC Module Lifting

III. Site layout

One key consideration for PPVC is logistic space for the delivery and offloading of modules. Therefore, deliveries need to be carefully planned and coordinated to avoid congestion outside the site as multiple modules arriving at the same time. Each vehicle is then timed to be called forward to the site while the current module is being installed

Thus, Logistics affect the PPVC project cost

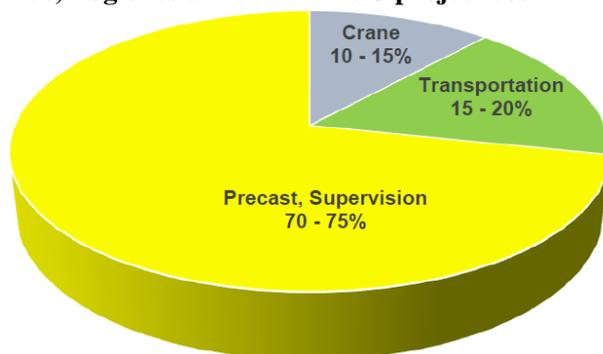


Fig. 7. Cost Drivers of PPVC

3.PPVC AS A SOLUTION

3.1 Lightweight modular unit

The weight of the module is the most critical part in implementation of PPVC, if it is reduced then it can to a great extent reduce load on the transportation vehicle and also relatively cranes with less capacity would be required to lift the module.

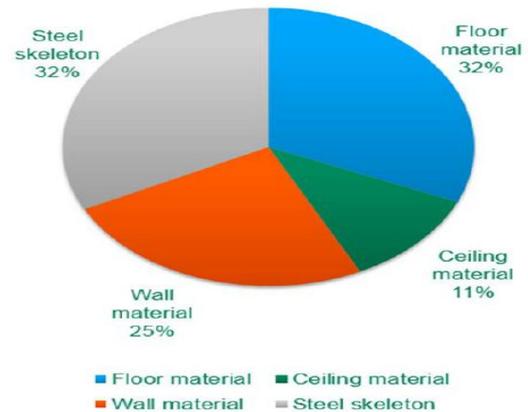


Fig. 8. Typical weight distribution in a steel modular unit.

It is observed from Fig 8. that the two largest components that contribute to weight are floor material and steel weight., thus composite slab and beam design can be used in order to reduce floor weight and increase performance. Other than reducing the weight, because of its double slab system (e.g., floor and ceiling) it increases the available internal headroom and also can help in reducing overall height of the module. The weight of a modules can be further reduced by using **lightweight concrete** in the slim floor system and partition walls as non-structural elements for good acoustic and fire protection. Therefore, the application of light weight concrete help in reducing building costs, easing construction and has the advantages of being a relatively ‘green’ and durable building material.

3.2 Scope of Work

Delivery logistics needs to be studied to identify the scope of work at following stages-

- At the factory
- At the Local holding yard
- At the site

3.3 Consideration of Just-In-Time (JIT) Operation

Unlike conventional precast, PPVC modules are unable to be stored on site. Therefore, a Just in Time (JIT) installation could prove to be efficient and productive. The rate of installation has to be determined for a smoother JIT operation. Precast supplier can further employ systems such as Traffic Monitoring and GPS for Prime Movers to better facilitate deliveries. This will in turn make JIT operation smoother and more predictable. It is advisable to have space for unloading and storage (stockyards) in the event where JIT installation is not possible, e.g., during inclement weather, etc. which involves high cost for its set up and maintenance.

3.4 Generation of new segment of labours

In PPVC, there is reduction in site labour but simultaneously it increases skilled labour requirement for logistics activities like factory operations for loading the module, packaging, transportation, lifting operations etc. Hence would overcome the construction related unemployment issue in the country.

3.5 Hoisting Management

Duration of the project and availability of the specialized cranes are important aspects in crane employment. The cranes rentals being very high hence duration for which it is required needs to be calculated and accordingly, for contractor to decide upon whether the crane is to be rented or purchased.

3.6 Automation technologies

Poor design of lifting frame that leads to unstable module (Fig. 9) during lifting might causes damage to internal finishes of PPVC modules.



Fig. 9. Unstable module lifting.

Advanced technology has enabled BIM models to calculate the center of gravity of each module, incorporating with auto-calibrated lifting frame, to stabilize the module during lifting. Thus, the above considerations can help in overcoming the challenges in application of PPVC.

4. CONCLUSION

In India and specifically in Hinjewadi, Pune, the success of PPVC would largely depend on reduction in the overall weight of the module, efficiency in transportation plan, availability of lifting equipments and accordingly trained labours. Thus, Logistics has one of the major impacts on time and cost in PPVC application.

5. ACKNOWLEDGEMENT

I would like to thank my guide Ar. Zohar Siamwala, faculty at Allana College of Architecture, Pune for his invaluable guidance in my research work. I sincerely express my gratitude towards Dr. S.J. Vijay, Director at Hommission, India whose insight interview influenced me to take up this research topic.

6. REFERENCES

- i. *PPVC Guidebook- Design for Manufacturing and Assembly (DfMA) – Building Construction Authority (BCA) -Singapore- www.bca.gov.sg*
- ii. *Pre-Fabricated Pre-Finished Volumetric Construction (PPVC) For Residential Projects- Threesixty Cost Management Pvt Ltd- www.surbanajurong.com*

- iii. *Manufacturing and Assembling Buildings As 3d Monolithic Shear wall Modules-Author S.J.Vijay - AKGEC International Journal of Technology, Vol. 9, (2)- www.akgec.ac.in*
- iv. *Steel Concrete Composite Systems for Modular Construction of High-rise Buildings -J. Y. R. Liew, Z. Daia and Y. S. Chuua – www.ocs.editorial.upv.es*
- v. *Prefabricated Prefinished Volumetric Construction: Key Constraints and Mitigation Strategies - W Q Liu, B G Hwang, M Shan and K Y Looi -IOP Conf. Series: Earth and Environmental Science 385(2019) 012001- www.iopscience.iop.org*
- vi. *Breaking the Prefabricated Ceiling-Challenging the limits for Modular High-rise- Shone Mills and Dave Grove of Ramboll group and Mathew Egen- Council on Tall buildings and Urban habitat www.global.ctbuh.com*
- vii. *www.concreteconstruction.net projects-residential-clement canopy*
- viii. *www.hommission.com -3D Modular Monolithic Construction company namely Hommission, based at Bangalore and Director is Dr.S.J.Vijay*
- ix. *MICRO APARTMENTS - A Potential Solution for the Severe Shortage of Small Affordable Apartments in Stockholm - Nóra Gazdag and Anna Torlegård- www.semanticscholar.org*
- x. *Comparative Study of IPS & PPVC Precast System- A Case Study of Public Housing Buildings Project in Singapore- Mizanoor Rahman, Habibur Rahman-Conference: 4th International Conference on Civil Engineering for Sustainable Development (ICCESD 2018), KUET, Khulna, Bangladesh- www.iccesd.com*

A Study of Everyday Urbanism and the Meanings That It Creates For People - A Case of Mutha River Pune

Ar. Amey Wadegaonkar

VIT's PVP College of Architecture, Pune

email – ameywadegaonkar007@gmail.com

Abstract : Rivers play a major role in shaping the development of cities, as well as it is connected to the everyday activity of people. This aspect of everyday urbanism is important in the context of riverfront development to maintain meaning in urban spaces. This research is mainly focused to identify the relation between the everyday life of people with spaces near the river and their use. The crucial importance is for the spaces of the city for the conduct of everyday life, social interaction, and the creation of social meanings. Meanings are created where the built environment and the rhythms of social life coincide. It helps to understand the everyday behaviour of people in urban spaces near the river through everyday urbanism. This research is proposed to study the Mutha river in Pune and specifically to the spaces near the river with everyday activities. This research demonstrates the everyday life meaning in spaces through various empirical studies and activity observation. Through observations this research helps to extract the new meaning of the everyday life of people near the river. In the term of contribution, this research improvises the knowledge of public spaces near the river through the everyday urbanism point of view.

Keywords - Everyday Life, Everyday Urbanism, Riverfront Development, Public Spaces, Meanings of Spaces

1. Introduction

1.1 Background

Cities provide opportunities, connect people to the spaces, and make everyday life more practical. This everyday life people are important to see the vision of urban reality. Many of the global population spend their everyday lives in an urban environment. A riverfront of any city is a major part of cultural, social, and economic activities in the city life. Many things happen like rapid urbanization which reduces the connectivity of people with rivers but they are still connected in some way of everyday use. It is important to study everyday urbanism because the city is constantly reshaped by citizens while using the spaces created by everyday use, and hence the chances of following in response to user preferences are much higher than in the case of predictable, top-down approaches where public spaces are designed and

implemented with little to no user engagement. To explore this perspective of urban space study near the river and their meaning is the central inquiry for the research.

1.2 Literature Review

The everyday urbanism proposed by Crawford is concerned with the everyday use of spaces by the public by doing some changes or creating their way of using space. He aims to find what ordinary people do in their everyday lives that are often outside planning regulations. Public spaces are elements that make up the city and give it a structure. Everyday urbanism is “an approach to Urbanism that finds its meanings in everyday life”. This approach helps to find unnoticed existing situations and experiences that occur in everyday life. (Crawford, 2004) We want to reconnect these human and social meanings with urban design and planning, something that hasn't been attempted for quite a while. Everyday life can connect to urban design through the conceptualization of everyday space and everyday public activity, it is the connective tissue that binds daily lives together. It views cities as a conversation between and among its residents. This leads to a dynamic urban form that evolves not from outside pressures or plans dropped from above, but from activities that occur within a neighbourhood. (ARTIBISE, 2010)

There is another interpretation of everyday urbanism is “local communities and entrepreneurs reclaim leftover spaces of the city for their use” It is a reading of everyday life of the public and their uses in public space. According to David Walters, the space of everyday urbanism is the amalgam of the stores, parks, gardens, street vendors, street life, and various spaces where people come every day and interact with the space. Everyday urbanism celebrates the richness of vitality of daily life and ordinary reality. It is mostly interested in reading the city like a text interpreting space and activities to generate the meaning, it is not activities of urban design and planning. Urbanism is less concerned with the design as a practice it is more integrated to hypothesize a range of meaning within an urban condition. (Walters, 2007)

The character of the city or the urbanity is defined by the everyday rhythm of the city. Every place has an identity and an image of the place. To fully capture the meaning of a place as a basis for regeneration initiatives, the setting, the activity

within a defined boundary, and the sense of place should be complementarily taken into account (Agnew and Duncan, 1989 from Gustafson, 2001). To understand everyday life meaning the theory of J. Montgomery is used. The physical form, activity, and meaning are mixed to form the sense of place. (Montgomery, 1998) Meanings or the imageability of the places are identified by the set of feelings of individuals or the group of people and impression about the place. These feelings come from the filtered information collected about the place based on individuals as well as groups of society's values, beliefs, and ideas about the place. This meaning can be generated by peoples meeting place, their symbolized memory, traditional associations, and their psychology of the place.

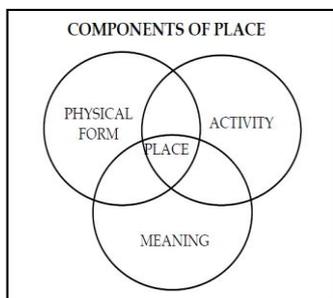


Fig. No. 1: The components of place (Source: Montgomery, 1998)

Riverfront is a large public space in the city. It has a large number of activities present near to the river which is connected to the everyday life of people. The riverfront portrait its characteristic to create vibrant public space. The area has the strength to promote human contact and social activities as it is already a place of public interest and be able to promote community involvement. In the current situation river transformed into the most polluted water body due to urbanization over the past decade. (Banerjee, 2018) The river Mutha, once the pride of Pune city, is in an unwell state. The river was valued and was a part of the everyday lives of the people in the city. The city of Pune gradually developed as well. There were fourteen ghats on the river where people bathed and prayed. People were still connected to the river as it was associated with their everyday lives. The unwanted and forgotten riverbank is the shelter for the poor and disadvantaged sections of the society. According to references of various literatures of the Pune riverfront, there are many studies done under the environmental, ecological, geomorphological, and historical point of view but no one is seen it by the everyday urbanism frame of reference. Also due to the river and its spaces are mostly used by people in their everyday life they play an important role in riverfront development. Many studies are not in this consideration of everyday life therefore everyday life meaning remains understudied in the context of riverfront.

1.3 Topic Identification

From the literature review, it is identified that there is a gap between the study of riverfront in the context of meaning in everyday life. This research helps to fill the gaps in the study on the river and find the use of the river by people, and other activities performed near the river. The central inquiry is to identify the everyday urban life near the river and its meaning.

In Pune there are many temples are situated along the river mutha in which many of them have historical importance and major people interaction. In some parts riverbank is accessible and many of the spaces in such areas are used by the temporary food vendors and unauthorized food stalls, eateries under the bridge. Some parks and gardens are present along the river. Therefore, the area of study is taken the river stretch from Mahtre bridge, Erandawane to Chatrapati Shivaji Maharaj bridge in Shivajinagar Gaothan. The reason selected this area is, it has a good historic background and many activities found in this area such as food vending, parking, workplaces, education, recreation, and religion, etc. which are mostly part of the everyday life of people.

1.4 Research Objective

To find the meaning of everyday life activities present at the spaces near the riverfront.

1.5 Research Questions

1. Which stakeholders are involved in everyday activity?
2. Which all everyday life activities are present near the river?
3. Which are spaces being to perform everyday activity?
4. How people find their meaning in that everyday activity?

2. Method

2.1 Research Methodology and Methods

The stakeholder associated within the area of consideration of the mutha riverfront are identified through various methods like site visit observations, discussions with the local people, and from secondary sources literature and official websites of the different organisations and the departments.

The research is conducted through various types of practical methods. The information about places and their impressions on people is collected through the unstructured interviews and the literature available about the place. These interviews also helped to get the details about the people associated with everyday places place and their beliefs and ideas about the place. Also, by doing this interview we get the information about how people perform their everyday life activity. To find the complete information about the river different relevant

literature of previously done and historical studies are observed. The method of public observation is used to find the activities done in different spaces. Also, it gives details of activity mapping which shows the intensity of people using which spaces and for how much time. Also, the behaviour observation is conducted for finding the activity connected with the built form. These activities help me to find the stakeholders of this place who perform the everyday activities. In the second stage, these collected data will be analysed and it helps to understand spaces connected to the river which creates the meaning of places and how people have the image or the impression of that place near the mutha river and their association with everyday life of people. Then these meanings are further analysed based on their spatial implications with different scales through the lens of stakeholders and their everyday activities.

3. Data discussion



Fig. No. 2: Map showing the extent of river for the data collection. Mutha river stretch from Mahtre Bridge (left) to Nava Bridge (Right) (Source: google maps.).

Activities done by Stakeholders and imageability about the spaces:

Pune municipal corporation – Pune municipal corporation is the civic body that governs the Pune central. It includes the Irrigation department, Revenue Department, Maha metro, PMPML (Pune Mahanagar Parivahan Mahamandal Ltd), Health Department, Garden department, Drainage department. They used the spaces along the mutha river for metro pillars, drainage lines, and provide spaces for some businesses along the river.



Fig. No. 3: Sewer pipeline along the river banks with manhole chambers. (Source: Author)



Fig. No. 4: Metro pillars along the river bank (Source: Author)



Fig. No. 5: PMC bus station. (Source: Author)

This bus stand which is near to the PMC, for people this place is a way-finder because of its regular bus service connectivity with almost every part of Pune which is the backbone of transportation for the city.



Fig. No. 6: Parking on the riverbanks. (Source: Author)

Social organizations – It includes Jeevit Nadi Foundation, Sagar-Mitra, Creative foundations, Vishwakarma conservation workers, Janwani, Environmental Organisation Earth5R, Vivekanand Organisation, Royal Connaught Boat Club (RCBC), etc. These organisations are those invisible stakeholders that belong to the river with their social activities like cleaning the river, conservation of the heritage and ecology of the river.



Fig. No. 7: Ghorpade ghat and other old structures along the mutha river. (Source: <https://punemirror.indiatimes.com>)

This Ghorpade ghat present near the PMC building is one of the oldest ghats in the city. Many social organisations find this place for requesting to preserve and try to get attention from PMC to improve this heritage site.



Fig. No. 8: Mutha river cleaning by different social organisations. (Source: <https://www.thehindu.com/>; <https://earth5r.org/>)

Vendors - It includes Food vendors, Vegetable vendors, Pooja thali vendors, and Paanwals. They have their allotted spaces along the riverfront and also, they are active all the time.



Fig. No. 9: Food vendors under Z-bridge (Source: Author)

This Deccan Chaupati is places under the Z-bridge along on the riverside road. For people, this place is the location where food gets in cheap rates as well as this is the best option available in the surrounding because it remain open during late-night which shows its more active hours. Also, it has many educational institutes and Deccan Gymkhana (P.M.P.M.L.) Bus station.



Fig. No. 10: Food vendors and vegetable market place near Vruddheshwar temple (Source: Author)

People are coming in the morning as well as evening on ghat as well as temple. Near Vruddheshwar temple there are one small Chaupati connected to it therefore it is a strategic location for Vegetable vendors. At the extended part of the ghat and their landings are dining areas for the chupati food vendors.



Fig. No. 11: Fruit juice vendors in front of Poona Hospital. (Source: Author)

In the surrounding of Poona Hospital there are food and fruit vendors this are especially provide healthy juice for the patients admitted to Poona hospital. These juice centres are associated with hospital for three decades.

Informal vendors- It includes Newspaper & Maxine seller, Mobile cover and screen guard, Flower seller, Mask seller, Cobbler, Fruit seller



Fig. No. 12: Informal vendors with their temporary structures along the riverside road. (Source: Author)

People associated with religious places – It includes Pujari and guruji, Temple and ghat visitors, Ganapati Mandal.



Fig. No. 12: Omkareshwar ghat Dasha kriya vidhi rituals (Source: <https://punemirror.indiatimes.com>)

This temple is also an ASI world heritage site. Some small pooja thali vendors are sitting near the temple. Many people come here for the peaceful full environment also for meditation. Due to less traffic on road, there is a peaceful environment. This place creates traditional religious and emotional meaning as well as for some tourists it is also a tourism spot because of its historical importance.



Fig. No. 13: Vruddheshwar ghat and Ganapati visarjan tank near ghat. (Source: Author)

Vruddheshwar temple is accessible from congress Bhawan road and also riverside by using causeway. It is located on the left bank of the river people. People use this bank for Ganapati Dhol-Tasha practice.

Shop owners- The Poona hospital is surrounded by a large number of Medical shops that are accessible through Chavan bridge.



Fig. No. 14: Poona hospital and medical shops near it. (Source: Author)

For people near to this place as well as from other parts the medical shops present near to Poona hospital is the location of surety that they will find the medicine 24x7 with cheap rated than other locations.

People depending on river water and riverbanks – It includes Dhobi, Cattle ranchers, Fishermen's and Shrub collectors.



Fig. No. 15: Dhobi ghat near Omkareshwar temple along the riverside road. (Source: Author)

This Dhobighat is adjacent to the Omkareshwar temple and Vartak garden which is catering their work for the nearer hotels and lodges. These workers in that Dhobighat are also using that location for the refreshment.



Fig. No. 16: Cattle ranching along the riverbank near Chavan bridge and S.M. Joshi bridge (Source: Author)



Fig. No. 17: Fishermen fishing and collecting worms; women collecting monsoon herbs along the river banks. (Source: <https://en.gaonconnection.com/>)

People associated with gardens – These spaces are generally belonging to the residents include Old age group, Elders 45 and above, Youngsters, and Children 3-14yrs. Major three gardens are identified in the area of consideration Sambhaji garden, Vartak garden, and Nana-Nani park. People find this garden as a place of refreshment also many people do yoga practices. For the young generation, this place is like their meeting place.



Fig. No. 18: Science interactive equipment placed in Vartak garden also many dog owners come with their dogs on Sunday mornings. (Source: <https://punemirror.indiatimes.com>)

This park is situated near the Omkareshwar temple which is famous for pet lovers and the best place for children to learn because there is science equipment placed in that park which are interactive.



Fig. No. 19: Flower exhibition and fort making competition and exhibition at Sambhaji park (Source: <https://punemirror.indiatimes.com>; <https://www.thebridgechronicle.com/>)

This place is used by people as well as PMC for people this is the location for hangouts, also children can play safely.

Tourist – There are many historically important places available along the mutha river. PMC heritage cell is taking care of these historical structures and also introducing new activities for tourists.



Fig. No. 20: Pune darshan bus by PMC heritage cell

(Source: <https://www.pmc.gov.in/en/pune-darshan-ac-bus>)



Fig. No. 21: Vrudheshwar temple and Omkareshwar temple (Source: Author)



Fig. No. 22: Brahmarshi Annasaheb Patwardhan Samadhi and Nana Saheb Peshave Samadhi (Source: Author)

4. Results and analysis/findings

The following table explains the observations from the collected data and explains in terms of meaning and spatial implications.

Stakeholders	Meaning	Spatial implications
Pune municipal corporation	Meaning of legality and decision-making authority Also, find development locations for the infrastructure in the city.	Metro line and provide spaces for small business-like food vendors and dhobi also provision of parking spaces on the riverbank
Irrigation department	Meaning of extent of river and river as a source of water for irrigation.	The Irrigation Department of the Government of Maharashtra has used a 'blue line' - highest flood -25 years. 'red line' - highest flood - 100 years.
Revenue Department	Meaning of Land ownership	The Revenue Department defines the River's extent based on land ownership information.
Maha metro	Meaning of transportation	Maha metro announced that the Vanaz to Ramwadi corridor would be called the Aqua Line as it passes through the Mula-Mutha riverbed.
PMPML (Pune Mahanagar Parivahan Mahamandal Ltd)	Meaning of transportation	Major nodes like PMC and Deccan Gymkhana Bus Station
Health department	Meaning of healthcare and protection	Removal of water hyacinth from Mula and Mutha river. Channelization of Nallas.
Garden department	Meaning of caretaker of greens in the city	Development of new garden management of all public parks and their maintenance.
Drainage department	Meaning of recycling of water and send it back to the river	Sewer lines constructed along the riverbanks with manholes chamber.
Water Resources	Meaning of	This department decides to

Department	decision making on the mutha river water	released water from the khadakwasala dam.
Forest department (State government)	Meaning of conservation.	Maharashtra Forest Department, being the custodian of the State's rich and diverse biodiversity, is committed to a conservation-centric management and protection strategy. Tree plantation program.
MPCB (Maharashtra Pollution Control Board)	Meaning of management and monitoring of pollution	The Infrastructure Projects are mandated by MPCB to recycle 60% of treated sewage for secondary use by 17 providing dual pipeline.
Social organizations		
Jeevit Nadi Foundation	Meaning of conserving the river and heritage surrounding	These social organizations improve the surroundings of temples, samadhis and riverbanks also provide the access to the temples and ghat by cleaning them.
Sagar-Mitra		
Creative foundations		
Vishwakarma conservation workers		
Janwani		
Environmental Organisation Earth5R		
Vivekanand Organisation	Meaning of knowledge sharing about health and meditation	It teaches yoga, mental sport, and spiritual activities. It gives the art of living to the people. Daily People come here take the enjoyment of happiness.
Royal Connaught Boat Club (RCBC)	Meaning of sports of aquatic life.	Demands for the rejuvenation of river and also involve in cleaning river they celebrate 150 th anniversary of RCBC some member sails regularly.
Vendors		
Food vendors	Meaning of revenue generation and for PMC by getting taxes and business for the vendors.	Vendors create their parking area along the riverside road as well as extended dining spaces and their stalls arrange area under the bridge.
Vegetable vendors		
Pooja thali vendors		
Paanwals		
Informal vendors		
Newspaper & Maxine seller	They the meaning of opportunist to run their small business with the help of nearer large businesses	These vendors daily arrange their small carts or vehicles near the temples, food vendors, or hotels and run their daily vending activities
Mobile cover and screen guard		
Flower seller		
Mask seller		
Cobblers		
Fruit seller		
People associated with religious places		
Pujari and guruji	This place has a	Perform the rituals and

Temple and ghat visitors	sacred meaning for the people Also, for the people, these temples are historical survival. (Remaining structures after flood)	worshiping place. Dasha kriya vidhi.
Ganapati Mandal	Meaning of tradition	Ganapati visarjan tanks are constructed.
Shop owners		
Medical shop owner	They find this place opportunist because presence of a city-level multi-specialty hospital near to it.	Poona hospital is the location of surety that they will find the medicine 24x7 with cheap rated than other locations.
People depending on river water and riverbanks		
Dhobi	Occupational meaning, they conduct their small businesses or the supportive members of other businesses.	They run their business on the land provided by PMC
Cattle rancher		Cattel's grazing along the river banks and tied under the bridges.
Fishermen's		A channelized river wall is used by these people for fishing.
Shrub collectors		On the riverbank, monsoon herbs are collected and sell to the traditional medical shops.
People associated with gardens		
Elders 45 and above Youngsters	Elders have the meaning of recreation and entertainment	Gardens are used by people regularly for walking and relaxing also PMC is taking role in garden by arranging different temporary exhibition and events to attract more people regularly.
Children 3-14yrs	Children have the meaning of learning	
Tourist	Tourist have the meaning of historical importance	The presence of many old structures, as well as major tourist spots, are accessible from the bridges along the river therefore heritage walks are introducing in this place for visitors.
PMC heritage cell	Meaning of conservation and restoration.	Various Conservation and restoration work. Organizing Heritage walk and Tour. PMPML provides a Pune Darshan bus service.
People on the bridges		
General public	Meaning of experiential viewpoint, social space, and also the meaning of spiritual worship due to visibility	Many people come, sit and relax on the bridges also some people come for cycling and morning and evening walk.

	of river.	
Vendors	Opportunist because of regular flow of people	On both sides of the footpath on the bridge, they use the bridge wall and footpath for their temporary vending structures.
Beggars	Meaning of shelter and daily routine	Many beggars created their tents under the part of z-bridge they also use the footpath along the congress Bhawan road and metro pillars near the footpath. They also use river water for washing and bathing.

These activities are also divided in the form of different spaces which creates the typologies of the activities.

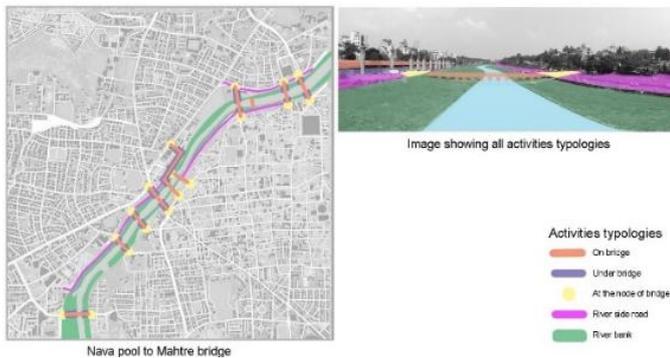


Fig. No. 27: Plan & image showing the activities space typologies. (Source: Author)

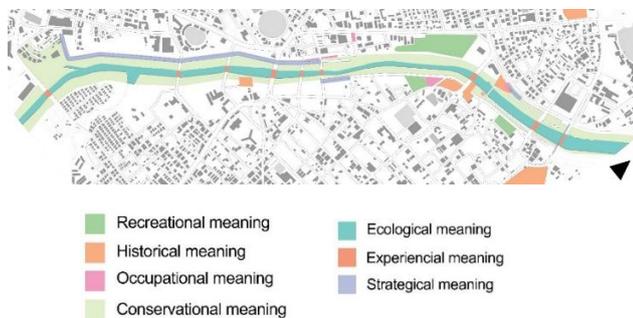


Fig. No. 28: Plan showing the broad categories of meanings identified for different spaces. (Source: Author)



Fig. No. 29: Existing land use plan (Source: <https://www.pmc.gov.in/>)

4. Discussion and conclusion

Riverfronts have good amount of potential to improve the public space in the city and create a quality public realm with special meanings to the spaces. Following are the inferences drawn based on collected data observations and the meaning of the places.

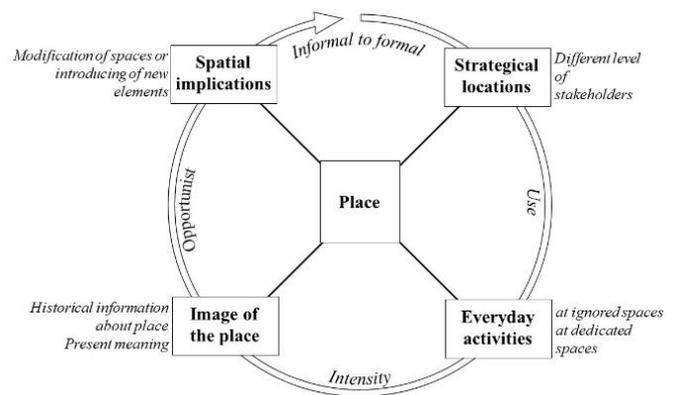


Fig. No. 30: Flow of formation of place through different stages (Source: Author)

The above diagram shows the place formation along the mutha riverfront context it has four stages starts with the strategic locations different stakeholders started using it with it may be ignored spaces in the area or the dedicated spaces. Then these everyday activities with its different intensity it creates the image of the place which includes historical importance as well as present meaning and people's perspective about the place or that activity. These places with different meanings are modified with new spatial implications.

These meanings are creating some patterns of the spatial implications and the activities within these everyday spaces like when the social organizations or the group of people in different occupations are introducing the activities then the PMC provides dedicated spaces for such activities or they introduce new programs for that specific action. It shows that the common, traditional or large number of activities with similar meanings are happens then these activities are legalised or legal land provided for that activity. This includes economic, socio-cultural, ecological, etc. stakeholders. The spaces which create opportunity to the PMC introduces the transportation medium like metro and bus services.

Many historically important sites near the river are improved after accepting the conservation demand to PMC these places get added in the heritage walk programmes and newly introduced as tourist destinations. These structures along the river have their own character and associations with the local culture or history. Also, social organisations started river walk showing heritage near river and awareness for river cleanliness as well as PMC heritage cell started bus service for tourists. It shows that the clean and accessible historically rich elements are attracts outsiders as well as local public.

There are two types of capitalisation exists one is legal and another one is illegal the legal is introduced or allowed by PMC in the authorised spaces which come under their authority and another one is illegal which includes all

informal activities along the roads as well as spaces near the commercial or intuitional environment due to its good amount of foot fall. (For example – Exhibitions at Sambhaji Garden and temporary vendor in front of garden entrance).

Many of the observed activities are interacting with the built form. The unused spaces are converted into some informal or illegal activities and these activities use the closest built form like beggars uses foot path for their tent floors and retaining wall for holding their tents; informal vendors do the same just the use these components for holding or displaying their products which they want to sell. The slum dwellers or the beggars are always look for the locations where they get their required food, water and area for shelter. Mostly they use unused spaces by people. Beggars regularly use river water for washing and bath they find the meaning of shelters in any places they live.

References

- i. Adoloye, A. J. (2009). *River and human development, Fresh Surface Water*, 3, 117-141.
- ii. AHMED, I. (2015). *IMPACT OF RIVER ON HUMAN LIFE: A CASE STUDY ON THE GUMTI RIVER, TRIPURA. A Journal of Radix International Educational and Research Consortium.*
- iii. Anthwal, A. G.-H. (2010). *Conserving biodiversity through traditional beliefs in sacred groves in Uttarakhand.*
- iv. ARTIBISE, Y. (2010). *EVERYDAY URBANISM: CELEBRATING ORDINARY LIFE IN THE CITY.*
- v. Banerjee, S. (2018). *Resuscitating the dying Mula-Mutha river in Pune.*
- vi. Buzarboruah, P. D. (2014). *Rivers and the Assamese folk life: A right relationship of man and nature, International journal of social sciences and arts and humanities*, 2, 2, 33-45. Buzarboruah, P. D.
- vii. Carsten Butsch, S. K. (2017). *Growing 'Smart'? Urbanization Processes in the Pune Urban Agglomeration. Institute of Geography, University of Cologne, Cologne.*
- viii. Cosens, E. P. (2019). *Understanding rivers and their social relations: A critical step to advance environmental water management. Australian Research Council.*
- ix. Crawford, M. (2004). *Everyday Urbanism. New York: The University of Michigan.*
- x. Dipali Babubhai Paneria. Vishwa D. Mehta, B. V. (2017). *Waterfront Development: A Case Study of Sabarmati Riverfront. Surat, Gujarat.*
- xi. Fadtare, V. V. (2007). *STUDIES ON WATER POLLUTION OF MULA, MUTHA AND PAWANA RIVERS IN SUMMER SEASON IN THE PUNE CITY REGION. PUNE: Nature Environment and Pollution Technology.*
- xii. Gavandi, M. U. (2019). *What is Pune losing and how fast ? Pune.*
- xiii. J. Diddee, S. G. (2000). *PUNE - QUEEN OF THE DECCAN. INTACH Pune Chapter.*
- xiv. khambete, A. k. (2015). *Reminiscence by the riverside.*
- xv. Khambete, A. K. (2018). *Slow death of a river.*
- xvi. Mačiukėnaitė, J. (2013). *The Role of the River in the City Centre and its Identity. Lithuania: Kaunas University of Technology, Institute of Architecture and Construction, Tunelio st. 60, LT-44405 Kaunas, Lithuania.*
- xvii. Manjusha Ukidve & Ritu Gavandi, P. (2019). *What is Pune losing and how fast?*
- xviii. Monrgomery, J. (1998). *Journal of Urban Design. Making City : Urbanity, vitality and urban design.*
- xix. O'Keeffe, J. (2013). *Rivers, time and conservation, especially in developing countries. Aquat. Conserv. Mar. Freshw. Ecosyst.* 23, 184–188.
- xx. Singh, S. B. (2014). *Environmental management in mass gatherings : a case study of Maha Kumbh Mela 2013 at Prayag, India. Int. J.*
- xxi. Walters, D. (2007). *Designing community: charranes, master plans and form-based codes. Oxford: Architectural Press.*

A Study of Carbon Neutrality Assessment Factors in The Existing Certification System for Green Campuses in India

Ar. Samruddhi S. Desai, Ar. Aditi Lanke

Bharati Vidyapeeth College of Architecture (Deemed to be University) Pune, India

Email: desaisamruddhi6@gmail.com, 1918110006@bvcoa.in ; avl@bvcoa.in

Abstract: Carbon emission is one of the major contributors to climate change and a hazard to sustainable development. The construction industry with large campuses produces the highest environmental impacts among all the other sectors. Various green building codes are developed to improve energy efficiency, rate architectural developments, and performance with specific environmental goals but significantly lack in addressing the carbon emissions of projects. The study is an attempt to develop an assessment benchmark for carbon emissions in office campuses which shall help in improving understanding of carbon emissions and ways to limit their adverse effects on the journey towards Carbon Neutrality.

Keywords – Climate Change, Carbon Emissions, Greenhouse gas, Green Building Certification System, Carbon Footprints Analysis, Carbon Neutrality, Green Office Campus.

Introduction

When a large project is planned and executed, it includes multiple infrastructural accommodations. Performance Assessment for such projects should go beyond the design of each building and calls for an assessment of larger environmental issues. Climate change is one such serious issue, caused primarily by carbon dioxide and greenhouse gas (GHG) emissions. Taking measures towards mitigating the worst effects of emissions is the first step towards carbon neutrality.

The Oxford University (2006) defines Carbon Neutrality as, “Being carbon neutral involves calculating your total climate-damaging carbon emissions, reducing them where possible, and then balancing your remaining emissions, often by purchasing a carbon offset: paying to plant new trees or investing in “green” technologies such as solar and wind power.” [i]

In the global scenario according to UN Environment (2019), “The buildings and construction sector should be the primary target for GHG emission’s mitigation efforts, as it accounted for 36% of final energy use and 39% of energy and process-related emissions in 2018.” [ii], this makes buildings the biggest single contributor to anthropogenic climate change.

In the effort to curb climate change the design of energy-efficient structures becomes a “monumental but vital task”. Green Building energy certification includes policies that assess the performance of a structure and its notional energy usage and systems.

Green Building Certification in India aims to educate the users and create a market for more sustainable and competent buildings, but there is still an absence of a direct assessment scheme for quantification of carbon emission contribution of any specific project.

Authors quote that, “The most common approach for green building certifications is to rate the compliance of each green building standard through a point rating system. No green building system has yet correlated its rating to the level of “greenness” of buildings. The level of certification does not reflect the corresponding reduction in environmental impact and carbon emission.” [iii]

Currently, limited progress of policies demands more focused action plans to limit emissions and deliver a low carbon-built environment. There is a need to focus on the revival of carbon assessment factors in the existing green rating systems so that the designer, developer, and assessor can enhance their applicability in a more meaningful way.

While addressing the need for direct inclusion of carbon impact assessment in green certification rating criteria, the Researcher states, “Carbon emission reduction policies demand tighter building Life Cycle Assessment (LCA) qualification standards. However, it is widely believed that it will be difficult to efficiently reduce the carbon emissions of buildings with only a fragmentary revision of the qualification standards.” [iv]

Several countries are considering advanced building codes or modifying existing ones to cover wider lifecycle emissions beyond energy; on this background respective paper henceforth aims to study the existing green rating certification systems of large campus projects in India for their carbon performance; compare them to find out the gap between established systems and factors responsible for carbon emission, that will further potentially contribute to suggest an assessing scheme to improve efficiency towards carbon neutrality.

Material and Methodology

Categories to indicate project performance of varied nature with a mix of predicted and measured approaches.

In this study context, the scope was limited to green-rated office campuses in India, since big institutions and office campuses that are close-knit communities of people from different parts of the country and strata of society have the potential to enable the large group to take initiatives on the sustainability path.

Hence, the study focused on ‘IGBC Green Campus Rating System’ [viii] and ‘GRIHA for Large Development’ [ix] rating typologies, some studies have examined and compared this particular group of rating systems selected for various parameters as rating tools; but this particular study analyzed them to find the gap between existing established systems and potential factors responsible for carbon emission.

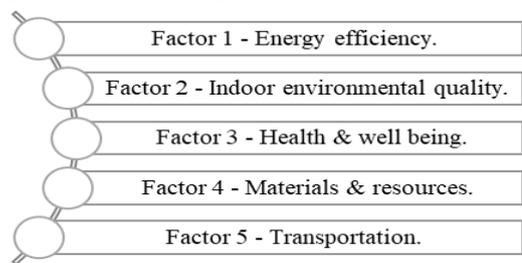


Figure 1 Carbon Emission factors identified from Green rating systems.

Green certification rating for campuses is further divided into ‘Existing Buildings’ and ‘New Building’ typology. A large part of the office sector and industries are already developed in the Indian context and are flourishing to meet future demands. In such campuses, the rate of energy renovations and the level of energy efficiency in existing buildings have higher growth capacities.

Key steps to raise the performance of existing buildings involve, increasing both the number of buildings improved and the amount of improvement achieved at an organizational level. ‘Infosys Limited’, a global leader in next-generation digital services and business consulting is one such example with its prestigious ‘United Nations Global Climate Action Award’ in the ‘Climate Neutral Now’ category. Infosys Limited is well-known for its Sustainable organization policies and hence was chosen as a case study[x]

The organization has multiple green-rated office campuses in one and two-tier cities around India, five of its well-known green-rated campuses namely - Infosys Thiruvananthapuram, BPO Pune, SDB 1 Hyderabad, Infosys Mangalore, SDB 6 Mysore were selected and analyzed to identify variables affecting the carbon mitigation.

The research establishes a framework based on secondary data to associate green-rated office campus development

standards and case study of Infosys organization with equivalent carbon emissions by primarily, identifying theThe study green building criteria resulting in direct and indirect carbon emission over their entire life cycle and means or approaches of avoiding carbon.

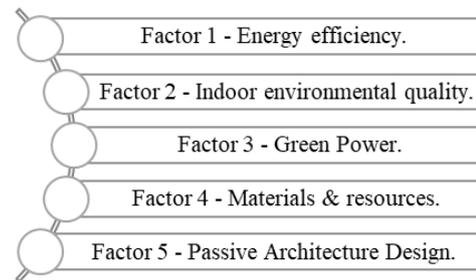


Figure 2 Carbon Emission factors identified from Infosys organization case studies.

Both the Green rating system (Figure1) and case studies (Figure2) gave similar variables after their analysis.

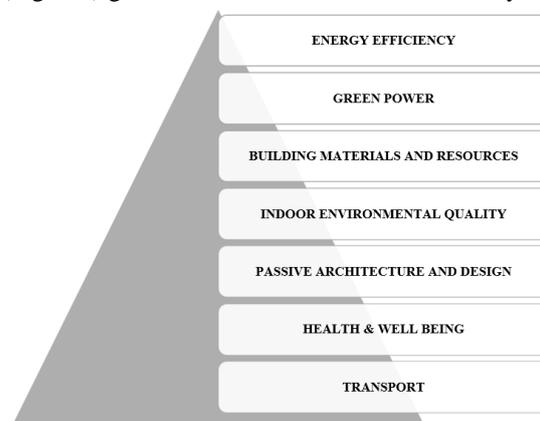


Figure 3 Factors responsible for carbon emission in large campus projects.

Results and Tables

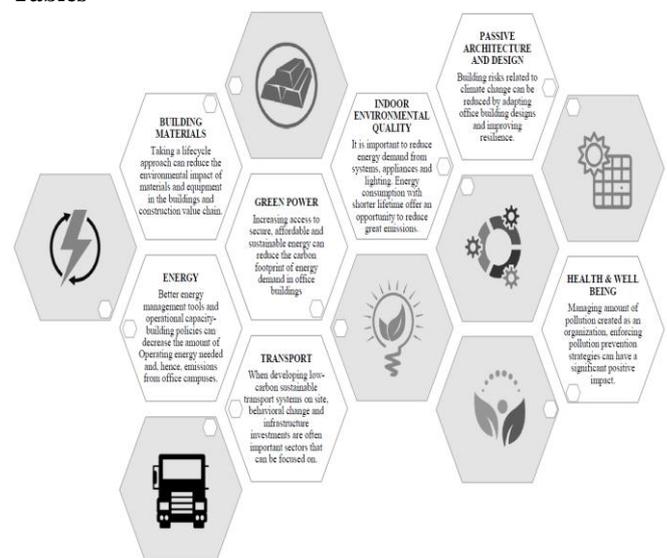


Figure 1 Target Variables for Carbon Assessing Scheme

The mentioned seven factors in Figure 3 were followed as major variables and further reviewed for their probable adverse impacts on the environment through the built and unbuilt environment.

Also, associated policies, existing bylaws and standards that potentially help to ease these adverse effects were studied and finally were used for incorporating and generating an assessing scheme to mitigate carbon emission in existing green rating certification systems of large campus projects in India.

This framework estimates carbon footprints along with the overall sustainability of existing large office campus projects. The carbon footprint analysis comprises seven indicators listed in Figure 3 based on the sources and sinks (offsets) of greenhouse gas (GHG) emissions in Green office campuses. Assessment indicators have been identified and categorized under each of these seven components based on literature, case studies, and the following mentioned are the key inferences –

Table 1 Key Inferences of Study

	Current Variable Status in selected Green Systems.	Target Status in Campus Rating	Suggested Key Recommendations.	Assessment
Target Typology - Existing office Campuses.	The whole performance of on-campus existing buildings is generally unknown, only a few energy-driven retrofits are suggested to enhance efficiency.		<ul style="list-style-type: none"> Acceleration of actions on Existing Building's retrofits, expansions, and renovation percentage to reduce energy consumption by 30-50% or more. Development and implementation of carbon mitigation strategies for refurbishment. Make use of available Government / Non-Government renovation incentives and financing policies. 	

Building Materials.	High embodied carbon materials are still in usage. Low awareness regarding the impact of such materials on the environment. Absence of awareness about available low carbon materials options due to little data, and standards availability.	<ul style="list-style-type: none"> Develop embodied carbon databases for materials/products at the organization level. Raise awareness and promote low carbon, low energy ideal materials. Acceleration in the efficiency of the company's own product manufacturing process. Increase disclosure of embodied carbon - use it as an educational aid. Support the development of material recycling, reuse, and upcycling processes for products and materials to reduce life cycle embodied energy and emissions.
Indoor Air Quality.	Deals Average efficiency of appliances and systems much lower than the best available technology.	<ul style="list-style-type: none"> stimulation & education of demand for energy-efficient appliances, Policies, available incentives to end-users and builders. further develop, enhance and strengthen minimum energy performance requirements. Provision to restrict dust during construction, Tobacco smoke, Genset emission on-site, other emission sources.
Green Power.	Not enough awareness of using fossil fuels and their carbon emission capacity, energy ingress, and environmental impacts. Knowledge of government incentives and energy policies lacking.	<ul style="list-style-type: none"> Acceleration of decarbonization measures in each energy source. Develop clean regulatory frameworks. Provision of adequate incentives. Encourage and educate end-users and builders for on-site renewable energy or green power procurement is suggested.
Project Resilience through Passive Design.	Some planning strategies are discussed but the importance and validation are not widespread.	<ul style="list-style-type: none"> Develop integrated risk assessment and resilient passive strategies to ensure adoption of existing buildings and follow it during expansion and retrofit, the entire lifecycle of campus. Implementation of mandatory building energy codes to intensify high performance. Awareness of Passive design at all stages of development.

Energy.	Currently, Minimal use of tools for enhancing energy performance and lacking disclosure of the information is done.	<ul style="list-style-type: none"> facilitation of maintenance and building energy source management. sustained adoption of energy sources, performance tools is recommended to meet set emission targets. allowing systems and standards enabling evaluation, and improvement in operations are advised for on and off-campus energy security.
----------------	---	--

Health and Well-being.	Guidelines for the sustainable well-being of users are explained but their implementation can be seen lacking during the constructional/ similar procedure phase.	<ul style="list-style-type: none"> Raise awareness; promote and implement mandatory codes to intensify high performance in green office campuses at all stages of development. Educate end-users to follow the recommended steps.
-------------------------------	---	---

Transport	Guidelines, awareness, and education for on-campus transport and the effect that it exerts on the macro and micro levels are absent.	<ul style="list-style-type: none"> • Quantification of energy exerted through transport is a necessity and should be documented at all stages. • The quantified data can be used as an aid to educate the users.
------------------	--	--

Conclusion

The study identifies the components of existing green office campuses in India, contributing to carbon emissions, and provides means to quantify their actual environmental impacts for directly targeting the reduction of carbon emissions in campuses.

Acknowledgment

I would like to express my deep sense of gratitude to my guide, Associate Prof. Aditi Lanke for all the relentless and selfless assistance extended. The guidance she rendered, helped me in the fulfillment of my study.

References

- i. Berge B. (n.d.). *The Ecology of Building Materials*, Oxford: Architectural Press; (2009). <http://iec.edu.uy/site/component/phocadownload/category/4-iec-diseno-y-construccion-sustentable.html?download=35:iec-diseno-y-construccion-sustentable>
- ii. *Global Status Report, UN Environment Programme* (n.d.). <https://www.unep.org/resources/publication/2019-global-status-report-buildings-and-construction-sector>
- iii. Kwok, K. Y., Statz, C., & Oswald Chong, W. K. (2011). *Carbon Emission Modeling for Green Building: A Comprehensive Study of Methodologies*. "International Conference on Sustainable Design and Construction (ICSDC)". <https://ascelibrary.org/doi/pdf/10.1061/41204%28426%292>
- iv. Lenzen M, T. G. (n.d.). *Embodied energy in buildings, Energy Policy*, (2002); 30:249–244. DOI: 10.1016/S0301-4215(01)00142-2. <https://www.sciencedirect.com/science/article/abs/pii/S030142150101422>
- v. Kiran, J., Victor, J., Dinesh, K. A., & Sithara, M. S. (2018, May). *A Review on various Green Building Rating Systems in India. International Journal of Scientific & Engineering, Research Volume 9(Issue 5)*.
- vi. https://www.academia.edu/41937079/A_Review_on_various_Green_Building_Rating_Systems_in_India
- vii. *About the Indian Green Building Council (IGBC)*, Retrieved from: <https://igbc.in/igbc/>
- viii. *About the Green Rating for Integrated Habitat (GRIHA)*, Retrieved from: <https://www.grihaindia.org/>
- ix. *About the IGBC Green Campus Rating System (2017)*, Retrieved from: [https://igbc.in/igbc/html_pdfs/abridged/IGBC%20Green%20Campus%20\(Pilot%20Version%20with%20First%20Addendum%20_%20January%202017\).pdf](https://igbc.in/igbc/html_pdfs/abridged/IGBC%20Green%20Campus%20(Pilot%20Version%20with%20First%20Addendum%20_%20January%202017).pdf)
- x. *About the GRIHA for Large Development (2015)*, Retrieved from: <https://www.grihaindia.org/sites/default/files/pdf/Manuals/GRIHA-LD-V2015.pdf>
- xi. *About Infosys Organization and its "United Nations Global Climate Action Award" in the Climate Neutral Now' category (2019)*, Retrieved from: <https://www.infosys.com/newsroom/press-releases/2019/carbon-neutral-now-category-award-cop25.html#:~:text=Press%20Releases-.Infosys%20Awarded%20UN%20Global%20Climate%20Action%20Award%20in%20'Climate,Now'%20Category%20at%20COP%2025&text=As%20one%20of%20the%20first,sustainable%20development%20and%20climate%20action.>

Influence of External Obstruction on Daylight Simulation In Residential Building

Kajal Rajesh Sawant

Department of Environmental Architecture, BNCA, Pune India

Email: kajalsawant22@gmail.com

Abstract: Daylight consideration improves efficiency of building in terms of energy performance. Good daylight enhances quality of space and improves productivity of user. Growing building development in urban areas can affect daylight availability in a space. The aim of this paper is to study effect of external obstruction on daylight in residential buildings. The objectives are to study change in daylight pattern results with and without external obstruction. LightStanza tool was used for simulation. The result indicates that external-obstructions affects daylight with ground floor being affected most. Results explain the necessity of considering external obstruction for calculating daylight availability in a space.

Keywords – Daylight, Light Stanza, external obstruction, residential building, bungalow, surrounding, trees

INTRODUCTION

Importance of Daylight - Daylight is one of the important aspects in residential building design. The good amount of daylight helps to keep area daylit, that indirectly helps to reduce the consumption of artificial light (Kumia et al., 2017) and directly results upto 40% reduction in electrical bills (Du et al., 2014). It also helps in increasing productivity of occupants and keeps environment healthy. If building is designed in a correct manner to cater right amount of daylight required for particular spaces that helps to reduce HVAC loads (Pereira F. et al., 2009).

External Obstruction and their Effect on Daylight - The daylight in a building is affected by many factors like external buildings, trees, sky conditions, etc. Different orientation has different impacts of external-obstruction on daylight in a building (Sun J. et al., 2017). The north side effect is comparatively negligible (Sun J. et al., 2017). There are 15 standard sky conditions and each of them has different effects on daylight in a building. Surrounding buildings and trees have shading effects and that affects daylight in a building. So, to study the effect of the external obstruction on daylight is very important.

The ground floor apartments are overshadowed by trees etc. so experience less daylight illuminance (Perisic A. et al., 2016). Different trees have different effect on daylight in a building (Hongbing W. et al., 2010).

Criteria of Daylight Analysis for Various Rating System - The daylight criteria is a mandatory requirement of various Green building rating systems like LEED, GRIHA etc. and

each has their own method to judge the sufficiency. Daylight is calculated either by simulation approach or manually, using space-by-space or whole building method.

In the whole process the architectural projections are considered for daylight analysis but effect of surrounding trees and building are neglected.

Pune Context - A rapid growth in the population is seen in a fast-growing city like Pune. So, to fulfill the requirements growth in infrastructure is seen. In Hong Kong, most of the buildings are high-rise constructed in densely built business districts and experiences the shading effect from nearby buildings and effect is very significant (Li et al., 2006). Pune is on same track so similar study for city should be carried.

Aims and Objectives – Paper aims to study effect of external obstruction on daylight in a bungalow in Pune. The study was carried on following objectives:

- To identify external obstructions that affect daylight.
- To identify the different residential building typologies for study.
- To study the daylight parameters of various rating system.
- To study the daylight pattern in a bungalow without considering external obstruction.
- To identify the change in the pattern of daylight due to external obstruction.
- To compare bungalow daylight results with and without obstructions.

Scope and Limitation of the Work - The effect of external obstructions on daylight in bungalow can be understood from study.

Many parameters act as external obstruction for daylight but for study only trees and surrounding-buildings will be considered.

METHODOLOGY AND SIMULATION PARAMETERS

The method was based on a parametric study to assess through simulation how external obstructions affect daylight availability in a bungalow. In secondary data collection, daylight parameters for various rating system, daylight

importance and different external obstruction were studied. In primary data collection firstly case study identification is done and then site surrounding study is conducted. Once its done then model will be prepared using sketch-up software and then simulation using LightStanza tool will be carried for two cases. In case 1 simulation is run for a model only with architectural projections while for case 2 all the external obstruction parameters are considered. The results obtained were analyzed and then conclusion was made on that basis.

Definition of the model

The main objective of the paper was focusing on daylighting analysis. In this section, a preliminary analysis using LightStanza tool was done and later it was used to clarify the impact of external obstructions. The main focus of the simulation is:



Figure- 1 Site surrounding of Bungalow

Figure- 2 Floor Plans of Bungalow

- Average daylight level on the floor in a bungalow.
- Comparison of the rendered image for different parameters for both cases is generated in LightStanza for average annual illuminance level and simulation for 5 May at 1 p.m.

In the simulation study, a bungalow is used as case study and analysis is conducted. From different types of external obstructions, two types of obstruction i.e. trees and surrounding buildings are considered for analysis. To study change in illuminance level in the interior space of residential unit, the sky condition is considered as climate sky and it is kept constant for both the cases. The climate sky condition uses weather data dependent on settings in the “site” tab on the left-hand side of the 3D viewer. In site tab location of the building is selected as Pune.

Simulation input parameters

The bungalow was modelled with all the architectural features like walls, doors, window, floor, ceiling, chajjas, architectural projections and balcony’s for case 1 and later for case 2 all the external obstruction like trees and surrounding buildings was modelled. Both the models were first created using sketch-up software and later they were imported in LightStanza tool for further studies.

The daylight illuminance was calculated according to 600 mm calculation grid over the whole working plane

set at a distance of 80 cm above the floor. The unit of the calculation is lux and scale are kept between 0 – 3000. The sky condition is kept as climate sky. One grid illuminance was calculated for 15 may and time was set as p.m. and other was annual grid illuminance. The window glass is considered as clear glass. All the other parameters like wall is considered as brick wall, floor, door material and WWR ratio is kept constant for simulation in both the cases.

RESULTS AND FINDINGS

The present case study was selected from the core city of Pune. The total site area is 360.26 sq.m. and the total built-up is 250 sq.m. The ground floor footprint is 120 sq.m. The structure is G+1 and is surrounded by different bungalows with maximum height upto 12 m. The length between selected bungalows for study and surrounding buildings varies between 3-10 m according to site conditions. Difference of Building A and B is 3m, G is 4.5m, F is around 6m while C, D and E buildings are opposite to road. All the roads are 6m wide. Trees are along the compound wall of bungalow and height of tress varies between 1.5-4.5 m. The two simulation cases have been studied for this case study:

1. Bungalow model with all the architectural projections.
2. Bungalow model with all surrounding buildings, trees and roads.

Case 1: LightStanza Simulation Results for Bungalow with all Architectural Projections.

Simulation Carried for 15 May at 1 p.m.	
Floor	Average Lux
Ground floor	3,049.20
First Floor	16,589.60
Average of both floor	9,819.40
Annual Average Daylight Illuminance	
Floor	Average Lux
Ground floor	2,046.49
First Floor	11,642.01
Average of both floor	8,432.58

A synthesis of the results that were obtained through the

Table-1 Results with all Architectural Projections integrated approach is presented in this section

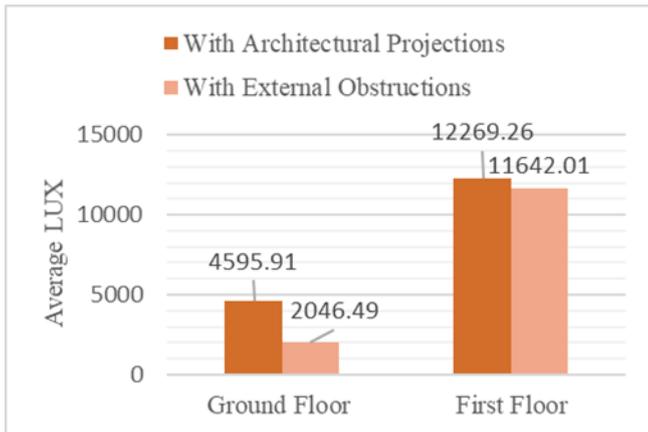


Figure -1 Comparison Graph for Annual Average Daylight Illuminance

Table- 2 Results with External Obstruction

Simulation Carried for 15 May at 1 p.m.	
Floor	Average Lux
Ground floor	4,322.10
First Floor	17,048.30
Average of both floor	10,685.20
Annual Average Daylight Illuminance	
Floor	Average Lux
Ground floor	4,595.91
First Floor	12,269.26
Average of both floor	8,432.58

Case 2: LightStanza Simulation Results for Bungalow with all Architectural Projections.

Comparison of Both the Cases

- **Simulation Carried for 5 May at 1 P.M.**

From the graph, we can notice that there is difference in illuminance level in both the cases.

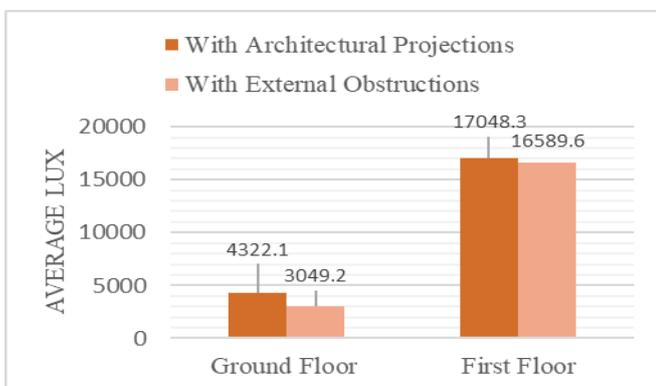


Figure- 2 Comparison Graph

The difference between the ground floor and the first floor is

1,272.90 lux and 458.70 lux respectively. It is observed that there is reduction in lux level when external obstruction is considered. The difference in the ground floor is more than first floor.

- **Annual Average Daylight Illuminance**

From the graph, we can notice that there is difference in annual average illuminance level in both the cases.

Ground floor is 2,549.42 lux while the first floor is 627.25 lux. It is observed that there is reduction in lux level when external obstruction is considered. The difference in the ground floor is more than 50%, while upper floor is upto 10%. It is noticed that effect of trees on ground floor is more than upper floor.

Findings –

In this paper the bungalow case of core Pune city is studied. The impact of external obstruction on the daylight availability together with other concern issues is explored. Several preliminary conclusions from the study can be drawn as follows:

The external obstruction affects the daylight availability in the space. For bungalows, from results it can be seen there is decrease in luminance level in the ground floor experience large amount of difference. So, ground floor are the more affected due to external obstructions, as it experience maximum shading from trees and building then the upper floor.

CONCLUSION

From the study we can understand that there is effect of surrounding buildings and trees on daylight in a building. The ground floor is most affected then the upper floors. So, at design stage external-obstructions should be considered and strategies should be applied considering the effect of external-obstruction.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Prof. Sujata Karve and Prof. Prajakta Kulkarni for their valuable guidance, inspiration and encouragement. Their keen and indefatigable indulgence in this work helped me to reach an irreproachable destination.

REFERENCES

- i. ALEXANDER LEE, S. A. (2016). DEVELOPING A WORKFLOW FOR DAYLIGHT. CAADRIA 2016 (pp. 363-372). Research Gate.
- ii. FERNANDO O. R. PEREIRA, S. M. (2009). Sky Obstruction and Daylight: Using the preferable sky window to urban daylight analyses. 26th Conference on Passive and Low Energy Architecture, Quebec City, Canada (pp. 1-7). Research Gate.

- iii. Cristina Carletti, G. C. (2017). *The influence of daylighting in buildings with parameters nZEB: application to the case study for an office in Tuscany Mediterranean area.* ELSEVIER (pp. 1-12). ELSEVIER.
- iv. Jingting Sun, Z. L. (2017). *The influence of exterior obstruction on the integrated evaluation of daylight utilization during initial design stage.* ELSEVIER (pp. 1-8). ELSEVIER.
- v. Solange M. Leder, F. O. (2006). *Impact of urban design on daylight availability. Passive and Low Energy Architecture, Geneva, Switzerland* (pp. 1-7). ResearchGate.
- vi. Islam Ayman Mashaly, Y. M. (2015). *THE EFFECT OF VEGETATION ON DAYLIGHT AVAILABILITY.* (pp. 1-9). Research Gate.
- vii. Istiadji, N. H. (2004). *Effect of external shading devices on daylighting. The Chartered Institution of Building Services Engineers 2004* (pp. 317-333). Research Gate.
- viii. Rockwell, K. (2020). *SPATIAL DAYLIGHT AUTONOMY IMPRECISION CORRELATED TO THE INCREASED APPLICATION OF DAYLIGHT DRIVEN DESIGN.* 2020 Building Performance Analysis Conference and SimBuild co-organized by ASHRAE and IBPSA-USA (pp. 130-135). ASHRAE.
- ix. Shuyang LI, D. H. (2019). *Estimation of Point Daylight Factor (PDF) Average Daylight Factor (ADF) and Vertical Daylight Factor (VDF) under various obstructed CIE Standard Skies.* 16th IBPSA Conference Rome, Italy (pp. 1177-1182). Rome: International Building Performance Simulation Associates.
- x. Solange M. Leder, F. O. (2006). *Impact of urban design on daylight availability . The 23rd Conference on Passive and Low Energy Architecture, Geneva, Switzerland.* Research Gate.
- xi. Wang Hongbing, Q. J. (2010). *Optimal tree design for daylighting in residential buildings.* Building and Environment (pp. 2594-2606). ELSEVIER.

Investigating Survival of Public Space in a Shrinking City : Study of Civic Centre in Bhilai Nagar

Ar. Anuja Joshi

M.Arch Urban Design VIT's PVP CoA PUNE

Email: anuja.joshi2306@gmail.com

Abstract : *Shrinking cities are by no means a new phenomenon; the loss of population has been as much a part of urban history as growth. Bhilai Steel Plant located in Chhattisgarh, was the first Steel Plant in the country that developed the Township of its own and provided housing to 100% of the employees. Bhilai Steel Plant (BSP) Township is the core of Bhilai Nagar and Civic Centre is city centre that houses varied activities of entertainment. Population loss is the indicator of urban shrinkage. This paper discusses shrinkage of industrial township of Bhilai Steel Plant and the signs for shrinkage that it may experience in near future. The paper focuses on 'Public spaces' and 'its role in shrinking cities' are manifestations of shrinkage that had received little attention in other literature on this topic. The periphery might be flourishing but because of presence of huge scale public gathering spaces Civic Centre being in core is still in use and also flourishing.*

Keywords: Shrinking Cities, Industrial Township, Survival decline, City Centre, Public Spaces

Background

In India the cities are urbanising at a rapid pace. According to 2011 Census, 31% of the total population of India are living in urban areas. But, the level of urbanization is not similar all over the country. Out-migration of people from small or medium size cities to mega cities is resulting into change in demographics of the cities. Out-migration is a global phenomenon caused not only by economic factors but many other factors like social, political, cultural, environmental, health, education are Push and Pull factors of migration. Along with these factors the change in employment also plays a major role in in-migration as well as out-migration. Bhilai Steel Plant located in Chhattisgarh, was the first Steel Plant in the country that developed the Township of its own and provided housing to 100% of the employees. According to Census, Chhattisgarh is having 7 cities that have population more than 10 lakhs. Raipur, Bhilai, Bilaspur and Rajnandgaon are the cities that are growing at a good pace (Wikipedia). The reason behind growth of population in Bhilai Nagar was the provisions it had for the employees of Steel Plant. It also had several scales of public spaces for people to spend quality time with family. These things majorly attracted the people from all over the country. The study of Census data shows that in past few years there is a decline in population of Township.

Introduction

Cities have experienced boom and bust cycles over time, and in some places, decline and population contraction result in permanent alterations to city structures (STATE OF THE WORLD'S CITIES, 2008/9). Shrinking cities are by no means a new phenomenon; the loss of population has been as much a part of urban history as growth. But because industrialization has triggered an accelerated expansion of cities, which has exceeded all our historical experience, we have almost forgotten about the opposite side of urbanization. The close relation between shrinking cities and industrialization can accurately be retraced if the historic and geographic developments of growing and shrinking cities are compared. Obviously, the increase and distribution of shrinking cities in the twentieth century has followed the same geographic route than the growing industrial cities took decades before. Those countries that had pioneered industrialization and rapid urban growth were also the first to see a growing number of shrinking cities. Causes and features of shrinking cities are as manifold as those of growing cities. In quantitative terms, shrinking cities can be characterized by a population decrease within a defined urban territory (Rieniets, 2009).

Shrinking Cities involves the systematic rapid growth of areas on the outskirts of cities, while growth in the inner core slows down, remains stagnant or declines. Suburbanization is associated with urban sprawl and urban decline (STATE OF THE WORLD'S CITIES, 2008/9). BSP Township is the core of Bhilai Nagar and Civic Centre is city centre that houses varied activities of entertainment. Yellow boundary (figure1) shows the geographical extent of Bhilai Nagar and the red boundary demarcates Bhilai Steel Plant (BSP) Township within it. The location of Civic Centre (figure 2) is located centrally in the township being equally accessible for people living in different sectors. In decade of 1980 civic centre was the only place in the city where substantial amount of retails was present and people were highly dependent on it; but with time because of emergence of other markets in periphery and good connectivity the shopping facilities got decentralised. In spite of development of several amenities and markets in the city the Civic Centre of BSP Township is still in use, the purpose and frequency of visiting and number of visitors might have changed somehow, but it is getting used by residents of Township as well as the periphery. The initial symptoms of shrinking city can be observed in Census data

(Figure3). Population loss is the indicator of urban shrinkage, the tip of the iceberg which results from underlying complex sets of causes propelling specific problems for urban development, typically listed as economic decline, demographic stagnation, decay, or abandonment (Grossmann, 2013).



Figure: Bhilai Municipal Corporation Area(Yellow) & Bhilai Steel Plant (BSP) Township (Red) | Source: Author

Literature Review

The shrinking city phenomenon is a multidimensional process, comprising cities, parts of cities, or entire metropolitan areas that have experienced dramatic decline in their economic and social bases (Pallagst, 2009). Shrinking cities can be well characterized and measured based on population loss, the territorial extent or the built volume of cities is less conclusive. Though urban populations can change within a relatively short period of time, the physical and legal dimensions of cities are much more inert and need much longer to adapt to the new requirements caused by demographic changes. Urban areas that experience depopulation often suffer from abandoned streets, boarded windows, and ruinous infrastructures and, consequently, from ambient feelings of fear among inhabitants and tendencies of stigmatization among the other residents of the same city (Rieniets, 2009). Cities and regions in different political contexts might play different roles in building communities, but when the cities shrink, they share common elements of what can be characterized as a “shrinkage identity”.

Urban shrinkage is often a challenge on the wide scale of metropolitan regions. Urban decline and the loss of employment opportunities are closely linked in a downward spiral, leading to an out-migration of population (Pallagst, 2009). Cities of the industrial age have experienced unprecedented economic crises followed by waves of out-migration; they have suffered from violent destruction, made possible by the mechanization of war; they have been drained by suburbanization driven by an industrialized building sector and increasing private car ownership; and they have undergone processes of deindustrialization followed by losses

of workplaces and population. Hence, industrialization has in many ways actively contributed to process of urban shrinking. Population losses by no means equally impact the entire population of a city; they are usually concentrated among those groups most prone to certain demographic dynamics. (Rieniets, 2009). There is no doubt that economic decline and the loss of employment opportunities are the primary causes of urban contraction. Other factors are intimately linked to the demographic decline of cities, as well (STATE OF THE WORLD’S CITIES, 2008/9). Migration may have different motives, but is mainly job and educational driven what implies the migration over long-distances. Outmigration due to employment deficits the most important impact on a city other than the demographic change. The level of qualification has also to be taken into account, because primarily well-educated and highly skilled people leave the city.

With regard to the population development in shrinking cities three major aspects are essential: total evolution, migration and aging. When fewer children are born and mainly young people leave the city, the age structure of the remaining population changes. (Wolff, 2010) In the township, expansion of urban periphery is emptying the central city and inner suburbs. Robert A. Beauregard calls this process “parasitic urbanization” characterized by suburbs growing at the expenses of central cities and the latter shrinking ineluctably. (Emmanuèle C. Cunningham-Sabot, 2013)

Population losses in core city caused by processes of suburbanization have therefore been counted as symptom of “shrinkage” even if the overall greater urban area has grown (Rieniets, 2009). Migration may have different motives, but is mainly job and educational driven what implies the migration over long-distances. Outmigration due to employment deficits the most important impact on a city next to the demographic change. The level of qualification has also to be taken into account because primarily well-educated and highly skilled people leave the city. A changing profile of number of employees says that by the late 1980s, the company had around 65,000 employees on its direct payroll, in worker grades. By January 2011 this was down to 31,500, a reduction accomplished through voluntary retirement and natural attrition, without forced redundancies or significant investment in labour-saving technology. Currently by 2019 there are only 20,400 permanent employees in the industry. The average age of the employees is around 49 years (Public Relation Department, 2019) which clearly shows that most of them will get retire within 10-15 years.

Study of Bhilai Steel Plant Township has great significance as it shows the symptoms that it may turn into a shrinking city. If city get studied from the perspective of urban design, then the process of hollowing that can take place in near future, can be

reversed with the help of Urban Design Guidelines or solutions accordingly.



Figure: Map showing all the sectors of BSP Township & Highlighted Civic Centre | Source: Author

This paper discusses shrinkage of industrial township of Bhilai Steel Plant and the signs for shrinkage that it may experience in near future. The paper focuses on different levels of analysis. The macro-level refers to the demographic change due to outmigration of younger population and its effects. The meso-level refers to the relationships between sprawl and shrinkage; and the micro-level refers to the study of role of public spaces in the township. In particular ‘Public spaces’ and ‘its role in shrinking cities’ are manifestations of shrinkage that had received little attention in the literature. The studies carried out regarding the shrinking cities talks only about the social impact, demographic change, type of shrinkage, cause of shrinkage and about the overall condition of the city before and after shrinkage, but none of the paper has focused on the public spaces of these shrinking cities. And most of the studies on the shrinking cities are done for developed cities, but the phenomena can also be studied for the developing countries and that too only when the cities are showing the early signs of turning into a shrinking city. Public spaces in the city are of greater importance and as they are the activity generators they can show some different nature than the other parts of the city. So to fill this gap in the study of shrinking city the research has been focused on the city centre of the BSP Township of Bhilai Nagar, Chhattisgarh.

Research Methods

The research is on investigating survival of public space in a shrinking city, Study of Civic Centre in Bhilai Nagar.

The Research Questions are as follows:

- What are the Public spaces in Bhilai Nagar that are showing decline in context of Shrinkage in BSP Township? How Civic Centre is positioned in the process?
- Which are the symptoms of decline or survival of the Civic Centre and the associated activities?
- What are the factors that are making these Civic Centre survive or decline?

The research applies Qualitative method that helped describing the factors that are making decline or survival of

City Centre of the town known as ‘Civic Centre’ and by recording the behaviour of people in detail.

To begin with, desk research was conducted and archival data have been collected to have the deeper comprehension of the symptoms and type of shrinkage that is observed in the city. This helped creating the baseline information and has brought forth what is already known about the context. This was the most appropriate method to begin with as it helped to know about the population and demographic change with the help of census data and the data for no. of employees and amenities that were and are present in the township. Also it provided the information about the ratio of population of different age groups.

In order to get a better insight of the symptoms of decline and survival of Civic Centre the structured and unstructured interviews were conducted. Sample got selected based on the age, area of residence and the employment profile of different people. To know the answers to several questions interviewing one or two people was not enough as Civic Centre has mix of use and variety of users as well as stakeholders. The questionnaire consisted of 4-8 questions depending on the type of activity. Sample got collected for several places such as Kala Mandir (Auditorium), Art Gallery, Shops, Food Zone (Chawpaty), Non-vegetarian Food Trucks, Coaching Centres in New Civic Centre, Banks and Sports Grounds as well as Stadiums. The stakeholder was selected based on the longer period of association that he/she/it had with the Civic Centre. Interviews got conducted on the site itself, some in morning hours and some in evening hours depending upon the type of activity. Answers for structured interviews were recorded by note-taking with consent (McCombes, 2019).

Two methods, ‘Participant Observation’ and ‘Discrete Observation’ were conducted for the research. This observation got conducted on weekdays as well as on weekends and public holidays to note the difference in use of spaces. These observations have answered the questions about the decline and survival of different spaces. It has also helped to comprehend the active hours of all the above listed areas within research boundary. This was achieved by having observations at different timings within a day.

Data Discussion

The collected data from desk research reveals that; there were 34,309 houses in Township in the year 1986 (Shrinivasan, Ripples - socio economic impact of Bhilai, Sept. 1988). Whereas now there are 34,350 houses out of which only 6000 are on 30 year lease and 2500 are in dilapidated condition and rest of them are allotted to employees (Public Relation Department, 2019). A changing profile of number of employees reveals that by the late 1980s, the company had around 65,000 employees on its direct payroll, in worker grades. By January 2011 this was down to 31,500, a reduction

accomplished through voluntary retirement and natural attrition, without forced redundancies or significant investment in labour-saving technology. In the year 2019 there were only 20,400 permanent employees in the industry. The average age of the employees is around 49 years (Public Relation Department, 2019) which clearly shows that most of them will get retire within 10-15 years. In the case of BSP Township outmigration because of unemployment is taking place but the Industry is not shutting off, because of the new technology the manpower that was need earlier has now reduced. This is the reason why they are not hiring as many permanent employees as they hired earlier. Number of houses was constructed as per the need of that time, earlier the production of 1 million ton was produced by 65,000 employees, where as now 7 million ton is getting produced by 20,400 permanent employees and more contract labour. Now there is a need of comparatively less number of houses and existing ones are much more in number, this might be the reason behind ignorance to the maintenance of houses.

Amenities such as schools are shutting down one after the other but the other amenities such as Hospital, Markets and Public Places of different scales need to be studied as they are also getting used by the people from periphery.

Population of the District has increase over time; the decadal increase was 17.24% in 2001 and 18.98% in 2011. According to Census of Bhilai Nagar City in 1991 population was recorded as 685474, in 2001 it was 927864 and in 2011 it got increased to 1064222 (Census). There is an increase in population in Bhilai Nagar as a city, but in case of B.S.P. Township with emergence of footloose industries, decentralization of employment and residence played a role in urban shrinkage. As central city is shedding jobs and residents, its suburbs expanded rapidly and grew segregated. In contrast to it a decline in population in each sector of BSP Township has been recorded.

By analysing the data it can be clearly observed that there was increase in the population from 1991 to 2001 and from 2001 to 2011 there is decline in population. But the decadal percentage of district tells a different story, that there is an increase in the population. This shows that the process of hollowing the core can take place in near future as the population in periphery is increasing and core is depopulation.

The decline in number of schools has been observed from the data collected regarding the schools that BSP owns. The beginning of education infrastructure was made in 1957 and by 1988 there were 58 schools in Bhilai 61,872 children having a staff of 1,469 teachers, who were the permanent employees of BSP. (Shrinivasan, Ripples - socio economic impact of Bhilai, Sept. 1988) And now, only 12 schools left in working condition (Public Relation Department, 2019). As very less number of young workers resides in the township,

less number of students is getting enrolled in BSP School. These were the schools where getting admission in the decade of 1990 was a matter of pride. The decadal growth is 18.89%; periphery has flourished and many of the Private schools, Hospitals and other amenities are present for the people residing in the periphery of township so a very few of them are dependent on the amenities of the township.

Table: Census Data of Wards that fall under Bhilai Steel Plant Township Area

S.No.	Ward No.	1991 Population	2001 Population	2011 Population
1	46	4427	13151	10819
2	47	4900	10064	9218
3	48	4969	7935	6225
4	49	6499	8590	7330
5	50	6499	7255	6999
6	51	7204	4737	4758
7	52	7461	7213	6572
8	53	6901	9146	8628
9	54	4568	7713	9922
10	55	9942	6003	6170
11	56	9942	5999	6734
12	57		4949	4398
13	64	8858	10179	6982
14	65	7565	8876	7099
<i>Total</i>		89735	111810	101854

Figure: Table showing Census data of BSP Township

Data Source: District Handbook 2001 and 2011

(CorporateAuthor, DISTRICT CENSUS HANDBOOK, 2001)

(CorporateAuthor, DISTRICT CENSUS HANDBOOK, 2011)

(CorporateAuthor, DISTRICT CENSUS HANDBOOK, 1991)| Table Source: Author

Bhilai Steel Plant allotted the houses to the employees for the span of time they are employed by the industry, people who were about to retire started buying the houses and plot of lands in the periphery of the city as they will be replaced by new employees, and they wanted to live in the city so they moved to periphery in search of the houses or land that they can owe for lifetime. This was also a major reason for the growth of periphery. More than half of the People from the second generation also got the job in B.S.P. and with increase in population; the size of the city also got increased. In present condition young generation (third generation) is getting migrated out of the city as the industry is not employing permanent employees and it is dependent more on the contract basis workers. As most of the buildings are over 40 years of age so they are in dire need of retrofitting and renovation. As the authority is not employing permanent employees there is no need to allot the houses and resulting in they are not getting renovated. Few places such as Sector- 6 have sizable amount of abandoned housing. Data has clearly established the early symptoms of shrinking.

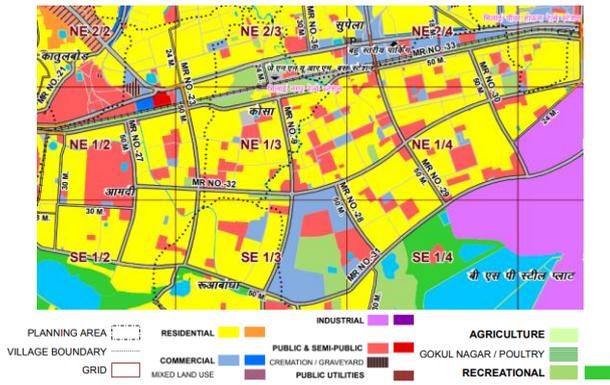


Figure: Map showing different scales of Public and commercial spaces | Source: Durg Master Plan 2031 Report

Studies on various examples from different countries in the world have revealed about the post shrinking scenario or about how the city or part of the city started to redevelop etc. and none of the papers have highlighted learning about the city centres or the public spaces of the city; to fill this gap City Centre and public spaces got selected as study area. Civic centre in Bhilai Nagar caters to many of the city scale activities; learning from each of the space has been elaborated. For the auditorium named Kala Mandir, there is a change in the frequency of bookings. Authority doesn't provide this auditorium to everybody who comes with the request for booking; it is majorly for programmes related to B.S.P and the township. There are some conditions under which it is giving to private authority.

Earlier the combined week long Annual Function of all the B.S.P. schools use to take place once a year in which best cultural programmes from each school use to be there and there use to be a competition for that, but now as many of the schools have shut off this programme doesn't take place. B.S.P. also appointed some people based on their music and art background; so those people in a group use to perform here and it used to be open for public to attend those functions, but as many of them got retired the programme does not take place. Whereas for the Art Gallery where people from the whole city are allowed to make the bookings, has witnessed a rise in the number of bookings.

Many of the owners of the shops of Civic Centre Market are associated with market since 1970. Since it was a centralised market of that era, they purchased the shops in this market. Because of growth of city in periphery and emergence of new shops, the concentration of this activity has decentralised; but this market still attracts people also from the periphery. Earlier the shop keepers use to stay on the first floor, above their shop. Because of increase in family size they moved to periphery in their personal bungalows. There was the provision of Residences, which have now turned out to be the vertical extension of some of the shops, some of them are

abandoned and a very few of them act as residence for the workers of shops.



Figure: Same space in Morning and in Evening hours | Source: Author

The collected data tells that there is a substantial growth in the number of people in evening hours, reason being the presence of large scale food zone. This being a leisure zone of the city the activity of food vending hiked with time. Earlier they use to be in a smaller ground in between auditorium, Art Gallery and Market. It has become a huge food zone after they were told to shift to a new ground.



Figure: Food zone in Morning and in Evening hours | Source: Author

A small park known as 'Pioneer Monument' is not so much in use in evening hours but it was observed to be active in morning hours for different activities like for Yoga classes, Taekwondo practice, Badminton practice, fencing practice and boxing practice.



Figure: Pioneer Monument Garden | Source: Author

There is not much change in the number of people using Sports grounds. But there is a change in user group on week days and on weekends. On weekend the group of people playing cricket on the ground in front of Jayanti Stadium is more. The same ground on weekdays is used by people to learn and practice car driving. A mix of people from township and from periphery can be observed. But currently the higher

percentages of people from periphery use these grounds in morning hours.

On the sports ground earlier the practice for state level or interschool matches were observed which can be seen in a decreased amount now. The open grounds are sometimes used for city scale exhibitions. Civic Centre is preferred by people who visit in different hours of the day and for different activities because it doesn't get congested and they can easily move from one point to other either on feet or on vehicles, also there is ample of space for parking their vehicles.



Figure: Playground in front of Jayanti Stadium | Source: Author

New market of Civic Centre came up in the decade of 1990 and has emerged as a hub of coaching Centres. As CC is located centrally and particularly this portion was a new emergence and was a silent zone coaching got emerged here. The ratio between students residing in township and students residing in periphery has changed in last 5-10 years. Earlier there were almost equal amount of students from B.S.P. Schools and Private Schools. Coaching centres flourished most in last decade now they are neither flourishing nor declining as the number of users is same, the change is in the ratio of students from township and periphery. This activity attracts students and because of continuous coaching classes students need something to eat in the breaks and this is the reason behind emergence of food vending activity nearby which makes the streets active throughout the day.

Similarly many of the tea and coffee shops of temporary nature have also flourished in different pockets of Civic Centre. Most of these shops remain active from early morning till late night; in morning hours people visiting the place for morning walks, or playing several games, etc. congregate in groups after they are done and visit these shops. Similarly in noon hours these are active because of presence of students and people visiting banks or markets.

Conclusion

The research has helped to identify the condition of city level public place that is present in the township and the initial symptoms of the hollowing of the core. From the studies it has been established that BSP Township is at verge of turning into a Shrinking City and the process of hollowing of the core can take place in near future. But on the same line it is being observed that the public spaces or city centre of the township states the different thing, they are still surviving. Public spaces

are still flourishing in the City Centre known as Civic Centre that caters various public engaging activities. Because of emergence of some of the market places in expanding periphery, some amount of change can be observed. But still Civic Centre attracts people from township as well as periphery; some activities engaging them on daily basis where as some on weekly or monthly basis. A few of activities have also declined because of the type of use and the activities that were associated with specific user group.

Availability of huge open spaces is also a reason in some or other way for survival of Civic Centre in the case of Bhilai Nagar. Because of absence of sports grounds in periphery people visit this place to play, to walk, to exercise in groups, to get coaching of specific games and to learn car on the open grounds. These grounds are the places that show a mixed kind of outcome, as these remain active in morning and evening hours but turns into silent and inactive zone in late evening. There is a possibility of introduction of some activities in these areas, which can convert it into a full time active space.

The periphery might be flourishing but because of presence of huge scale public gathering spaces Civic Centre is still in use and also flourishing.

Works Cited

- i. *Census, O. o. (n.d.). City Population. Retrieved from City Population: <https://www.citypopulation.de/India-Chhatisgarh.html>*
- ii. *CorporateAuthor. (1991). DISTRICT CENSUS HANDBOOK. Durg.*
- iii. *CorporateAuthor. (2001). DISTRICT CENSUS HANDBOOK. Govt. of India.*
- iv. *CorporateAuthor. (2011). DISTRICT CENSUS HANDBOOK. Govt. of India.*
- v. *CorporateAuthor. (2008/9). Shrinking Cities. STATE OF THE WORLD'S CITIES, 40-47.*
- vi. *Emmanuèle C. Cunningham-Sabot, C. M.-F.-F. (2013). THEORETICAL APPROACHES OF "SHRINKING CITIES". Research Gate .*
- vii. *Grossmann, K. (2013). Shrinking cities: notes for the further research agenda. Cities .*
- viii. *Madanipour, A. (2019). Contextuality of shrinkage and positionality of. Journal of Urban Design .*
- ix. *McCombes, S. (2019, February 25). Scribbr. Retrieved November 11, 2020, from Scribbr: <https://www.scribbr.com/dissertation/methodology/>*
- x. *Pallagst, K. (2009). The Future of Shrinking Cities: Problems, Patterns and Strategies of Urban Transformation in. UC Berkeley IURD Monograph Series .*

- xi. *Public Relation Department, B. (2019). Bhilai at a Glance. Bhilai Nagar: SAIL, BSP.*
- xii. *R.C.Singh. (1994). Geography of Industrial Complex. Deep & Deep Publications.*
- xiii. *Rieniets, T. (2009). Shrinking Cities: Causes and Effects of Urban Population Losses in the Twentieth Century. Research Gate .*
- xiv. *Ruff, A. (January 2009). Expanding cities, shrinking cities, sustainable cities: challenges, opportunities and examples. Research Gate .*
- xv. *Shrinivasan, N. R. (Sept. 1988). Ripples - socio economic impact of Bhilai. Bhilai: Public Relation Department, BSP.*
- xvi. *Shrinivasan, N. R. (Sept. 1984). The History of Bhilai. Bhilai: Public Relation Office, BSP.*
- xvii. *STATE OF THE WORLD'S CITIES. (2008/9). Shrinking Cities. STATE OF THE WORLD'S CITIES , 40-47.*
- xviii. *Wikipedia. (n.d.). Wikipedia. Retrieved from en.wikipedia.org/: https://en.wikipedia.org/wiki/List_of_cities_in_Chhattisgarh_by_population*
- xix. *Wolff, M. (2010). Indicators to measure shrinking cities. Research Gate .*

Evaluating The Impact of Rooftop Greening Methods on The Urban Microclimate At A Neighborhood Level (Residential)

Chetana Airani¹, Sujata Karve², Prajakta Kulkarni³
MKSSS Dr. Bhanuben Nanavati College of Architecture, Pune
Email: chetana.airani@bnca.ac.in

Abstract: Vegetation plays a key role in optimizing the urban thermal comfort and microclimate of any area. This study checks the effects of using a green roof with varying aspects: 1) Thickness of growing medium and 2) Leaf Area Density (LAD), in comparison to a conventional roof. The scenarios are analyzed on the basis of their Urban Heat Island Effect Mitigation parameters. The objectives are to study green roofing strategies and their impact on Urban Heat Island Effect and, to analyze conventional and green roofing methods. The study aims to explore the effect of green roofing strategies on the urban microclimate.

Key words – Urban microclimate, Green roofing, Urban Heat Island Effect, Thermal Comfort, Urban Vegetation, Passive Design

INTRODUCTION

The study aims to explore and analyse the effect of intensive and extensive green roofing strategies on the urban microclimate. To achieve this, a neighbourhood level urban morphology from the city was selected and mitigation scenarios were defined. Using the ENVI-met simulation tool, the proposed scenarios were evaluated. Seawoods is a planned, posh locality of Navi Mumbai, with Nerul on the North, Panvel Creek on the South, CBD Belapur on the East and Thane Creek on the West. With the help of the nearby air quality monitoring station in Nerul, the results could be cross checked for the conventional case.

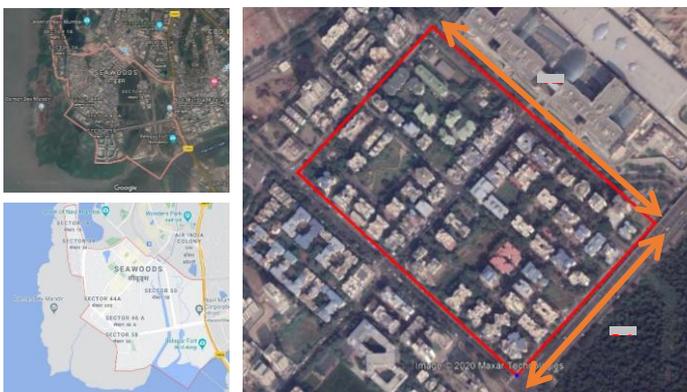


Figure-1 Site Location

This paper aims to evaluate the effect of using green roof strategies on the urban microclimate of Navi Mumbai. To conduct this research, a pilot area in Navi Mumbai, Maharashtra, was selected and two types of green roofing

techniques were applied. With the use of a climate model, the changes in microclimate were studied and evaluated.

LITERATURE REVIEW

According to the 2018 Revision of World Urbanization Prospects produced by the Population Division of the UN Department of Economic and Social Affairs (i), 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050. (i). The gradual shift in the human population from rural to urban areas is called Urbanization. Studies suggest that it causes changes in the climate of cities as compared to the rural areas. Current projections show urbanization combined with the overall growth of the world's population could add another 2.5 billion people to urban areas by 2050. Generating awareness regarding sustainable development has become the need of the hour, as rightly pointed out by these global statistics.

In the Indian context, in terms of number of persons living in urban areas, Maharashtra continues to lead with 50.8 million persons comprising 13.5 percent of the total urban population of the country, according to a report by the Ministry of Housing and Urban Affairs. (ii). Increase in the population density leads to a rise in the demand of infrastructure, services and resources to keep up with the growing needs. This puts pressure on the environment, the effects of which are felt at a large scale.

Some of the environmental problems associated with fast paced urbanization would include rise in temperature and humidity, air, water, and land pollution, climate change etc. A few of them are discussed below:

1. Rise in Temperature: The unplanned construction of large buildings in urban areas absorbs solar radiation and, in the afternoon, these emit heat radiations increasing the temperature of its surroundings. Cities often receive more rain than the surrounding countryside since dust can provoke the condensation of water vapor into rain droplets.
2. Air Pollution: The air of urban areas gets polluted due to a lot of anthropogenic activities, industries, automobiles etc. These activities release pollutants like carbon monoxide, carbon di-oxide, oxides of nitrogen, oxides of Sulphur, hydrocarbons, vapors of organic compounds, particulates, and toxic

metals etc. which are the primary cause of a large number of health hazards. (iii)

Urbanization greatly affects the urban microclimate and has been the topic of interest in many research projects. Urban morphology, density and surface materials are the key factors which affect the microclimate (iv). The authors Maleki and A. Mahdavi, make a point that the undeniable increase in population in megacities around the world are facing the brunt of fast paced planning, that did not take into account the basic materials that were used to carry out development and how they would later affect the people at large.

Under certain weather conditions a substantial difference in the air and surface temperature may be observed between a city and its surrounding rural areas. When the isotherms are drawn for the area in request, the city is apparent as a series of concentric, closed lines of higher temperature, with the maximum values recorded at or near the dense part of the urban area. This condition is known as the “Urban Heat Island” (v). Authors, Erell E, Paarlmutter D, Williamson T. agree with the notion of microclimate change with practical observations drawn from all around the world, but since the magnitude of microclimate change seems almost negligible, the common person does not concern himself with understanding mitigation strategies and their implementation until it becomes a problem.

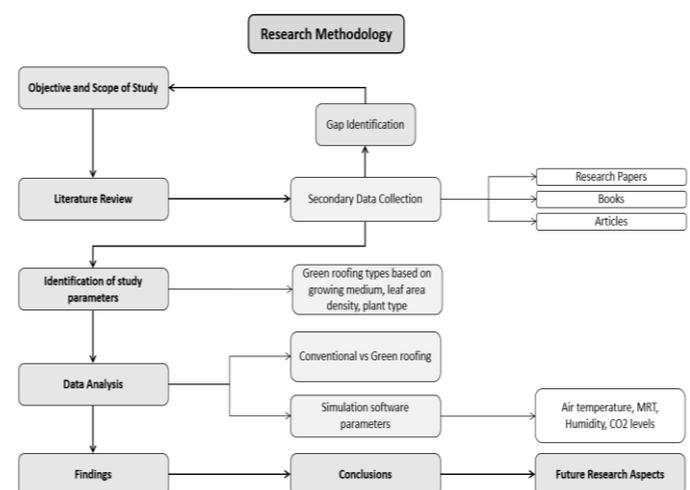
There are several potential ways to reduce Urban Heat Island (UHI) and its negative consequences in urban environment. Among them, one of the potential and effective ways is green roof measures. Green roofs involve rooftop vegetation growth in supporting layer of growing media that can be replaced the vegetated footprints that was destroyed when the buildings were constructed (vi). Authors Getter, K. L.; Rowe, D. B. state that although in cases where land degradation due to development has already occurred, providing vegetated rooftops becomes a way of regenerating lost resources. It not only improves the aesthetics and provides insulation but also creates an ecosystem supporting local flora and fauna.

Green roofs have numerous environmental benefits. It adds as insulation for roof tops (vii), maintains biodiversity, carbon sequestration and lower urban temperature. Green roof reduce temperature by creating a buffer zone in between roof and sun’s radiation therefore it shades roof and prevent surface from the heat exposure. It is found that daily maximum surface temperature underneath the green roofs has significantly lower than the daily maximum temperature in common roofs surface (viii). Authors Gaffin, S. R.; Khanbilvardi, R.; Rosenzweig, C. agree with authors Sailor, D. J.; Dietsch, N. regarding the multiple advantages to installing green roofs for any and every kind of built form. The comparison of green roof and

conventional roof properties has been discussed in multiple research studies, but the degree of microclimate impact differs in situations based on morphology, applicability of roofing system, type of green roof, and climatic condition.

Green roofs have versatile values in thermal urban environment. Green roofs vegetation absorbs solar energy to fuel photosynthesis. It also protects the roof membrane against solar radiation. It increases the longevity of roofs by protecting it from ultraviolet light. The green roofs expectancy is estimated at 40 years compared to the 7-13 years for a typical roof (ix). The question arises, that why has green roofing system not been used extensively over the years and what are the restrictions in its implementation. Cities, especially the compact ones, are generally characterized by a severe shortage of ground-level green spaces due to the scarce fertile land area. The huge bulk of urban dwellers trapped in the concrete jungles are largely deprived of the vital and pleasing natural greenery. Consequently, the intensity and effects of urban heat island is severe. In this context, greening the barren roof space provides a promising pathway to ameliorate urban heat and climate change (x). As a respite to the grey-black nature of the city, green roofs positively affect human productivity and comfort, while providing an environmental connect that psychologically soothes the mind. Inclusion of fruit bearing plants that can be supported with a thicker growing medium, brings an added advantage to this roofing technology, it is also called intensive green roof. Comparisons between the impact on microclimate by using different types of roofing materials can be a method to understanding its applicability in a particular development typology.

MATERIAL AND METHODOLOGY



Flow Chart-1 Methodology

Regarding to the capabilities of the selected area, scenarios pertaining to change in vegetation and roofing systems that have been identified are:

1. Base Case - Conventional roof: Using the existing concrete roof material as Base Case for all roofs in selected radius.
2. Case 1 - Extensive Green Roof: Using a 2-3 inch growing medium with drought-tolerant sedums (succulent plants) and grasses on all rooftops, as an easy and economical solution to reduce heat gain.
3. Case 2 - Intensive Green Roof: Using an intensive green roof technique on applicable rooftops, with a 6-inch growing medium and vegetable and herb garden plants type, which acts as an ecologically and socio-culturally advantageous option.

ENVI-met model for each of the scenarios for a typical summer daytime were created and simulated. For both the cases parameters were compared to evaluate their impact on:

- Air temperature
- Mean Radiant Temperature
- Humidity
- CO₂ levels

The tool ENVI-met was selected as it has the capability to simulate the urban microclimate while considering a relatively comprehensive range of factors (complex building shapes, vegetation etc.). The high-resolution output generated by this tool includes air, soil and surface temperature, air and soil humidity, wind speed and direction, short wave and long wave radiation fluxes, gas particles and many other important metrological factors. ENVI-met is a 3-dimensional non-hydrostatic model fit for the simulation of surface-plant-air interactions within urban environments. It is a micro-scale model with a time step between 1 to 10 seconds and resolution that ranges from 0.5 to 10 m, for the grid length (x) and the width (y). Height of the grids (z) can be more than 10 m. ENVI-met calculates the dynamics of microclimate during a diurnal cycle (24 to 48 hours) using the fundamental laws of fluid dynamics and thermodynamics.

RESULTS AND TABLES

The selected site consists of residential buildings (neighborhood) with the presence of a few small pockets of open spaces in between them. The existing buildings, soil surfaces and vegetation were mapped and converted into an Envi-met model as the Base Case. The simulation of the three cases were run for a typical peak summer day (May) for five hours, starting from 11am in the morning to 4pm in the afternoon. The location has a warm and humid climate type with an average of 34°C ambient temperature during the day and 27°C as the average low. The predominant wind direction is Southwest with an average speed of 4 m/s. An input of -47° North is fed for the model to align with the true North according to the location.



Figure- 2 Envi-met model – Case 1_Extensive Green Roof

The results obtained on comparison between the three cases based on the selected parameters were as follows:

1. **Mean Radiant Temperature (MRT):** The maximum MRT recorded was 60°C and minimum was 39°C when conventional roofing is used. The case of extensive green roof shows the most decrease in temperatures with around 2-3°C drop. Surprisingly, the intensive green roofs show negligible temperature differences considering they have higher LADs than extensive green roofs.

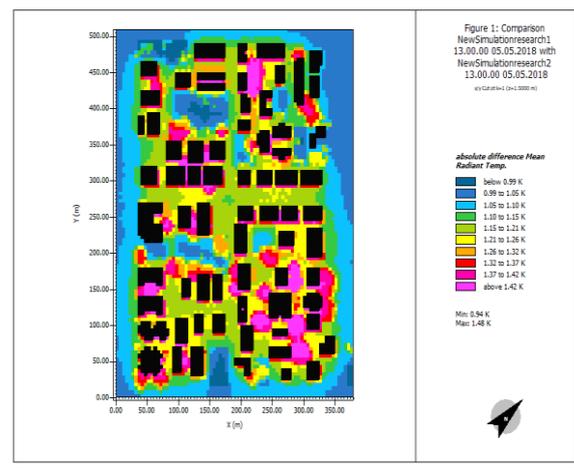


Figure- 3 Difference between MRT in base case and extensive green roof case

2. **Potential Air Temperature (PAT):** Potential temperature can be used to compare the temperature of air parcels that are at different levels in the troposphere, and it tends to decrease with decreasing altitude. Given the fact that the rooftop is on an average 24 to 30 meters from the ground level and the measure of comfort is taken at 1.5 to 2 meters above ground, the effect of changed roofing methods provides nearly negligible difference in potential air temperatures. Thus, it has no effect on pedestrian comfort or the urban microclimate.
3. **Relative Humidity (RH):** The Relative Humidity increases with each case as the vegetation LAD increases. This in turn makes the atmosphere more humid in an already warm and humid climate. With

the introduction of vegetation, the wind speed negligibly increases in the case of green roofs (0.1 m/s), but since the humidity is higher too, it does not show improvement in the microclimate.

4. **CO₂ levels:** The difference in CO₂ levels between the Base Case and both green roofing cases 1 and 2 show almost similar difference of reduced CO₂ (1-2 ppm). With acceptable CO₂ levels between 250-450ppm in outdoor spaces, the introduction of vegetation provides significant reduction in air pollution and could be improved with curbside vegetation at pedestrian levels too.

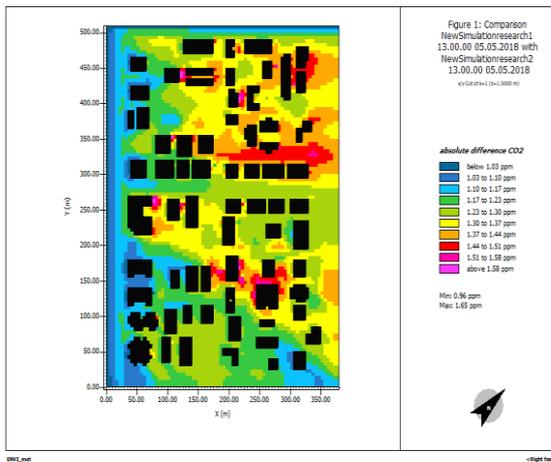


Figure- 4 Difference in CO₂ levels for base case and intensive green roof case

CONCLUSION

There is significant difference in a single parameter, namely, Mean Radiant Temperature, but a drop in temperature by a few degrees still deeply improves the comfort perception among users. Other UHI mitigation strategies like changing hardscape material, introducing additional curb side vegetation etc. might show a more significant microclimate improvement.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude to my guides Prof. Sujata Karve and Prof. Prajakta Kulkarni for their valuable guidance, inspiration and encouragement and also, for this wonderful opportunity. I appreciate the love and support provided by my family while I conducted this research.

REFERENCES

- i. UN DESA, (2018). *World Urbanization Prospects by the Population Division of the UN Department of Economic and Social Affairs*
- ii. Ministry of Housing and Urban Affairs, Government of India. *Report on Level of Urbanisation.*
- iii. Mohit Singh Rai (2017). *Impact of Urbanisation on Environment.*
- iv. Maleki and A. Mahdavi (2015). *Evaluation of Urban Heat Islands Mitigation Strategies Using 3dimensional Urban Micro-Climate Model Envi-Met.*
- v. Errell E, Paarlmutter D, Williamson T. (2011). *Urban Microclimate- Designing the Space Between the Buildings, Earthscan, Washington DC.*
- vi. Getter, K. L.; Rowe, D. B. (2006). *The Role of Extensive Green Roofs in Sustainable Development. Hortscience.*
- vii. Castleton, H. F.; Stovin, V.; Beck, S. B. M.; Davison, J. B. (2010). *Green roofs; building energy savings and the potential for retrofit. Energy and Buildings.*
- viii. FEMP, Federal Energy Management Program. United State Department of Energy; *Energy efficiency and renewable energy. DOE/EE, 0298. http://www1.eere.energy.gov/femp/pdfs/fta-green-roofs.pdf. 2004.*
- ix. RRRPDC, Richmond Regional Planning District Commission/Richmond area Metropolitan Planning Organization. 2010.
- x. Binod Baniya, Kua-anan Techato, Sharvan Kumar Ghimire, Gyan Chhipi-Shrestha (2018). *A Re-view of Green Roofs to Mitigate Urban Heat Island and Kathmandu Valley in Nepal. Win Tech Brochure – year 2013 – pages 28*

Assessing Thermal Performance of Dynamic Façades in Office Building for Hot and Dry Climate

Kasturi Bhandakkar, Associate Prof. Priya Bangle.
Bharati Vidyapeeth (Deemed to be University) Katraj Pune.
College of Architecture
Email: kasturi9159@gmail.com

Abstract: A dynamic façade, also known as a responsive façade is a building element that responds to its surrounding environment to maximize its performance (Nady, 2016). A façade can help to control the comfort conditions indoor and minimize the energy consumption which happens because of heating or cooling requirement. This study will focus on details and types of **Dynamic façade**; in particular, depending upon the climatic conditions and which type of system can be installed with which technology in detail with the focus on its thermal performance of the facade through simulations.

Keywords: Dynamic Façade, thermal performance, Façade Design, Simulation tools.

I. INTRODUCTION

The construction industry is one of the major contributors to emitting harmful emissions and also consumes a huge amount of energy. A building should be designed so that it interacts with the surrounding local environment and acts accordingly. The interaction happens mostly through the façade as it's a barrier between the inside and outside.

The envelope plays an important role in controlling interior comfort. If it is designed appropriately it can reduce the load on the cooling or heating systems which will help in energy conservation. Currently, there is a major focus on energy conservation because of the depleting natural resources.

Utilizing the façade for this purpose makes for the most of it. Traditionally the façade was developed just as a shelter. In vernacular architecture, façade plays a major role where it was designed to cater to the needs of people and also according to the climate. As the technology started developing something was lost along the way with the traditional knowledge about adaptive buildings and facades. Climate is a major concern while designing a façade. An adaptive façade can cater to changing environmental parameters.

As the world is progressing people are trying to change their perception towards the Dynamic Façade. Dynamic Façade have the ability to react to these environmental conditions with improved energy efficiency. The term 'DYNAMIC' in architecture is described as the ability of artificial and natural systems to adapt to varying environmental conditions. (Nady, 2016) Environmental conditions encompass a range of different elements such as daylight, wind and heat. All these

are natural elements which are a renewable source of energy. Dynamic facades provided according to climatic conditions respond well to four major requirements using these natural resources i.e heating, cooling, ventilation, daylight. The façade can move and transform according to the movement of the sun to cut off the harsh radiation in a hot climate and vice versa to create comfort conditions inside the building to reduce the load on mechanical systems thus helping in energy conservation.

For example, in Hot and dry climatic conditions people tend to stay indoors because of the harsh climatic conditions. These envelope systems can seize the opportunity to save energy by adapting to prevailing weather conditions and support comfort levels by immediately responding to occupants' needs and preferences.

If Dynamic facades use BIPV panels it can save energy and simultaneously help in shading and cutting of the harsh radiation as per its movement and also generate energy and can be used to reduce the cooling load of the building.

Working of a Dynamic Façade depends upon various factors such as purpose, operation, response time, material, degree of adaptability, spatial scale etc. (Loonen, et al., 2015) Also there are factors such as climate, function, site condition, requirement, orientation, movement, control etc. All these things need to be studied before implementing any design.

II. MATERIAL AND METHODOLOGY

Aim: To assess the thermal performance of types of dynamic façade in an office building in hot and dry climate with simulation tool.

Objectives:

- Studying Dynamic Façade and its types in detail through data collection.
- Studying the Climate Data and its parameters to be dealt with respect to Dynamic Facades.
- Simulating the different types derived by taking base case and its analysis on various parameters.

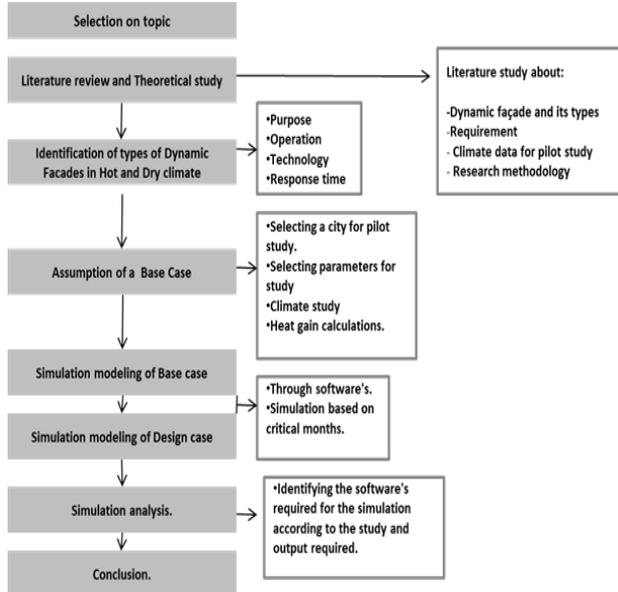
Scope:

This study will focus on details and types of DYNAMIC FAÇADE in particular depending upon the climatic conditions and which type or system can be installed with which technology in detail with focus on its thermal performance of the facade through simulations.

Limitations:

This will be an in-depth study of types of DYNAMIC FACADES only which are suitable for hot and dry climatic conditions for assessing its thermal performance and shading on façade in Indian context with help of simulation tools.

METHODOLOGY



Flow chart1. Methodology chart

CASE STUDIES

1. Kiefer Technic Showroom Austria.

It is an exhibition and office space. Austria falls in temperate climatic zone. The façade has 112 tiles that move according to the movement of the sun. Through the constantly moving aluminum perforated tiles it minimizes the need for air conditioning. The façade is controlled by engines. The tiles shift as the sun movement regulating the amount of light admitting inside. (JAAFAR AHMAD IBRAHIM, October - December 2019)



Image1(a) Kiefer Technic Showroom Façade

2. Al Bahr Towers, Abu Dhabi

It is an open plan office building used as Bank. Abu Dhabi falls under Hot and Dry Climate zone. The Dynamic screen is inspired from their ancient Islamic object known as "Mashrabiya" and motifs with two circular towers covered by a honeycomb inspired structure with automated screen. The movement of the screen is regulated by sun tracking software. It regulates the amount of sunlight inside the building. (JAAFAR AHMAD IBRAHIM, October - December 2019)



Image 1(b) Al. Bahr Towers

3. Penumbra- A kinetic Daylight and shading system.

A student Tylor Short created a super alternative to static window shades. He created vertical blinds that move right to left independently to optimize solar protection and also fold up against the high altitudes horizontally to avoid the radiation coming inside. Also the system is either powered by computer or manually. (JAAFAR AHMAD IBRAHIM, October - December 2019)



Image1(c) Penumbra Façade

III.ANALYSIS

The analysis was done by considering a Base case and two Design cases. A case of a single office floor at 60m was considered for this analysis. For analysis, climate data of Kota, Rajasthan is selected as it falls under the Hot and Dry climate zone.

After a detailed study about the climate, it was observed that the peak temperature Kota reaches is 42°C and its mostly clear sky condition throughout the year except for August which is a rainy month. There is a high diurnal temperature variation around 20°C in summers and 10°C in winters. The humidity levels are low except in August for most of the year. Prevailing wind directions from north/north-west and mostly calm winds throughout the year.

A base case of an office building is considered having a floor area of 720 sq.m with 18.5 % of openings. Heat gain calculations are done for the base case by using the internal heat gain and heat gain through opaque surfaces and glass.

i. Heat gain Calculations for Base Case:

HEAT GAIN CALCULATION			
AREA	MEDIUM OFFICE	WINDOW AREA (EAST WALL)	54.6
WINDOW AREA (NORTH WALL)	37.2	WINDOW AREA (SOUTH WALL)	37.2
FLOOR	LEVEL 10	TIME	MAY 1 PM
OUTSIDE TEMP (To)	41.8	EXPOSED FACADES	NORTH AND EAST AND SOUTH
OCCUPANTS	70	ROOF TYPE	FLAT ROOF WHITE IN COLOUR
EAST/ WEST WALL AREA	80.8	ROOF AREA	720
SOUTH/NORTH WALL AREA	146	FLOOR AREA	720
RADIATION ON WEST WALL	54	WINDOW FAÇADE	EAST, NORTH AND SOUTH
RADIATION ON EAST WALL	0	RADIATION ON NORTH WALL	0
RADIATION ON SOUTH WALL	65.22	HORIZONTAL RADIATION	598.64

INTERNAL GAIN		OCCU. + LIGHT + EQUIPMENT X FLOOR AREA (WATT)		
OCCUPANCY	70	84240		
LIGHTING	30			
EQUIPMENT	17			
TOTAL	117			
FLOOR AREA	720			
WALLS				
HEAT GAIN FOR EAST WALL				
SOL AIR TEMPERATURE			$T_s = T_o + (I \times a) / F_o$	
Ts	sol air temp		41.800	
Ti	inside temp (desired)	27		
To	outside temp			41.8
I	radiation intensity in w/sq m			0
a	absorbance of surface			0.3
Fo	surface conductance			13.15
$\Delta T = T_i - T_s$				$T_i - T_s$
Ti	27		14.800	
Ts	41.800			
Ts	41.800			
HEAT GAIN			$A \times U \times \Delta T$	
A (AREA)	80.8	1494.800		
U (U VALUE)	1.25			
delta T	14.800			
GLAZING				
HEAT GAIN/ LOSS THROUGH CONDUCTANCE FROM GLAZING ON EAST WALL			$T_s = T_o + (I \times a) / F_o$	
Ti	inside temp (desired)	27	41.800	
To	outside temp			41.8
I	radiation intensity in w/sq m			0
a	absorbance of surface			0.3
Fo	surface conductance			13.15
$\Delta T = T_s - T_i$				$T_s - T_i$
Ti	27			14.800
Ts	41.800			
HEAT GAIN			$A \times U \times \Delta T$	
A (AREA)	54.6	2101.01		
U (U VALUE)	2.6			
delta T	14.800			

HEAT GAIN THROUGH RADIATION (FOR GLAZING)			$I \times A \times SHGC$	
I	0		0	
A	54.6			
SC (SHADING COEFFICIENT X 0.86)	0.860			
HEAT GAIN FOR NORTH WALL				
SOL AIR TEMPERATURE			$T_s = T_o + (I \times a) / F_o$	
Ti	inside temp (desired)	27	41.800	
To	outside temp			41.8
I	radiation intensity in w/sq m			0
a	absorbance of surface			0.3
Fo	surface conductance			13.15
$\Delta T = T_s - T_i$				$T_s - T_i$
Ti	27			14.800
Ts	41.800			
HEAT GAIN			$A \times U \times \Delta T$	
A (AREA)	146	2701.00		
U (U VALUE)	1.25			
delta T	14.800			

HEAT GAIN THROUGH RADIATION (FOR GLAZING)			$I \times A \times SHGC$	
I	0		0	
A	54.6			
SC (SHADING COEFFICIENT X 0.86)	0.860			
HEAT GAIN FOR NORTH WALL				
SOL AIR TEMPERATURE			$T_s = T_o + (I \times a) / F_o$	
Ti	inside temp (desired)	27	41.800	
To	outside temp			41.8
I	radiation intensity in w/sq m			0
a	absorbance of surface			0.3
Fo	surface conductance			13.15
$\Delta T = T_s - T_i$				$T_s - T_i$
Ti	27			14.800
Ts	41.800			
HEAT GAIN			$A \times U \times \Delta T$	
A (AREA)	146	2701.00		
U (U VALUE)	1.25			
delta T	14.800			

GLAZING			
HEAT GAIN/ LOSS THROUGH CONDUCTANCE FROM GLAZING			$T_s = T_o + (I \times a) / F_o$
ON NORTH WALL			
Ti	inside temp (desired)	27	41.800
To	outside temp	41.8	
I	radiation intensity in w/sq m	0	
a	absorbance of surface	0.3	
Fo	surface conductance	13.15	
delta T = Ts - Ti			Ts - Ti
Ti		27	14.800
Ts		41.800	
HEAT GAIN			A X U X delta T
A (AREA)		54.6	2101.01
U (U VALUE)		2.6	
delta T		14.800	
HEAT GAIN THROUGH RADIATION (FOR GLAZING)			
I		0	0
A		54.6	
SC (SHADING COEFFICIENT X 0.86)		0.860	
HEAT GAIN FOR SOUTH WALL			
SOL AIR TEMPERATURE			$T_s = T_o + (I \times a) / F_o$
Ti	inside temp (desired)	27	43.288
To	outside temp	41.8	
I	radiation intensity in w/sq m	65.22	
a	absorbance of surface	0.3	
Fo	surface conductance	13.15	
delta T = Ts - Ti			Ts - Ti
Ti		27	16.29
Ts		43.288	
HEAT GAIN			A X U X delta T
A (AREA)		146	2972.56
U (U VALUE)		1.25	
delta T		16.288	
GLAZING			
HEAT GAIN/ LOSS THROUGH CONDUCTANCE FROM GLAZING			$T_s = T_o + (I \times a) / F_o$
ON SOUTH WALL			
Ti	inside temp (desired)	27	43.288
To	outside temp	41.8	
I	radiation intensity in w/sq m	65.22	
a	absorbance of surface	0.3	
Fo	surface conductance	13.15	
delta T = Ts - Ti			Ts - Ti
Ti		27	16.29
Ts		43.288	
HEAT GAIN			A X U X delta T
A (AREA)		146	2972.56
U (U VALUE)		1.25	
delta T		16.288	
GLAZING			
HEAT GAIN/ LOSS THROUGH CONDUCTANCE FROM GLAZING			$T_s = T_o + (I \times a) / F_o$
ON SOUTH WALL			
Ti	inside temp (desired)	27	43.288
To	outside temp	41.8	
I	radiation intensity in w/sq m	65.22	
a	absorbance of surface	0.3	
Fo	surface conductance	13.15	
delta T = Ts - Ti			Ts - Ti
Ti		27	16.288
Ts		43.288	
HEAT GAIN			A X U X delta T
A (AREA)		37.2	1575.38
U (U VALUE)		2.6	
delta T		16.288	
HEAT GAIN THROUGH RADIATION (FOR GLAZING)			
I		65.22	2086.51824
A		37.2	
SC (SHADING COEFFICIENT X 0.86)		0.860	
HEAT GAIN FOR WEST WALL			
SOL AIR TEMPERATURE			$T_s = T_o + (I \times a) / F_o$
Ti	inside temp (desired)	27	43.032
To	outside temp	41.8	
I	radiation intensity in w/sq m	54	
a	absorbance of surface	0.3	
Fo	surface conductance	13.15	
delta T = Ts - Ti			Ts - Ti
Ti		27	16.03
Ts		43.032	
HEAT GAIN			A X U X delta T
A (AREA)		80.8	1619.23
U (U VALUE)		1.25	
delta T		16.032	
GLAZING			
HEAT GAIN/ LOSS THROUGH CONDUCTANCE FROM GLAZING			$T_s = T_o + (I \times a) / F_o$
ON WEST WALL			
Ti	inside temp (desired)	27	43.032
To	outside temp	41.8	
I	radiation intensity in w/sq m	54	
a	absorbance of surface	0.3	
Fo	surface conductance	13.15	

delta T = Ts - Ti			Ts - Ti
Ti		27	16.032
Ts		43.032	
HEAT GAIN			A X U X delta T
A (AREA)		6	250.10
U (U VALUE)		2.6	
delta T		16.032	
HEAT GAIN THROUGH RADIATION (FOR GLAZING)			
I		54	278.64
A		6	
SC (SHADING COEFFICIENT X 0.86)		0.860	
ROOF			
HEAT GAIN FORM ROOF			
SOL AIR TEMPERATURE			$T_s = T_o + (I \times a) / F_o$
Ti	inside temp (desired)	27	55.457
To	outside temp	41.8	
I	radiation intensity in w/sq m	598.64	
a	absorbance of surface	0.3	
Fo	surface conductance	13.15	

delta T = Ts - Ti			Ts - Ti
Ti		25	30.46
Ts		55.46	
HEAT GAIN			A X U X delta T
A (AREA)		4262	31965.00
U (U VALUE)		2.5	
delta T		3.000	
HEAT GAIN/ LOSS THROUGH INFILTRATION			
FLOOR AREA		720	3312
TOTAL			
		WATT	136697.24
		WATT PER SQ M	189.86

Table 1. Heat gain calculations

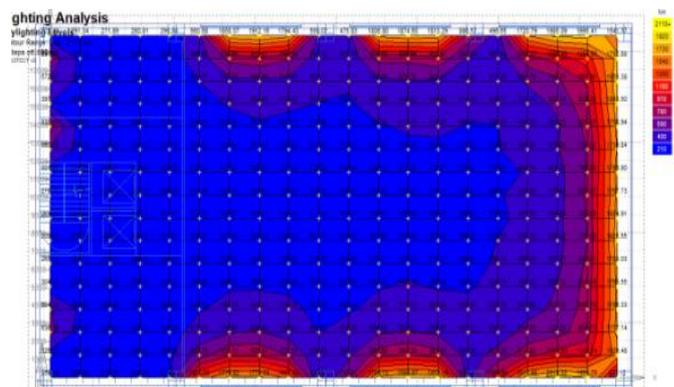


Image2. Daylight simulation in Ecotect

Total heat gain through envelop and roof: (manual calculations)

MAY 1 PM = 189.86 W/M2 K

ANNUAL = 326 kwh/m2 (software- Revit analysis)

ii. DESIGN CASE 1:

Altitude angles: May 11 AM: 70*, May 2 PM: 60* ,May 4 PM: 30*

CONSIDERATIONS FOR DESIGN CASES:

Envelop material: Gypsum Plaster, AAC Blocks, Semi-transparent photovoltaic cells, **Roof material:** White tiles, Concrete slab, Glass Details: Visible light, **Transmittance:** 40% , **U-value:** 0.48 W/M2K, 20 mm thk. Double glazing with argon cavity, **SHGC:** 0.49

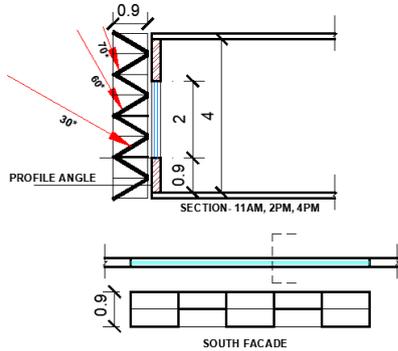


Image 3(a) Plan and section of the façade

OPTION 1-

Here annual solar radiation study is carried out on the façade with and without dynamic façade where the radiation is received is 326 kwh/m².

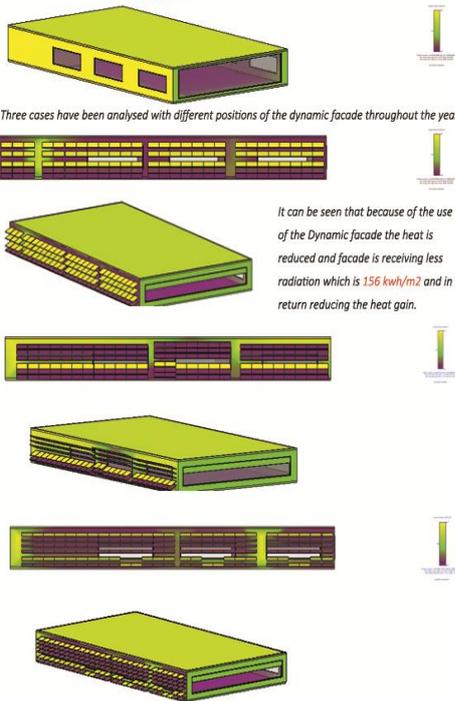


Image 3(b) Revit-Insight Insolation analysis

Radiation analysis: It can be seen in these results that in the base case where there are no shading devices used whole south façade are receiving more radiations throughout the year i.e 326 kWh/m². But after placing the dynamic façade radiations are cut off to i.e 156 kWh/m² and the heat gain through the façade is reduced.

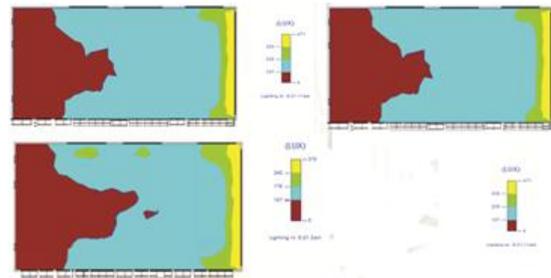


Image3(c) Revit-Insight Daylight analysis

Daylight: Lux levels observed here are 167-471 lux which satisfies the NBC Norm. The semi-transparent photovoltaic cell modules are used as panel's material, providing natural light quality throughout the daylight hours all year round.

iii. **DESIGN CASE 2:**

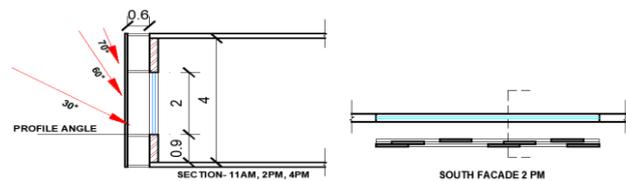


Image 4(a) Plan and section of the façade

OPTION 2-

Here annual solar radiation study is carried out on the façade with and without dynamic façade where the radiation is received as 326 kwh/m².

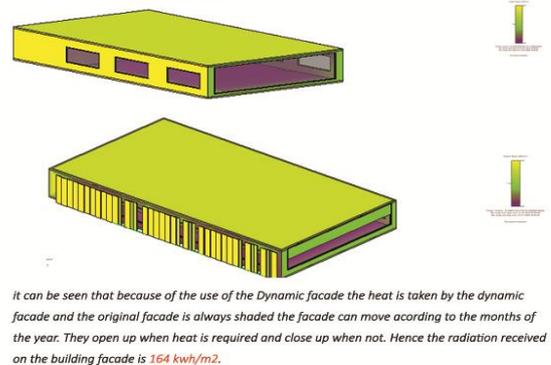


Image 4(b) Revit-Insight Insolation analysis

Radiation analysis: It can be seen in these results that in the base case where there are no shading devices used whole south façade are receiving more radiations i.e 326 kWh/m² throughout the year. But after placing the dynamic façade the radiations are cut off to 164 kWh/m² and heat gain through the façade is reduced.



Image 4(c) Revit-Insight Daylight analysis

Daylight: Lux levels observed here are 107-426 lux which satisfies the NBC Norm. The semi-transparent photovoltaic

cell modules are used as panel's material, providing natural light quality throughout the daylight hours all year round.

IV. CONCLUSION

The paper aims to assess the thermal performance of Dynamic Façade for office buildings in Hot and Dry climate. It was noticed after placing the dynamic facades the radiation was cut down to almost 47% in case 1 and 50% in case 2 hence, it was concluded that Case 1 proves to delay the intervals of sun penetration and potential glare to the indoor office building space by 47% and achieve acceptable comfort and illumination level inside.

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my mentor Associate Prof. Priya Bangle, for her constant support and guiding me through correct direction.

I. REFERENCES

- i. Aelenei, L., Aelenei, D., Romano, R., Mazzucchelli, E. S., Brzezicki, M., & Rico-Martinez, J. M. *Case Studies –Adaptive Facade Network*. TU Delft Open. (https://www.researchgate.net/publication/329339413_Case_Studies_-_Adaptive_Facade_Network)
- ii. Ansari, K. U. (April-June, 2017). *Intelligent and Adaptive Façade System – The Impact on the Performance and Energy Efficiency of Buildings*. *Journal of Civil Engineering and Environmental Technology* p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 4, Issue 3; , pp. 295-300. (<http://www.krishisanskriti.org/Publication.html>)
- iii. Attia, S. (2017). *Evaluation of adaptive facades:The case study of Al Bahr Towers*. *QScience Connect* , 1-12. (https://www.researchgate.net/publication/316331795_Evaluation_of_adaptive_facades_The_case_study_of_Al_Bahr_Towers_in_the_UAE)
- iv. Bess Krietemeyer, K. R. (n.d.). *Real-Time Multi-Zone Building Performance Impacts of Occupant Interaction with Dynamic Façade Systems*. *Smart and Responsive Design - Applied - Volume 2* . (http://papers.cumincad.org/data/works/att/ecaade2015_139.content.pdf)
- v. Doris A. Chi, D. M. (2017). *Design optimisation of perforated solar façades in order to balance daylighting with thermal performance*. Article in *Building and Environment* · September 2017 DOI: 10.1016/j.buildenv.. (<https://www.researchgate.net/publication/319607578>)
- vi. Esam Elsarrag, Y. A. ((October 2011)). *Using Dynamic Façade for Indoor Air Quality, Thermal Comfort and Energy Efficient Air Conditioning*. *UNIVERSITY of KHARTOUM ENGINEERING JOURNAL (UofKEJ)*Vol. 1 Issue 2 pp. , 63-66. (<http://www.uofk.edu/uofkej>)
- vii. JAAFAR AHMAD IBRAHIM, H. Z. (October - December 2019). *KINETIC FAÇADE AS A TOOL FOR ENERGY EFFICIENCY*. *International Journal of Engineering Research and Reviews* Vol. 7, Issue 4 , 1-7. (https://www.researchgate.net/publication/338188733_KINETIC_FAÇADE_AS_A_TOOL_FOR_ENERGY_EFFICIENCY)
- viii. Loonen, R., Rico-Martinez, J., Favoino, F., Brzezicki, M., Menezes, C., Ferla, G. L., et al. (2015). *Design for façade adaptability –Towards a unified and systematic characterization*. In *Proceedings of the 10th Energy Forum - Advanced Building Skins.*, (pp. 1274-1284). Bern, Switzerland. (https://www.researchgate.net/publication/279955723_Design_for_facade_adaptability_-_Towards_a_unified_and_systematic_characterization)
- ix. Nady, D. R. (2016, October 1-3). *Dynamic Facades Environmental Control Systems for Sustainable Design*. *Renewable Energy and Sustainable Development (RES D)* , 118-127. (https://www.researchgate.net/publication/316615517_Dynamic_Facades_Environmental_Control_Systems_for_Sustainable_Design)
- x. WAGDY, A., FATHY, F., & ALTOMONTE, S. (July 2016). *Evaluating the Daylighting Performance of Dynamic Façades by Using New Annual Climate-Based Metrics*. *PLEA 2016 Los Angeles - 32th International Conference on Passive and Low Energy Architecture Cities, Buildings, People: Towards Regenerative Environments*. Los Angeles. (https://www.researchgate.net/publication/305726120_Evaluating_the_Daylighting_Performance_of_Dynamic_Facades_by_Using_New_Annual_Climate-Based_Metrics)

Feasibility Analysis For Preparing Management Plan For Revitalisation Of Heritage Places Of Old Nashik City – Precinct Saraf Bazaar

Ar. Pallavi Pathak

Email – pallavik80@gmail.com

Second Year M.Arch (Project Management)

Prof. Pushpagandha Shukla

professor@ctescoa.com

CTES College of Architecture, Chembur Mumbai

Abstract-The pursuit for heritage conservation got structured worldwide in the past few decades through pioneer bodies like UNESCO and ICOMOS, and through Government policies, ASI, INTACH and community participation, in India. Nashik, with its rich historical heritage, awaits the synergy. Sporadic efforts under SMART CITIES and INTACH remain meagre to sustain the legacy and heritage is dilapidating rapidly. This research is focusing on creating a template of framework for Heritage Management plan of a sample precinct, The Saraf Bazaar of Old Nashik and evaluating its feasibility through understanding of the complex challenges and deriving potentials of revival possibilities.

Keywords: Heritage Management, Culture, Revitalization, Precinct, Feasibility

INTRODUCTION

Our heritage is our inheritance - what the past has conceded to us, what we value in the present and what we choose to preserve for future generations. Heritage management of any place is the endeavour to preserve its historic fabric in the most authentic manner. The pursuit for heritage conservation is age-old. As in the 18th Century, after the defeat of Napoleon, the British officersⁱⁱ decreed that the French should return all the Art Work that they had looted from Egypt and Europe. Later, after the Hague Convention and establishment of UNESCO, in 1945, and subsequent symposiums most of the countries took serious cognizance of heritage conservation.

In India too, successful heritage revival has been undertaken at different levels with collaborations between Corporations, Stakeholders, NGOs and International bodies in many cities like Ahmedabadⁱⁱⁱ and Pune^{iv}, and through fully government funded schemes like HRIDAY.

Nashik is also a historic town, well-known, for its mention in Ramayana, the Kumbhamela (which occurs every 12 years) and the historic Temples and Wadas of Peshwa Era. There are about 60 ancient temples in Old Nashik, which has earned it the name of Western Benaras. The 150-year-old British

Gazetteer,^v for Nashik enlists 300 Copper and Brass artisans, 1123 superior houses, describing 27 noteworthy Wadas with richly carved wooden framework. A large portion of the Old city still retains the ethnic grandeur showcasing vernacular building facades. Contradictory to adjacent megacities, where the River is analogous to bridges, Nashik's Godavari Ghats are opulent with community life.



Figure-1 Image showing Godavari Ghats in early morning
Sourced from <https://indiaandbeyond.com.au/>

And yet, vandalism and wear and tear over time can be seen all over the heritage structures. Incompatible additions and poor maintenance have outgrown their identity.



Figure-2 A dilapidated Wada in Old Nashik

THE PROBLEM

Despite having a significantly increasing footfall of visitors, (44,30,433 in 2009-2010^{vi} and 52,21960 in 2011-2012^{vii} and over 50,00,000 on a single Parvani day during Kumbhamela)

the revenue generation is insufficient for conservation, as such, heritage is crumbling to fiscal pressures. Handful projects under State Archaeology (Sarkarwada and SunderNarayan Temple) funded by Smart Cities^{viii} (Godapark) and temple trusts (Kalaram Temple and Balaji Temple), are meagre to sustain the legacy. Nashik gets a considerable facelift in terms of infrastructure development, during the Kumbhamela, but often, adversely affects the historic fabric. Conscientious revitalization of the heritage is viable, along with boosting community development and tourism, justifying the purpose of its conservation. However, this would be achievable only through a comprehensive and cohesive heritage management plan implemented at city level, or on a smaller precinct.

AIM, OBJECTIVE AND SCOPE

The aim is preparing a comprehensive heritage management plan for the revitalisation Saraf Bazaar precinct, integrating with the surrounding tourist interests and highly valued existing heritage and conservation elements in the old city. The objectives are focused on understanding the potentials and challenges of heritage revival for a precinct in Nashik. The interventions and reuse plan suggested shall contribute in promoting community development and revenue generation. Scope of study is limited to making a framework for heritage plan and evaluating its feasibility for a precinct which can have multiple applications through contextual modifications.

MATERIAL:

LITERATURE REVIEW

Several readings have been undertaken covering a range of subtopics related to heritage conservation and management. These include

- 2 Books on Heritage management (from India and UK).
- NITI Aayog report and INTACH report on on current status of Heritage conservation in urban context.
- 1 Book and 2 reports on Feasibility studies (from UK)
- 6 research papers on varying topics like case studies of heritage revival, roles of project manager in heritage management, challenges faced by pilgrim cities of India and Management of World heritage sites.
- 3 webinars on heritage management with case studies.
- Several news articles on current affairs in the field.

Amongst these, the Paper on Revival of walled city of Ahmedabad^{ix} is of special significance, which enumerates the vital role played by Ahmedabad municipal corporation, community stakeholders, Public Private Participation and strategic planning in the project's success.

Another paper on challenges of pilgrim cities of India^x enumerates the challenges and problems faced by the pilgrim cities of India, and also suggest a way forward.

THE PRECINCT

The precinct of Saraf Bazaar, consists of a 150mx5-7.5m (width is varying) lane connecting the Sarkar Wada (the headquarters of Peshwas) with the famous Naroshankar Temple on the Ghats. This highly commercialised and crowded area houses the 100-year-old Brass and Copper market, (30-35 shops) the traditional Silver Jewellers, (20-25) wholesale cloth (6 shops) and miscellaneous (5-6 shops) on Ground Floors plus offices and residences on upper two storied Wadas (now interspersed with modern buildings). Important residential buildings are The Balaji Temple, and The Pethe Wadas built 300 years ago, by the then Sardars of Peshwa.

The vibrancy characterizing the typical Indian street market is evident through the routine activities

- 4:30 am to 8:00 am- The florists, (the original market has been shifted, however, 5-6 remain)
- 8:00 to 10:30- The vegetable vendors,
- 10:30 to 8:30 - The main shops accompanied by the unauthorized Patwe, (artificial jewellers) and Tambat (Artisans who engrave names on utensils) and others selling odd items like rangoli, spices, etc.

The area gets overcrowded during annual festivals like Brahmotsav (Balaji Mandir), and Janmashthami (Murlidhar Mandir). This is also one the most affected areas during Kumbhmela.



Figure-3 showing the layout of precinct



Figure-4 showing the Saraf Bazaar Street

METHODOLOGY

Stage1:

The SWOT analysis is used to identify the basic challenges and opportunities for revitalization.

The first stage research contains analysis of qualitative and empirical data obtained through observations. Three potential precincts were shortlisted for study. Decision-making process has been used to select the most suitable precinct out of three. Six Pivotal elements within the precinct have been identified through discussions with experts and listed for modulations. decision making process is once again applied to select One of the Pethe Wadas (out of three) for detail revitalisation program in the first phase. Detail assessment of each element has been done on four criteria (Refer Table 1)

An exhaustive review of the rules, bye laws, and existing proposals is undertaken to identify needs for interventions at policy level.

Stage 2: Experts' interviews and stakeholders' surveys shall be used to support the data. Cost analysis shall be made to determine the financial implications.

OUTCOMES:

SWOT ANALYSIS OF THE PRECINCT

The strengths are the heavy footfall (around 10,000-12,000 daily on the adjacent river ghats) and the maximum turnover of Old Nashik area. This gives the area opportunities for various allied business proposals. Crowding and poor parking are the prominent weakness. Flooding during high rains is also a big problem, however, is on the agenda of Smart Cities. Fiscal interests of stakeholders along with the awaited Cluster Development proposal are the major threats.

The strengths and opportunities have been to used conceptualize the interventions and reuse possibilities. On the other hand, the study suggests certain elemental interventions at policy level to counter the weaknesses, such as:

- The Saraf bazar lane should be converted into a one-way lane from Sarkar Wada to the river and restricted only for two wheelers.

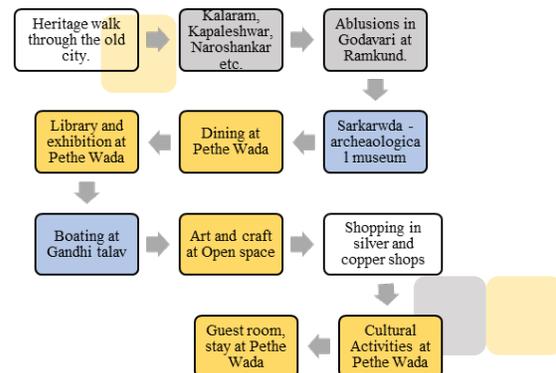
- Four-Wheeler Parking space should be assigned at Kapurthala.
- State Archaeology and Smart Cities departments need to operate harmoniously, also in conjunction with INTACH.
- Government should encourage 'Adopt a Heritage' policy by giving incentives to developers. Incentives could be in the form of equivalent FSI in other sites of same TDR Zone.

PROJECT PROPOSAL

Stage 1:

Interventions have been proposed for six pivotal elements of the precinct depending upon their current status and scope of the study. (Refer Table 1) Proposals are made by taking into account the experts' opinions and the stakeholder's perspectives. The key ideas are:

- To restore the ethnic character of the street that would also create an attraction for the tourists.
- To integrate the new developments with the existing heritage features will shall boost the visitors interests in the area. (Refer Flow Chart 1)
- Provide possibilities for community employment and revenue generation.



LEGEND

	Activities carried out by INTACH
	Existing features
	Activities proposed in research.
	Activities in SMART CITY proposal.

Flow Chart - 1 showing integration of proposed activities with existing features

Pethe Wada:

Proposals for Pethe Wada are based on a combination two approaches, one being merely for Social cause by providing a platform for the craftsmen and artisans for display of their expertise at a very meagre cost. The second part would focus on revenue generation along with benefitting the community employment and activities. (Refer Table 2)

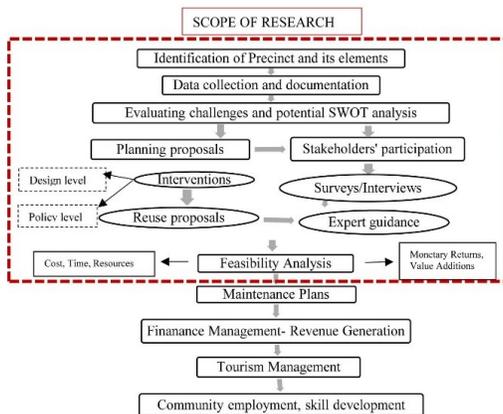
Table- 2 REUSE PROPOSAL FOR PETHE WADA (only for Ground and First Floor)

Criteria	Ground Floor	First Floor
1 Cause	Social Cause	Commercial
2 Finance Model	No Profit no Loass	Profit/Fund Raising
3 Functions	<ul style="list-style-type: none"> Local Crafts Center Library Museum for Antique utensils and jewellery Live Museums 	<ul style="list-style-type: none"> Community Hall for functions Maharashtrian Dining Hall Guest Rooms
4 Possible Funding	Grants, CSR funds	Loans, Partnerships

Reuse plans (Refer fig. 5) have been proposed in consideration with the sanctity of the structure, current market scenario, tourist inclinations and availability of resources.

HERITAGE MANAGEMENT PLAN

Framework for Heritage Management plan starts with identification of the precinct for detail study, covers data collections and analysis, designing proposals, and studying its feasibility. (Refer Flow Chart 2).



Flow Chart- 2 Framework for Heritage Management Plan

The scope of this research is limited to the feasibility analysis. Execution of the proposal shall require further stages of Management plan as mentioned in the chart

FRAMEWORK FOR FEASIBILITY STUDY

The feasibility analysis shall weigh the various cost factors (finance, time, resources, etc) required against benefits enjoyed by the multiple stakeholders of the project. Benefits are valued for monetary aspects, increasing the life span of buildings, employment, etc. and also non-measurable like fame, stature, satisfaction, which can be deliberated with respect to stakeholders' speculation.

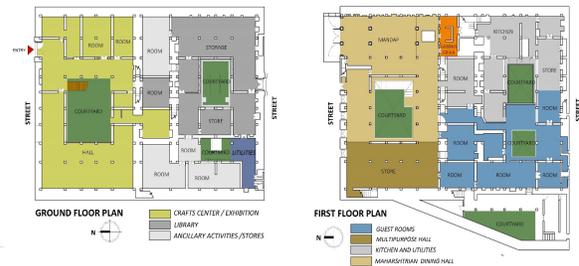
Stage 2 research shall be used further to validate the observations and suitability of proposals.

CONCLUSION

The feasibility analysis so obtained could be used to form the base for preparing a detail heritage management plan. The methodology of study could be used as a template for undertaking revitalization of further potential heritage structures from other precincts of Nashik and also other cities like Nashik.

ACKNOWLEDGEMENTS

I wish to express my deep sense of gratitude towards my guide Prof. Pushpagandha Shukla and co-guides Ar. Umesh Mallya and Ar. Dhaval Ghare for their valuable guidance and encouragement. I also wish to thank Mr. Amit Pethe for his enthusiasm and cooperation in the carrying out the research.



REFERENCES

- i. Sourced from www.heritagecouncil.com
- ii. Duke of Wellington and Viscount Castlereagh
- iii. Refers to the UNESCO World Heritage walled city of Ahmedabad; project undertaken by Ahmedabad Municipal Corporation.
- iv. Conservation of Shaniwar Wada, Karale wada and similar projects undertaken by INTACH Pune Chapter
- v. The Gazetteers Department – Maharashtra
- vi. https://gazetteers.maharashtra.gov.in/cultural.maharashtra.gov.in/english/gazetteer/Nashik%20District/appendix_n.html#6
- vii. Ministry of Tourism (Market Research Division) Government of India 2010
- viii. https://tourism.gov.in/sites/default/files/2020-04/Maharashtra_0.pdf
- ix. Maharashtra Tourism Development Corporation Government of India 2012 http://mahervis.nic.in/pdf/TourismStatisticsofMaharashtraApr2011_Mar2012.pdf
- x. <http://nashiksmartcity.in/>
- xi. Getting the City Back to the People Municipal Initiative in Debashish Nayak, Advisor, Heritage Programme, AMC
- xii. Challenges for urban conservation of core area in pilgrim cities of India by Shradha Chandan, Ashwani Kumar Department of Architecture and Planning, Malaviya National Institute of Technology Jaipur

Table- 1 COMPONENT WISE CONSPECTUS AND PROPOSALS

S r. n o.	Component Description	Project worth	Current status	Inalterable features	Possible degrees of Interventions	Prospective interventions
1	The street	Cord Connecting the different areas	Extremely crowded. No parking spaces. Concrete paving.	Sequence of shops their frontlines, levels.	Moderate to High	Convert street to one way. Cobble stone paving with ottas for petty artisans. Signages, street furniture,
2	Shops (silver, copper, cloth)	Oldest shops. Generate maximum turnover of Old Nashik area.	Individual shops have facades to suit their own taste.	Display requirements	Low to Moderate	Vernacular façade restoration. Innovations in products (by Experts)
3	Pethe Wada	Most prospective area for revitalization	Ground+2 storied Partly In a dilapidated condition. Has been vacated recently.	The wooden framework, narrow entrance.	High. As explained in Table 2	As explained in Table 2
4	Open Space	A dynamic space at the entrance of the street	Haphazardly occupied by hawkers and parking	Parking solutions need government nod.	Moderate to High	Multipurpose space for artists, potters, food, etc.
5	Murlidhar Mandir	important for its Janmastami Festival	Small wada temple, beautiful sanctum but narrow entrance	Narrow entrance.	Low	Enhancement of the entranceway.
6	Balaji Temple	Very famous and large wada temple	G+2 Storied with beautiful vernacular façade.	Nothing except entrance and shop facades	Very Low.	Emphasizing entrance

Usage of Green Building Materials in India's Building Sector

Divya Chaudhari

M.Arch Student, Department of Environmental Architecture,
Dr. Bhanuben Nanavati college of Architecture, Pune, India
chaudharividya295@gmail.com

Abstract : *The purpose of this research was to study the awareness regarding the use of green building materials in building sector of India. This study has tried to determine the possible challenges as well as drivers in adopting use of Green Building Materials. For this research experience and perspective of potential users in construction were considered. The responses were collected from professionals working in different cities in India. This paper outlines the roles of rating systems, various building sectors, base or reason to select and parts in which green building materials along with the motivators and barriers.*

KEYWORDS - Green Building Materials, Motivators and Barriers

I. INTRODUCTION

In India, the construction industry is the fastest growing field with almost 10% contribution to the country's GDP. It naturally has undeniable impacts on the economy (Ahuja, 2020). In order to make this contributor sustainable, green buildings can play a role in reducing the environmental impacts it would cause. Green materials are one of the factors considered in naming a building green. The market is still at a young and evolving stage with only 5% of buildings in the sector being green (International Finance Corporation). Buildings and construction account for 39% of energy-related CO₂ emissions in the world (World Green Building Council data). To minimize the impact of the building sector on the natural environment, various stakeholders have promoted the design and construction of green buildings.

GRIHA, LEED, IGBC, etc. are few environmental rating systems that evaluate green buildings in India. Buildings are rated according to some set standards. One of which is a criteria of using green building materials.

Even if financial and price concerns, market barriers and lack of government policies, hinder the use of green building materials, the ascent in innovation and rise in growth of building sector provides a great potential for market expansion (Prasad, 2020). Green Materials provide energy efficiency, low operating costs, waste reduction, and durability over conventional construction techniques (Kumar, 2020).

If there exists a technology to create a green building with the help of materials, then there must a trial to reduce the barriers

that have to be overcome to unburden the environmental impacts caused by buildings.

Literature Review

An article has mentioned that a green building uses less energy, water and natural resources than a conventional building. It also creates less waste and provides a healthier living environment for people living inside it compared to a conventional building (Gupta, 2010). Elattar and Ahmed (2014) evaluated the green building material system in Egypt and proposed methodology to evaluate materials in the Egyptian environment by analysing green building material's rating systems to achieve the requirements of green buildings. It was concluded that material rating systems help the designer to choose the right materials.

While locally available materials are an option, green building materials can be obtained through EPDs (Environment Product Declaration), LCA (Life Cycle Analysis) as well. Arvizu-Piña, et. Al (2019), specify the methods through which green building materials can be obtained in Mexico. The study uses a bottom up approach to survey the professionals in the Housing sector in Mexico. Similarly, Griffin, (2010) had conducted the same type of research to identify barriers in adopting green building materials in USA. Through the research, the author has stated that the client must be convinced of the value added by incorporating green structural materials and systems. Stakeholders involved in the design, including architects and engineers, must work more collaboratively to achieve green building objectives.

In their research, Woolley & Caleyron (2003), while studying about the green building materials in UK specify in their paper that most obstacles to a greater uptake in this sector appear at a practical level. The argument most commonly used to justify resorting to traditional building products has to be the higher cost of greener alternatives. There are technical, financial and business difficulties to the development of green products for SMEs (Small and mid-size enterprises). Lack of demand, expenses of materials, lack of knowledge can be put forth as barriers (Andersen, 2019). Scarcity of financial aspects, absence of profit, limits of financial provisioning, lack of financial motivation, differences in plan of action for energy and environmental integration, etc. (Gupta, et. al,

2017). These barriers can be applied to research about the barriers to green building materials.

As the research about the barriers and motivators to green building are prominent, there seems a need to look specifically at the use of green building materials. This research aims to study the green material usage in building sector of India.

II. METHODOLOGY

The design and construction of a building is a detailed process which includes different stakeholders to make decisions and carry out the built form. It takes many months or even years of their involvement to complete projects. To carry out this research, Architects, Builders, Contractors, Developers have been identified as stakeholders. The aim was to understand the use of green building materials by the respondents sampled. The identified respondents have expertise in varied sectors such as residential, commercial, industrial, transport, institutional. Materials are installed in parts of a project ranging from walls, roof, site, etc. They could be reinforced within the structural system also in facilities such as underground tanks or overheads or service areas of a building. The finishes and interiors were also considered as a section in which green materials could be used.

A background study of various literatures was done to identify these stakeholders. The contents of the questionnaire have been established with the help of articles and literature. The applied motivators and barriers were identified through the secondary data collection.

The primary data has been gathered by developing an online survey-questionnaire. The questionnaire was distributed in various parts. The first part collected personal information about the respondent such as their contact and profession. Other information related to their company (size, number of projects) was asked. The use of green certification and type, the use of green material in their projects were also included in the first part. The respondents were from various places in the country. Second part was for the respondents who used green building materials in their projects. Questions such as the year of implementation, part of building where the material is used, base of selection for green materials was asked. Third part was for all respondents which had questions related to the motivators and barriers in using green building materials. The questionnaire was sent via email between October and December 2020. The questionnaire was sent to 700 people. Responses from 104 professionals were collected and considered for further analysis. The annual projects taken by the respondents ranged from 1 to 50 in number.

Most of the respondents were from Micro sized companies (1-10 employees) – 46% while Small sized companies (11-50

employees)-24% have second-most highest respondents. Only 13% and 17% respondents belong to Medium (51-250 employees) and Big (more than 251 employees) sized companies.

The maximum respondents undertake 1-10 projects (90 out of 104 respondents) annually while the least number of respondents undertake more than 30 projects (6 respondents out of 104) annually.

III. RESULTS

The focus group was subjected to answer the process of implementing and selecting the green material for the buildings. As green certifications mention and promote the use of green building materials, it was important to identify the percentage of responses who undertake certification for their projects. This could also establish if they use green materials even without certification.



Figure-1 Percentage of green certification used in projects and the types of certifications applied

55% of the respondents do not undertake green certification which is higher as compared to the respondents undertaking green certification for their projects which is 45%. If the respondents had applied for certification IGBC certification was chosen by the maximum number of respondents. LEED was selected as the second preferred certification while GRIHA stood third. In others, certifications such as BREEAM, EDGE, ASSOCHAM GEM were mentioned. Maximum respondents (79 respondents out of 104) do use green materials in their project, and around 19 respondents are interested in using them in the future.

The usage of green building materials is mostly seen in residential and commercial having 56 and 44 respondents respectively. Other sectors selected by respondents were industrial, educational, healthcare and transport. In the question asking the year of implementation of green building materials, the usage was seen to be increased after 2016. IGBC, GRIHA, LEED commenced in 2001, 2007 and 2014 respectively. This data was recorded to identify relation

between the adoption of certification systems and the start year of use.

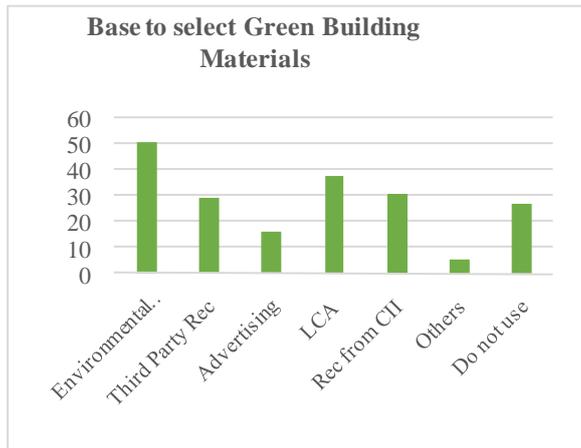


Figure- 2 Base for selecting green building materials

In Figure 2, use of environmental labelling such as EPD (Environmental Product Declaration) and LCA (Life Cycle Analysis) were the two most chosen options. People have mentioned cost, embodied energy analysis, recyclability of the material also their considerations.

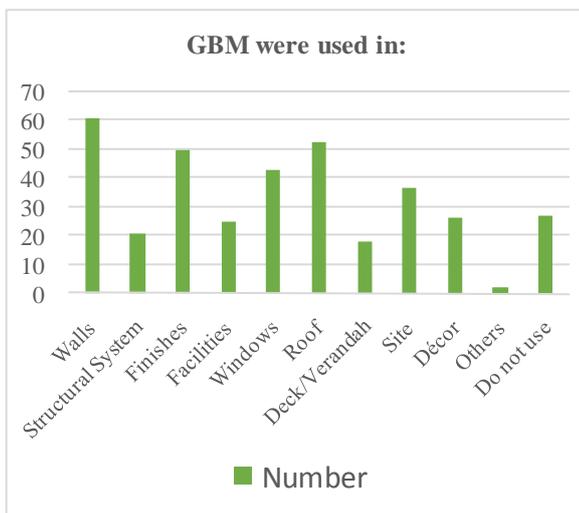


Figure-3 Parts of building where Green Building Materials were used

Walls, Roof and Finishes are the most chosen options where green building materials have been incorporated. Other options selected by the respondents were structural systems, windows, verandah, on site (landscaping or outdoor features), interior decors and facilities (utilities). One respondent also mentioned treatment to motifs and lattice work in heritage sector using green material. (Fig. 3)

All the respondents who used green building materials in their projects have seen reduction in environmental impacts.

Motivators

Minimize the Environmental Impact, Compliance with Building Regulations, Compliance with Environmental Ratings, Price of the materials, Customer/Client demand, Competitive strategies, Spread awareness, others were included as motivators. The biggest motivators for the respondents who were already using green building materials or were planning to use were minimizing environmental impact and second-most being to spread awareness. In others, people have mentioned their responsibility, support to the cause, experience the vernacular or local materials as their motivation (Fig. 4)

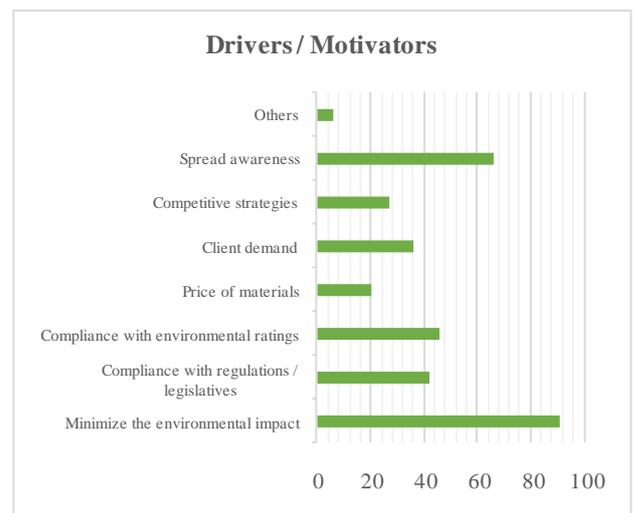


Figure -4 Motivators

Barriers

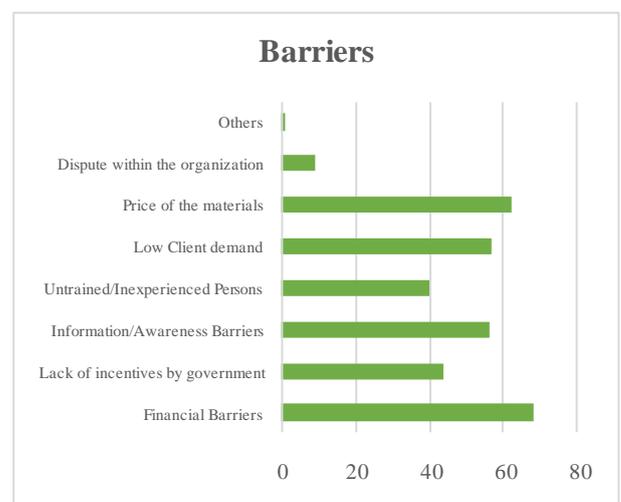


Figure- 5 Barriers

Financial Barrier, Lack of incentives by government, Information/Awareness Barriers, Untrained/Inexperienced Persons, Low Client demand, Price of the materials, Dispute within the organization, Others were included as barriers in

the questionnaire. Barriers accounting the maximum numbers were Financial and high price of the material. In others, respondents mentioned availability of the material is put out as a barrier (Fig. 5).

IV. ANALYSIS

		Number of projects annually	Company size	Are the buildings you construct green certified?
Number of projects annually	Correlation Coefficient	1.000	0.101	-.322*
	Sig. (2-tailed)		0.306	0.001
	N	104	104	104
Company size	Correlation Coefficient	0.101	1.000	-.373**
	Sig. (2-tailed)	0.306		0.000
	N	104	104	104
Are the buildings you construct green certified?	Correlation Coefficient	-.322*	-.373**	1.000
	Sig. (2-tailed)	0.001	0.000	
	N	104	104	104

Table 1: Factor analysis for number of projects, company size and use of green certification

With the help of IBM SPSS Statistics tool, correlation was studied with Spearman's Test. It showed that the number of projects and company size have negative correlation with the buildings with green certification. This can be interpreted that more the number of projects, there must be varied type of requirements of the projects. Thus all of them do not go for certification. (Table 1)

		Do you use green materials in your building?	Environmental labelling/EPD	Recommendation from third party	Advertisement	Life Cycle Analysis	Material recommendation from CII	Others	None
Do you use green materials in your building?	Correlation Coefficient	1.000	.462*	0.168	0.095	.274*	.295*	-.023	-.484*
	Sig. (2-tailed)		0.000	0.089	0.339	0.005	0.002	0.813	0.000
	N	104	104	104	104	104	104	104	104
Environmental labelling/EPD	Correlation Coefficient	.462*	1.000	0.119	0.115	.334*	.328*	-.131	-.581**
	Sig. (2-tailed)	0.000		0.228	0.246	0.001	0.001	0.187	0.000
	N	104	104	104	104	104	104	104	104
Recommendation from third party	Correlation Coefficient	0.168	0.119	1.000	.626**	0.063	0.157	-.040	-.368*
	Sig. (2-tailed)	0.089	0.228		0.000	0.526	0.111	0.690	0.000
	N	104	104	104	104	104	104	104	104
Advertisement	Correlation Coefficient	0.095	0.115	.626**	1.000	0.175	.246*	-.096	-.252*
	Sig. (2-tailed)	0.339	0.246	0.000		0.076	0.012	0.333	0.010
	N	104	104	104	104	104	104	104	104
Life Cycle Analysis	Correlation Coefficient	.274*	.334*	0.063	0.175	1.000	.204	-.077	-.449*
	Sig. (2-tailed)	0.005	0.001	0.528	0.076		0.038	0.436	0.000
	N	104	104	104	104	104	104	104	104
Material recommendation from CII	Correlation Coefficient	.295*	.328*	0.157	.246*	.204	1.000	0.050	-.386*
	Sig. (2-tailed)	0.002	0.001	0.111	0.012	0.038		0.614	0.000
	N	104	104	104	104	104	104	104	104
Others	Correlation Coefficient	-.023	-.131	-.040	-.096	-.077	0.050	1.000	-.133
	Sig. (2-tailed)	0.813	0.187	0.690	0.333	0.436	0.614		0.178
	N	104	104	104	104	104	104	104	104
None	Correlation Coefficient	-.484*	-.581**	-.368*	-.252*	-.449*	-.386*	-.133	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	0.010	0.000	0.000	0.178	
	N	104	104	104	104	104	104	104	104

Table 2: Correlation Test

In Table 2, the buildings which are green certified has significant correlation with Environmental labelling/EPD (Environmental product declaration), Life Cycle Analysis and Materials recommendation from CII. It can be interpreted as the respondents are going for technical aspects of selection rather than mere advertising or recommendation from third party seller.

The Factor Analysis for motivators on IBM SPSS was observed. The Compliance with building regulations and environmental ratings are reduced to one component. This may be related to its connection of institutional arrangement. The Price of materials and Client demand are reduced to one component showing that the client prefers the materials according to their low price. Third component has Minimizing Environmental Impact, Competitive Strategies and Spread

Awareness. Awareness for minimizing the environmental impact is related. Also if there is awareness, there might be more competition within the offices for using the green materials.

While studying Factor analysis for barriers, the financial barriers and lack of incentives by government fell into one component. It can be interpreted as the financial barrier could be overcome if incentives are provided by the government.

V. DISCUSSION

It is observed that most of the people using certifications are inclined to use the green materials in buildings. Also, some respondents are using green building materials even if they are not applying for green certifications. Micro and Small sized companies are applying for green certifications rather than Big and Medium sized. This might be due to the varied type and number of projects in larger companies. It also might be the case that Small and Micro sized companies tend to handle certain type of projects (such as green certifications, sustainable planning) and thus have mostly the same kind of projects. The use of green materials in the building sector increased significantly after 2016. This might be interpreted by the commencement of LEED in India. The Material section of LEED mentions the allowance of credit with use of green building material with the use of Environmental labelling/EPD (Environmental Product Declaration) or LCA (Life Cycle Analysis). The use of green materials is also seen mostly in residential and commercial sectors.

Most number of respondents are driven by moral factors such as minimizing environmental factors and spreading awareness. It could be interpreted that realization or message is driving people more towards the use of green materials in their buildings. Barriers related to cost such as Price and Financial have been chosen the most. This implies that many professionals aren't able to implement the material due to their lack of capital. This suggests that government could provide incentive to the buildings using green materials which might eliminate financial barriers.

VI. CONCLUSION

As the system already exists in the country, the technical barriers must be overcome by various tools by the government authority for achieving sustainability. Green building materials are perceived to be costlier. An analysis tool which helps in determining costs with payback can contribute in use of green building materials.

ACKNOWLEDGEMENTS

The completion of this research would not be possible without participation of many individuals who took out their time in filling the questionnaire. Their contributions are sincerely

appreciated and gratefully acknowledged. Deep indebtedness is express to the following, Dr. Sujata Karve, Prof. Prajakta Kulkarni and Prof. Namrata Dhamankar for their guidance.

REFERENCES

- i. Ahuja, M., Soi, U., (2020, Nov,27) *The case for green buildings in India* Observer Research Foundation <https://www.orfonline.org/expert-speak/case-green-buildings-india/>
- ii. Kumar, P. (2020, Nov, 25) *Green Building Materials Market to see record break revenue \$377,029 million by 2022* Whatech <https://www.whatech.com/markets-research/materials-chemicals/674351-green-building-materials-market-to-see-record-break-revenue-377-029-million-by-2022>
- iii. Team Taxscan, (2020, Dec 15) *Finance Commissions and Local bodies should encourage Green buildings through Tax Incentives, says Vice President Taxscan* <https://www.taxscan.in/finance-commissions-and-local-bodies-should-encourage-green-buildings-through-tax-incentives-says-vice-president/89350/>.
- iv. Gupta, Y. (2010, January) *Need for Developing Green Building Concept in the Country* NBM&CW. <https://www.nbmcw.com/tech-articles/tall-construction/15837-need-for-developing-green-building-concept-in-the-country.html#:~:text=A%20green%20Building%20uses%20I,ess,compared%20to%20a%20standard%20Building.&text=The%20major%20consumption%20of%20Energy,lighting%20or%20air%2Dconditioning%20systems>.
- v. Elattar, S., Ahmed, E., (2014). *Towards The Adaptation of Green Building Material Systems to the Egyptian Environment*
- vi. Arvizu-Piña, V.A., Cuchí-Burgos, A. & Chargoy Amador, J.P. (2019) *A bottom-up approach for implementation of Environmental Product Declarations in Mexico's housing sector. Int J Life Cycle Assess 24, 1553–1572.*
- vii. Griffin C, Corey & Knowles, C. & Theodoropoulos, C. & Allen, J.H. (2010). *Barriers to the implementation of sustainable structural materials in green buildings. Structures and Architecture - Proceedings of the 1st International Conference on Structures and Architecture, ICSA 2010.*
- viii. Woolley, T. & Caleyron, N. *Overcoming the Barriers to the Greater Development and Use of Environmentally Friendly Construction Materials*
- ix. Andersen, S., Larsen, H., Raffnsøe, L., Melvang, C. (2019). *Environmental Product Declarations (EPDs) as a competitive parameter within sustainable buildings and building materials. IOP Conference Series: Earth and Environmental Science.*
- x. Gupta, P. & Anand, S. & Gupta, H. (2017). *Developing a roadmap to overcome barriers to energy efficiency in buildings using best-worst multicriteria decision making methodology. Sustainable Cities and Society.*

Role of Outdoor Spaces in Architecture Education

Tanvi Gupta, Prof. Archana Gaikwad

College of Architecture, Bharati Vidyapeeth (Deemed to be) University, Pune

Email: tanvimarch.gupta53@gmail.com

Abstract : *The research paper aims to analyse the role of outdoor spaces in architecture education. The present study has analysed factors contributing to outdoor learning, types of outdoor spaces and their characteristics for different learning activities in architecture colleges. The qualitative approach has been used to gain insight of students and teachers towards outdoor learning. The research study found that physical and functional qualities of outdoor spaces linked with psychological and environmental benefits. They can reduce stress, increase concentration and promote healthy and active lifestyle to students. Designing outdoor spaces in the college campus has a great positive impact on the environment. Students feel connected with nature by observing and spending time in a natural environment.*

Keywords – Psychological benefits, environmental benefits, outdoor spaces, outdoor learning, physical qualities, functional qualities

I. Introduction

Spaces are classified into indoors and outdoors. Spaces have impact on the environment as well as on mental health. According to various research environment psychologists any different kind of space stimulates creativity and productivity of human beings whereas an unpleasant environment can create negative emotions about a place. In learning spaces, it is usually found that there is lack of concern in designing outdoor spaces which can accommodate various learning activities. Traditional classrooms have never been able to stimulate creativity, mental development and encouragement in students for innovation. Learning atmosphere in the architecture colleges is an interrelation of indoor and outdoor spaces. As architecture is a creative and practical knowledge-based field outdoor spaces play a vital role in student's productivity and creativity hence, the research study is focused on factors and characteristics of outdoor spaces contributing to outdoor learning.

Environmental psychology is the study of human-environment relationship with surrounding built and unbuilt environment or the study of human behaviour in physical environment. College environment can be classified into a social and physical environment. Social environment is related to interaction among students, social norms and connection among students and teachers whereas physical environment is the location of the outdoor spaces where activities take place and it should reflect with nature, functionality and show high

environmental qualities. The environmental quality of outdoor spaces is based on three components physical, behavioural or functional and aesthetic quality. Physical environment of college gives students freedom to choose a space to conduct outdoor activities. There are two types of elements which define the quality of the physical environment: Fixed elements which includes infrastructure and buildings and half- fixed elements such as trees, boundary elements, signs, billboards, lighting elements and benches.

Outdoor spaces are effective and significant parts of college where various parameters of environment psychology in learning spaces like furniture, natural materials, colours, light, flexible and diverse space and thermal comfort are combined to give necessary sustainable life and usage of outdoor spaces.

II. Material and Methodology

The methodology to analyse the role of outdoor spaces in architecture education is a qualitative approach based on secondary data and case study research. Due to the pandemic situation it was not possible to do live case study. Factors which contribute to outdoor learning or usage of outdoor space was identified from secondary data.

Microclimate of the site affects the usage of the outdoor space. Outdoor spaces are focal points in student everyday behaviour while perception and use of outdoor spaces at a college campus. (Alper Ünlü, 2009). Air temperatures and solar radiation are the most prominent factor in relation to the use of space. Integrating social and environmental factors would be useful to increase the use of the outdoor space. Comfort factor classified into Climatic features, Furniture layout, air quality, visual quality, natural areas and cleanliness. Air circulation refers to the air quality of the surroundings. It should be pollution free. It should not block outdoor spaces in warm and humid climates for good ventilation in the space. Cool air should be blocked in cold climates. Visual quality determines the use of the space. As human body movement is affected by the distribution of obstacles and boundaries, additional aspects of visual information, experience and familiarity influences the route choice and decision behaviour. (Peponis et al. 2004,453-473). According to the Ghazze, outdoor scenery and presence of natural environment, especially water affects location preferences. Outdoor spaces give a feeling that the college's learning environments are in harmony with nature. (Alper Ünlü, 2009). The way the furniture is designed influences the way the space is being used and with learners

expressing the desire for larger and more comfortable furniture. (Harrop & turpin,2013). Cleanliness is the part of the college campus management. It may affect the overall perception of the usage of the space. Proximity to the classes influences students for preference of the space. Outdoor spaces should be in proximity from the studios and lecture halls so that it is convenient for students to meet up for group activities. It also relates to space for eating and other co-curricular activities.

Three architecture colleges were selected in different climates to identify the type of outdoor spaces, physical elements which affect its usage and factors of outdoor thermal comfort. Among which two colleges have outdoor spaces and one is without outdoor spaces for comparative analysis of outdoor spaces' effect on learning and development.

1. CEPT University in Hot and Dry climate
2. Bricks school of architecture in Moderate climate
3. School of Architecture, Apex Group of Institutions in Composite climate

Selected Open Spaces	Physical elements	Outdoor thermal comfort	Activities
 Source: @cepthub.com CEPT University	<ul style="list-style-type: none"> • Deciduous Trees • Hard Pavement • Movable furniture 	<ul style="list-style-type: none"> • Semi Shaded due to trees • Sunny in winter months 	<ul style="list-style-type: none"> • Juries • Workshop
 Source: @gpd.cept.ac.in CEPT University	<ul style="list-style-type: none"> • Hard pavement • Movable sitting furniture • Deciduous Trees 	<ul style="list-style-type: none"> • Shaded due to trees • Sunny in the winter months 	<ul style="list-style-type: none"> • Chatting with friends • Internet surfing • Group discussion • Eating with friends • Sketching
 Source: @gpd.cept.ac.in CEPT University	<ul style="list-style-type: none"> • Hard pavement • Movable furniture • Deciduous trees 	<ul style="list-style-type: none"> • Shaded due to trees in summer months • Sunny in the winter months 	<ul style="list-style-type: none"> • Juries • Workshop
 Source: @www.aajfkas.in CEPT University	<ul style="list-style-type: none"> • Hard pavement • Permanent sitting space around trees • Deciduous trees 	<ul style="list-style-type: none"> • Shaded due to trees in summer months • Sunny in the winter months 	<ul style="list-style-type: none"> • Chatting with friends • Informal discussion • Sketching
 Source: @design.careers200.com CEPT University	<ul style="list-style-type: none"> • Grass • Dense trees 	<ul style="list-style-type: none"> • Shaded near the trees 	<ul style="list-style-type: none"> • Sketching • Group discussion • Reading • Chatting with friends
 Source: from Rutuja Nalawade Alumni of the college Bricks School of Architecture	<ul style="list-style-type: none"> • Hard pavement 	<ul style="list-style-type: none"> • Need shaded area in the summers • It should be in the wind direction 	<ul style="list-style-type: none"> • Informal discussion • Juries • Workshop • Chatting with friends
 Source: from Rutuja Nalawade Alumni of the college Bricks School of Architecture	<ul style="list-style-type: none"> • Hard pavement • Trees 	<ul style="list-style-type: none"> • Need shaded area in the summers • It should be in the wind direction 	<ul style="list-style-type: none"> • Workshop
 Source: from Rutuja Nalawade Alumni of the college Bricks School of Architecture	<ul style="list-style-type: none"> • Hard pavement • Trees 	<ul style="list-style-type: none"> • Need shaded area in the summers • It should be in the wind direction 	<ul style="list-style-type: none"> • Group discussion • Sketching • Workshop • Co-curricular activities

Table – 1: Selected spaces – Physical elements, Outdoor thermal comfort factor and activities in CEPT University, Ahmedabad and Bricks School of Architecture, Pune

Shadow Analysis

The selected open spaces of CEPT University are in shade in the morning in winters. Hence, spaces required sun radiations for outdoor thermal comfort. Shade is required in summer months for outdoor comfort. It increases the usage of the outdoor spaces for learning and college activities.

In Bricks School of Architecture, Pune. All the outdoor spaces are in the sunny zone in peak summer months throughout the day except in the late evening. Shaded areas are desirable in hot summer days for outdoor thermal comfort. The campus required more shaded areas for outdoor learning spaces.

The online survey was conducted in September 2020. Questionnaires were circulated through mails and social media to students and teachers of the particular college to analyse their perception towards usage of outdoor spaces for academic activities, social activities and sports activities. Major outdoor spaces were highlighted in the site plan of the campus and identified the use of space and effect of its physical environment from the perspective of its users.

III. Results and tables

The responses given to the questionnaire by students and teachers of selected architecture colleges was formulated by thematic analysis. The first step in the analysis was familiarisation by data generated in an online survey.

A. Familiarisation by data

1. CEPT University, Ahmedabad

For academic purposes, the most used space is architecture block for group discussions, informal discussions, sketching, photography and contemplation due to visual comfort, thermal comfort, to connect with nature and in proximity to the indoor spaces. These outdoor spaces are mostly used in the evening followed by morning and least in afternoon due to high radiations.

Natural light, seating spaces and trees are most preferred physical elements in the outdoor spaces. Users feel fresh and stress free in the natural environment. It enhances creativity, social interaction for personality development, personal attachment with nature.

They prefer it for co-curricular activities, chatting, eating and relaxing. Badminton is most played sports in the campus along with exercise and running physical activities. They feel outdoor spaces are important for learning as it helps in

enhancing creativity, increasing peer interaction, sense of curiosity, mental skills and work productivity, and reduces stress. According to them, if there are no outdoor spaces their campus would be monotonous and less enthusiastic.

Outdoor learning provides a sense of freedom and relief from academic pressure. Open natural environment makes it feel fresh. More shaded, enhanced natural lighting, noise free and ventilated space are the most desirable changes suggested by users.



Fig 1: Outdoor spaces in CEPT University

2. Bricks School of Architecture

Outdoor spaces behind the studios is the most preferred space for academic purpose followed by central courtyard and other minor courtyard in the building. These spaces are mostly used for group discussions, sketching, workshops, reading, lectures and photography are other academic activities held in outdoor spaces. They prefer it to connect with nature and visual comfort. In this case also afternoon is the least preferred and evening is the most preferred time for outdoor activities. Trees, seating spaces and natural light are the most important physical elements according to them for outdoor learning. Physical elements merged with the outdoor spaces creates a feeling of comfort and it provokes the usage of outdoor spaces. Chatting, eating, relaxing and co-curricular activities are social activities which increases the usage of the space. It enhances creativity, reduces stress, increases work productivity and a sense of curiosity. It would feel dull and less enthusiastic if there were no outdoor spaces on the college campus. Expansion in landscape is the most desirable change suggested by students and teachers.

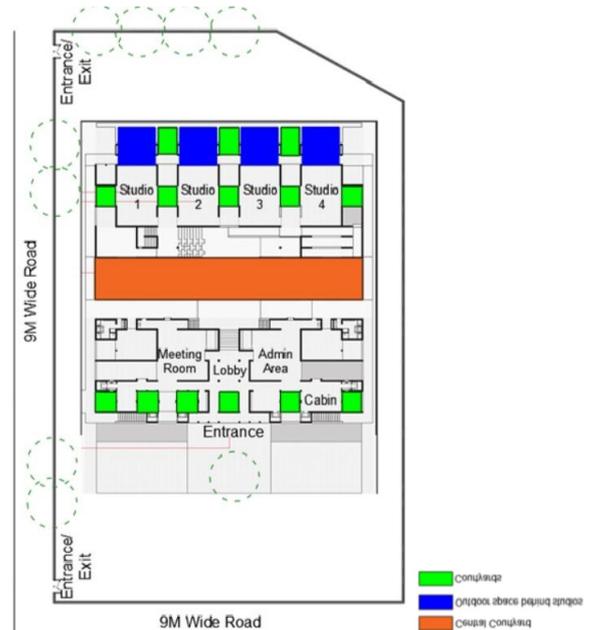


Fig 2: Outdoor spaces in Bricks School of architecture

3. School of Architecture, Apex Group of institutions, Jaipur
This college has no outdoor space for outdoor learning or for any other outdoor activity. Students and teachers feel the need and importance of outdoor spaces in the campus. They would like to use it for sketching, workshops, photography, group discussions and juries. In this case also trees, seating spaces and natural light are the most preferred physical elements. Softscape has also been chosen by them as there is no landscape area in the campus. They would like to connect with nature, for visual comfort and to work with enjoyment. They feel less enthusiastic in the college environment. They think outdoor spaces would increase their creativity, mental skills and work productivity.

B. Codes

The codes are formulated in four categories physical elements, academic activities, social activities and sports activities. Physical elements include Seating space, softscape and natural light. Group discussions, sketching, workshops, photography, reading and juries are under academic activities whereas chatting and eating with friends, relaxing and co-curricular activities was included in social activities. Badminton is the most preferred sports activity in all the three colleges.

C. Themes

The codes are generated in three different themes: physical quality, functional quality of outdoor spaces and psychological benefits of the outdoor learning.

Physical quality	Functional quality	Psychological Benefits
1.Seating space	1.Group discussions	1.Enhances creativity
2.Softscape	2. Sketching	2. Reduce stress
3.Proximity to the classes	3. Workshops	3. Increases work productivity
4. Natural light	4.Photography	4. Increases sense of curiosity
	5.Reading	5. Increases peer interaction
	6.Juries	
	7.Badminton	
	8.Chatting with friends	
	9.Eating with friends	
	10.Relaxing	
	11.Co-curricular activities	

IV. Conclusion

Designing outdoor spaces in the college campus has great positive impact on environment by spending time in natural environment and observation students feel connected with nature. There is a relationship between experience with nature, a connection to nature and an interest in environmental concerns.

Acknowledgement

I owe my gratitude to my friends and colleagues who have always cooperated with me throughout the research.

References

- i. https://www.researchgate.net/publication/237671909_Interface_of_Indoor_and_Outdoor_Spaces_in_Buildings_A_Syntactic_Comparison_of_Architectural_Schools
- ii. https://scholarworks.gsu.edu/cgi/viewcontent.cgi?article=1104&context=epse_diss

- iii. Harrington, K. D. (2014). *Community on Campus: The Role of Physical Space*. Georgia.
- iv. https://www.researchgate.net/publication/344124971_Effect_of_Common_Outdoor_Spaces_on_Social_Interaction_The_Case_of_College_of_Engineering_Campus_at_Salahaddin_University_-_Erbil
- v. IraqIkudayisi Ayodele Emmanuel, A. V. (2017). *Impact of Quality and Usage of Outdoor Spaces on*. *American Journal of Environmental Protection*.
- vi. https://www.researchgate.net/publication/282753793_Everyday_encounters_with_nature_Students'_perceptions_and_use_of_university_campus_green_spaces
- vii. Janet Speake, *. S. (2013). *EVERYDAY ENCOUNTERS WITH NATURE: STUDENTS' PERCEPTIONS*. *Human Geographies – Journal of Studies and Research in Human Geography*, 11.
- viii. <https://riunet.upv.es/bitstream/handle/10251/103926/5218-17854-1-PB.pdf?sequence=1&isAllowed=y>
- ix. Lee, J. W. (2017). *Learning spaces around the university: Factors that affect the preferences for a space*. *3rd International Conference on Higher Education Advances, HEAd'17*. Singapore : Universitat Politecnica de Val`encia.
- x. vi. https://ajeas-assets.s3.us-east-2.amazonaws.com/media/media/14_AJEES_ID007_Evaluation_of_Students_Perception_of_Outdoor_Learn_ILQKPLL.pdf
- xi. Okopi, U. M. (June, 2020). *Evaluation of Students Perception of Outdoor Learning Space in Sustainable Academic Environment: A Study of Bayero University, Kano*. *African Journal of Earth and Environmental Sciences Volume 2, No. 1.*, 476-485.
- xii. vii. <https://pdfs.semanticscholar.org/76ea/acc789035177e32ad5fd5d353d2cc6a8622.pdf>
- xiii. Vincent J. Granito, M. E. (2016). *Psychology of Learning Spaces: Impact on Teaching and Learning* . *Journal of Learning Spaces*, 8.
- xiv. viii. <https://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1186&context=crpsp>
- xv. Wilson, T. (2018). *Design Guidelines for Activating Outdoor Spaces*. *San Luis Obispo*.

Socio-Economic Impact of Princely States, a Case Study of Sangli-Miraj-Kurundwad-Budgaon States

¹Ramchandra.N.Gohad, ²Snehal.S.Kanade

¹Architect, Valuer, Urban Planner and Consultant in Techno-legal cases.

²Student of Master of Town and Country Planning, College of Engineering, Pune.

Email: rngohad@gmail.com, snehalkanade23@gmail.com

Abstract: *In present context, out of the 568 Princely States only four States are emphasized, capital towns were present in each of this States, the socio-economy, culture, industry and such other aspect were flourishing including the essential infrastructure and communication routes. This four States particularly fall in erstwhile South Satara District and were geographically, climatically well-developed States. The States were very compact in population and area. There was adequate provision of job opportunities in government and semi-government sector, trade commerce and cultural aspect. No much out migration was resulted except, those who were highly qualified. Hence, population growth was moderate. The primary, secondary and higher education facilities were available. Therefore, the population seems to be satisfied and comfortable in living. In fact during British regime, the British ruler encouraged the functioning of the States and provided additional facilities like transportation by Railways and State Highways. The local administration at this States were properly regulated, one with prevailing laws and rules. The financial resources were local taxes etc. The Indian Constitution elaborated on various aspects of human welfare, physical planning of towns etc., which are more than 5000 population but the democratic setup does not give power to Tehsildar or Prant (SDO) to make such plans for their own region or jurisdiction, which takes care of entire occupational structure. Now, because of MRTP Act 1966, Ch. II Empowers Gov. of Maharashtra to undertake Regional Plan for balance development and make the region empower for better and comfortable living. However, it is a suggestive law and do not give stress on implementation. This is reason for perished capital town of erstwhile Princely States which are not improving as they could have. Secondly the abolition of Princely States is main aspect of gross outmigration to the cities which were developing. Hence, the Government of India under the 73rd and 74th Constitutional Amendment Act, 1992 after 45 years of independence have guided and stress the urgent need of generating the potential for creating job opportunities and creating Gram Sabha as a third tier. The 28 years are already over after this two amendments effected but the result of this amendments are not even 28%. Hence, the research point is retrofitting of all this erstwhile Princely Towns considering their present growth, population etc. The physical plans for future growth to be immediately undertaken by the Town Planning Dept. itself or such NGO can be engaged in private sector for such works and at each tehsils, near the Tehsildar one physical planner, qualified in town planning to be appointed.*

Key words – Princely States, Socio-economic Impact, Sangli, Miraj, Town Planning.

INTRODUCTION TO PRINCELY STATES

As the history reveals that the India – Bharat was ruled by the kings, it is mention in Ramayana and Mahabharata that the entire Country was divided into different parts considering the natural settings. There were representatives appointed by kings to look out the different parts in their territorial possessions. However, the complete concept of democratic governance was not introduced as the power was within the King- the federal system.

There is mention in the Architecture of Mansara part I (Page 14), the Chapter 9 and 10 about Town Planning. It is treated in two heads – ‘Grama-Lakshana’ (Village Scheme) and ‘Nagar-Vidhanana’ (Town Layouts), under the three categories- Village, Towns and Fort. Villages are further divided into 8 types each of the type denotes some concept based on geometry, geography and topographical features. Particular design and layout of which, details etc., are mentioned in Mansara. Therefore each King-Prince was a ruler of a define territory (Owned in war) which is further divided into village system. Also, there is specific description of total length and breadth of settlement which consist of various buildings for various purposes and uses (Mansara).

The land component was a commodity of the settler’s kings and his residents. The agriculture was an aspect of economy and whatever agriculture produce was there was intercommunicated in Bazar places for sale and disposal. Due to small settlements a system of weekly bazar from Sunday to Saturday became operative in seven different villages – in the form of cluster groups situated adjoining to each other. Socially, it was having the unity, the barter trade was mainly used. In our Indian civilization we gave preference to different geometrical forms and this are elaborated in Sanskrit literature – Dandaka, Sarvatobhadra, Nandyavarta, Padmaka, Swastika, Prastara, Karmukha, Chaturmukha the whole socio-economic system was workable within this type of villages, which derives the convenience, homogeneity and removes the standalone settlement etc. The important infrastructure water was considered as main requirement and settlements were close to water bodies.

The soil was considered as main commodity and their several forms, colors, smell, taste were studied before construction any building or for agriculture purpose. Here we find that critical approach was present, while planning of the villages according to the suitability of land for Temples, Roads, and Houses etc., others depending on the preceding deity within the village. Hence, according to topography different Village Plans, Extent, Entrance, Accessibility etc., was considered.

The allocation of sites for different land uses was also detailed like for Schools, Public Halls and Residential Houses for different class. The Security and Defense of village was looked by the king who rules it and therefore the construction of Fortress on ground or hill was considered. The habitation of Kings, Brahmins, and merchants are also explained. Most important art and culture was found with buildings, sites and laying of whole villages.

In this system of kings ruling to accept the responsibility of settlers and residence of different occupational pattern. It was also considered by king that his territory was novel one and not copied from others. Therefore, as described in 8 types a combination suitable was chosen and operated.

HISTORY

As far as literacy was concerned the Gurukul system was in existence. It was located far from the main Town or City. This system emphasis that the child should be trained in boarding school of thoughts where he/she will go away from parents to compel the entire education system, which he has selected so far as science, medical, sports etc., specific education was also departed to brave students for defense and such other purposes to fight against enemies, invading the country. However, this system of Gurukul was not available to student community from all castes, which is a defeat and undemocratic attitude. Hence, it was necessary to evolve in system to spread the education and readings of historical books containing various science, unfortunately problem of language came and it was in Sanskrit script which is not a language of common man a large. Hence this only attendee seems to be noted. Collective defense and such ideology was absent. Chanakya says in an about the Takshashila there were small States which were stabled, living and with quite homogeneity. In the central part of the country thinking of Magadha was known as brave and powerful king which was succeeded by Chandra Gupta Mourya. Social attitude was getting little bit deteriorated and jealous and annuity was spreading. In second century invading from North West area that could have been easily passed by if there would have been princess holding the States and their territory together. Hence, there was a feeling that among the various king the brave king like Rama and Krushna was emerging so Arya Chanakya was busy in this endeavor.

The famous world class university was slater on destroyed by invaders and same is the case of Nalanda near Patna in Bihar this has happened because the kings and rulers were un-united and fighting separately. Thereby even though the development or planning system was in evoke there were instance of planning good building mention in 6 Volume in Mansara. It says about 8000 B.C the Hindu Architecture was so exclusively developed in all aspects confined to geometry, mathematics, topography, geology, climatology etc. we see lot of temples and monuments is a products of Princely States. Hence, by the growth of small, medium and large Princely States spread all over the India, numbering 568(by Gov. of India after the Independence, due to acceptance of government nature of rule, therefore kings States – Princely abolished) out of four are described as a case study below.

Even during the Mughal rules, (oldest rules over 600 years) and there after the British rule of 150 years the Princely States were existing by not conquered by both the dynasty during novel some of the Hindu Princely States were conquered by Mughal and taken e.g. Bhopal. This will show that existence

of Princely States and growth up to 568 and acceptance of demographic system, the existence of Princely States were undemocratic and we accepted the Indian Constitution, it was required to abolish the Princely States. This particular decision alright from administrative point of view were was unjustifiable from socio-economic, education, health, traffic and transportation, links, trade and commerce and linkages to all villages democratically for all democratic purpose.

LITERATURE STUDY

To give an example a city of Ayodhya ruled by Lord Ram was 5500 meters long and 400 meters wide with a broad avenues to take care of traffic and design to suit the surrounding conditions. Roads were flanked by beautiful buildings, auditoria's, public squares and separate parks for ladies. This type of features in physical plans was also observed in Bhor after crossing Bhatgar Dam, there is trample arch, and then we find a decorative fountain and administrative square flanked by palace which is attached by lord Shiva temple, so we can say that the urban design concept was also taken into consideration. In case of Phaltan, beautiful road were flanked by different buildings and at the end there are administrative offices, courts – an administrative square. Megasthenes (302 BC), has described Patliputra present Patna as city of 16 km long and 3.2 km wide, surrounded by deep mode. A fort of 60 entrance gate were built there. The palace was located in center with parks, gardens all around. In Aurangabad, Maharashtra there are 52 gates that means the chief of rulers has utilized levels while construction, where a 'Panchakki' and 'Bibi ka Makbara' (Copy of Taj mahal but plan is square) 'Soneri Mahal' and such other places are present. Madurai the capital of Pandyas was a temple city surrounded by forts (On the lines of Sarvatobhadra, Swastika or Padmaka), People of different occupations leaved on different sites (morphology of sites). The city was built, where Temple was center and after careful examination of site and other conditions prevailing.

Hence, in the North or South India the Princely Towns were mainly selected for obtaining the defense and security measures based on contour and elevation, which we see in western Maharashtra, Madhya Pradesh, Rajasthan, Uttar Pradesh etc. Hence, this Princely States were socially bound by the constitution – which was a practice in the Indian civilization right from Vedas and Sankhya yog and Nyaya yog were was observed in Veda and Upanishad. One aspect of planning a layout of Princely State is a novel that the main roads are absolutely wide, without hesitation of condition of land availability and suitability. We can observe this particular type of city and towns in the Princely States as mentioned in the Mansara Architecture. As per as palaces are concerned their use and conduct of administrative process by the king, a big hall for gathering villagers, for explaining the facts and hearing were conducted in proper sense were the proper democracy observed.

Even though this was a federal system, king rules, the duties discharge and justice departed was on the basis of our old Sanskrit literature, Veda, Upanishad etc., essence was observed that the topographic and physiography conditions of Princely Town along with climate, which are different for all Princely States and considered as main hindrance. Hence, standardization of plans was not there, except few concepts – Grid Ion, Radial, Liner Pattern and combinations according to the geography.

CONTEXT OF STUDY AREA

As we have considered the study of four Princely States in river Krushna valley in and around the Satara, Sangli, Solapur and Kolhapur Districts of today. This are the four Princely States located and situated in western Maharashtra, South section to the North of Karnataka boundary and Solapur district specifically. The geography of this area, already has a range of Sahyadri, starting from Kerala State, Southwestern entering in Karnataka, Goa, western Maharashtra further turning from Lonavala, Khandala, hills to eastern side to Kandesh, Dhule area known as western ghat area. As we have mentioned the various princess do fight with each other to enlarge and expand their existence of the State. This particular subject area came under Adhil Shahi rule because of infightings between Yadav and Mughal rule. And lord Shivaji so of Chhatrapati Shahaji son, the Pune, Supe, Chakan was a part of jahagiri allotted to Chhatrapati Shahaji for defense and other aspects. However the lord Shivaji did not agree the rule of Mughals or the natives and that started open fights against Mughals and when he was crowned as king in 1674 he appointed 'Ashta Pradhan Mandal' in which the 'Peshwe' were the prime minister of said system and appointed different Sardars in western parts to look after defense of Princely States, so the Sangli-Miraj-Kurundwad came under the dynasty of Patwardhan. Sangli State was established in 1782, Miraj 1820, Kurundwad 1783, Budgaon at the same time. So our main study of four States will be from the point of view of the socio-economic impact over this States.

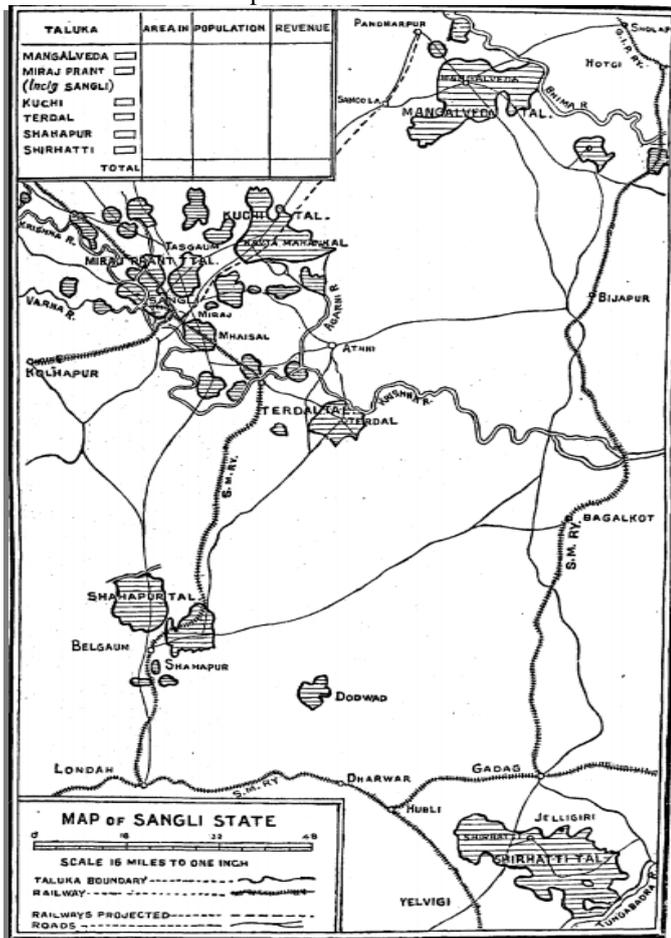


Figure 1 Princely States of Sangli, Miraj, Kurundwad
Source: Administrative Report of Sangli, 1923-24 A.D.

Work of the princess for the welfare of the citizens in the area and providing educational, health, recreational, trade and commerce, industrial and such other aspects of physical planning. This period of four States appearing after the lord Chhatrapati established the Hindavi Swaraj and that this four State were given under the Patwardhan for all purposes including the defense. Sangli being the largest geographical area on the bank of Krushna river and Miraj second to this, followed by Kurundwad, while Budgaon stand amalgamated in Sangli-Miraj complex. We are going to study the physical planning process of this four Princely States considering the geography, geology, topography, natural landmarks – rivers, Nallas, hills, hillocks of Sahyadri range and that to communication pattern in this area right from Devghriri, because it was under the rule of Devgiri before Mughal and then we are bringing the physical aspect and socio-economic life during Princely States and after independence (1947). Understanding the living pattern socially, the settlement pattern, construction of houses, amenities available, essential infrastructure available and the physical planning process started from earlier period to this period and thereafter rule takeover by British in 1880. And then we are comparing the situation, the impacts of all of the above Stated points on this State's during the British rule and how the peoples welfare was done and the degree of presence of amenities, facilities, infrastructure, transportation from agriculture produce to outside area, while other commodities imported. We will study the impact of Princely States on living pattern and administrative rule of the area. The economy in existence etc.

life during Princely States and after independence (1947). Understanding the living pattern socially, the settlement pattern, construction of houses, amenities available, essential infrastructure available and the physical planning process started from earlier period to this period and thereafter rule takeover by British in 1880. And then we are comparing the situation, the impacts of all of the above Stated points on this State's during the British rule and how the peoples welfare was done and the degree of presence of amenities, facilities, infrastructure, transportation from agriculture produce to outside area, while other commodities imported. We will study the impact of Princely States on living pattern and administrative rule of the area. The economy in existence etc.

ADMINISTRATION

All four States are run by respective Patwardhan and the Sangli being largest State consisting of 244 villages distributed in 6 tehsils it is specifically to be mentioned that formerly the State areas even coming from adjoining districts into them and are mentioned below

Table 1 Taluka and their Villages (1924)

Sr.No	Taluka	No. of Villages
1	Miraj-Prant	41
2	Kuchi	30
3	Mangalwedhe	32
4	Terdal Mahal	12
5	Shahapur	56
6	Shirhatti	73

Source: Sangli Administrative Report 1923-24

Hence, being in the Bombay Presidency the Mangalwedha tehsil even though today it is in Solapur district it was in Sangli State. Shirhatti Tehsil is from Dharwad district, Tardel is a Petha and surrounded by villages in Belgaon district of Karnataka and close to Jamkhandi State.

The Population of Sangli State as per 1921 was 2, 21,321 and the gross revenue of the average of past five years was 12,78,986 Rs. According to the British rule every State is ruled in the country was given the identification of the worth of the State, therefore the Sangli State was given 9 Gun Salute. Military of Hon. Lieutenantcy the princess KCIE. There was a system of campaign of prince in each and every tehsil in order to solve the problems of agriculturist, civil etc., it is known as campaign of Jamabandi. The British government appointed political agent on each State to report the British government that any adverse administration will not be having that will hamper the sovereignty of British. The political agent used to visit every year and he was given a total brief of year's activity completed. The land revenue demand according to the Jamabandi of the year 1923-24 was roughly speaking Rs 7, 66,278. The arrears at the close of the year accounted to Rs 3,52,068. The arrears are mainly due to series of bad seasons in the past year and the famine condition in the year under report.

The State with the exception 8 Inam villages has been brought under the operation of the envision survey and assessment is being levied according to revised rates as decided by officers of the Survey Department with the approval of the settlement Commissioner of the Bombay Presidency and sanctioned by Shrimant Chief-Saheb.

Out of this 244 villages 11 are Saranjam villages, 30 Inam villages, 4 Maka villages making total of 45 alienated villages Following are the 7 Inam villages.

Table 2 Inam Villages of different Tehsils

Sr.No	Villages	Tehsils
1	Byakud	Terdal
2	Basapur	Shirhatti
3	Khamkarhatti	Sahapur
4	Sulebhavi	Sahapur
5	Shagunmatti	Sahapur
6	Balekundri B.	Sahapur
7	Sutkatti	Sahapur

Source: Sangli Administrative Report 1923-24

LEGISLATION

So far as legislation is concerned, it is elaborated in the given list of the laws enforced. The military and police strength description is made. As per the information seen from the reports the total administration was quite good from crime, justice, birth-death and other court activities, there is separate civil court. There was 'Mamalat' (today's Tehsildar) to look the administrative work. All other aspects of purchase and sell of land was as per Indian registration Act, 1908. The Sangli city was divide into wards further to understand the population and area in detail and implement the proposals accordingly. Another aspects of local boards was there, they

have 3 nominated, 3 elected and 1 nominated president. Their power was given by law to perform.

The information about the rainfall production and prices of food grains, forest, trade, manufacturing's, factories and total State funds was also mentioned in the report. There was regular efforts to maintain the forest, recover the income derived from forest and like. There are 18 factories in the State, in which 7 are located in Sangli while other tehsils having 1 or 2 only.

The State was provided with the power, telephone, post and telephone offices were existing, the total administration system of government. The economic condition of town was considered very sound and the State was having a good production of food grains, cash crops while the distribution was also in good condition. Revenue and finance were also mentioned and we find that this State which were having property and general living was comfortable. There was no price rise and inflation there on.

PHYSICAL PLANNING OF LAND DURING THE PRINCELY STATES

It is already mentioned in the above paras the Mansara architecture, is the main aspect of Indian civilization which was there in vogue some 8000 B.C. and we are surprised in spite of non-availability of day time instruments, in that time the excavation of sculptures, working on stone work both dry course rubbers, undress and random rubber without use of steel and cement this temples are standing. The temples, ghats on river the tramphal arches, towers, public houses, palaces all this are constructed by then princess during their regime and succeed by heredities and it was a great contribution in nation from the point of view of rich heritage wonders in the world. It was also a speciality of princess that which deity is inherited in by his forefathers.

Our Hindu Architecture and Planning system is as old as Veda's time the geometrical forms or geography are utilized for physical planning of land to suit for residential, commercial, education, health, industry, utility services, traffic and transportation and to pertain the natural civic beauties. It is gathered from the history this princes used to visit England (Vilayat), frequently and they used to watch the development taken place, practice of development in prevailing days and planning for future considering the demographic status of growth. In our civilization system the market system was planned for each villages and in Maratwada it is known as 'Mondhana' in present context Agriculture Produce Market Committee (APMC). This bazar place conventionally located either in the beginning of their entry or end of the village with a proper access and display of day to day required goods, cattle bazar, health assistance etc. Therefore, this planning of trade, commerce and other aspect which is supplementary to settlements is require to do domestic use and is essential and one cannot forget to get included in physical plan. Hence, it is imbibed in our culture of weekly bazar system. Even some of the villages are famous for specific breeds of cattle's, cows, sheep's, hens etc. Therefore, those are also parts of weekly bazar. Socially, if we say that is a essential requirement of society from point of interaction from one villager to another, one family to another

and so on. This aspects are rich in our culture inherited day to day.

In planning, as we have mention about Mansara a typical temple structure of lord Shankar, Maruti and village god. Every villager may not be a prone to the god but such places are necessary for different age groups, male and female to come for darshana, discussion and for meeting place. From planning point of view these are necessary in village, town and are important as recreational places. The planning system so far as transportation was – gridiron, radial, and liner and also combination along with hierarchy of lane road, internal, external road etc., so every destination in village is provided with authorized access with fields and temples were owned by government by Local Self Gov. or Gram Panchayat so the ownership is vested. In fact, concept of Devarai- Open area along such temples on outskirts of towns, villages measuring such acres was preserved as a place for religious gathering. Hence, we can say that the residents are law abiding and no illegal activity of construction, house, shed or building was observed, everything was done by permission. During British Rule some of the Acts were present and during Mughal Rule some customized rules were present. In fact, there was cohesion between religious festivals of Mughal or Hindus and each of them have regard to their religious activities and therefore a life was peaceful and compactness was large observed, seen specifically.

As regards the Kolhapur, Patrick Geddes gathered at the request of Kolhapur prince and after visiting entire State, he has suggested many things after discussion. Sangli, Miraj, Kurundwad was close, so it is understood that such type of propagation and activities might have been in consultation with princess in fact it is said that the Prince Shahu of Kolhapur was more social and his approach was regardless of caste and creed a treatment to all citizens and he was a great reformer in his respect. In this places which were capital town's even princes have hostels for students coming from villages. So in no way the student community or like is deprived of not getting said amenities and facilities. The life was very peaceful and homogenous, enjoyable, home clubs were present for playing the indoor games like playing cards, caroms etc., and gymnasiums were mostly provided to built-up the young generation and to withstand the progress of succeeding year and provide good health (Bhanu Talim and Ambabi Talim).

It is specifically mentioned here the causes of developmental and promotional attitude of this princes has helped the growth of Sangli State and bringing the map of the British India. Due to starring of the southern Maratha railway from Mumbai to Goa, it was passing through Miraj and Sangli State. The map shows that this particular railway coming from Mumbai branching off to Kolhapur there after continuing to Belgaum then Loanda, Dharwad etc.(Refer to Figure 1 for Railway Line).

The construction of Sangli Rajwada which includes the residents of rulers and also the administrative buildings are on the lines of Padmaka. This shows that Indian civilization, Indus culture was in practice according to topography. Ring road around the fortification of the Rajwada was present, the

old town seems too emerged from oldest Peths from the western side, close by area of Krushna River as a main water source. It seems that further expansion on eastern side is seems to be planned and with building bye-law and keeping distance in buildings. On North-western side flanked by main Ganapati mandir and main and wide road east west direction. On Northern side it in the absence on Town Planning Scheme. Socio-economic impact of planning of internal roads for obtaining the convenience and their movements. There is a large stadium outside the fortified Rajwada immediately on western side abutting the ring road.

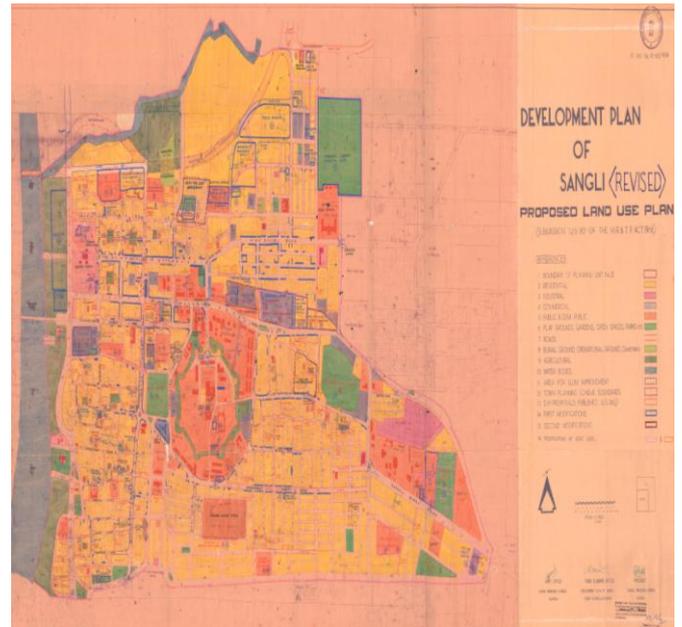


Figure 2 Development Plan of Sangli Municipal Council 1974, Source: Sangli Development Plan1974 Report, Town Planning Department, Sangli District

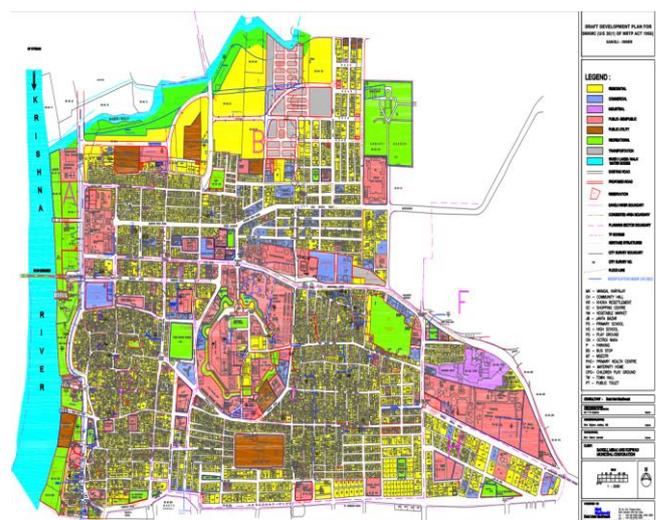


Figure 3 Development Plan of Sangli-Miiraj-Kupwad Municipal Corporation (2015), Source: Sangli Development Plan1974 Report, Town Planning Department, Sangli District(Just for reference to current development)

In the above paras a specific mention of physical planning of States has been done. The local-self Government Act 1859, The Bombay Land Revenue Code 1869. The Land Acquisition Act 1894. Where the main features of enactment towards the control and evolution of physical planning of the Municipal Governance. So wherever Princely States are having a Municipal governance this laws are applicable, so far as Sangli, Miraj, and Kurundwad is concerned the municipal administration is existing since its formation. When the non-agricultural sector was on increasing and that particularly and that 1763 onwards the industries where the main features of the socio-economic development both in the manufacturing sector and providing job opportunities. The Bombay Land Revenue Code does provide the conversion of land from agriculture to non-agriculture use permissible by the collector of respective district. For physical planning separate efforts are not made however in the Municipal Law there was mention of Building byelaw and provision of health and improvement schemes, hygiene, education, public governance, streets, essential infrastructure, water supply, storm water drains etc. So the land which is in the use of non-agriculture sector is considered to be laid out with a specific conceptual forms mention in Mansara Hindu Architecture book and such other references. The town Planning Department or Act was not there till 1914. Bombay Town Planning Act 1915 has been enacted by Bombay assembly while to care taking the principles of this law the State Town Planning Dept. was established in Jan, 1914. The first Town Planning law has a clear cut concept mention in the introduction note that Grama lakshana and Nagar Vidhana were the main features in the Municipal governance villages. This particular was mandatory for every Municipal body to undertake the preparation of Town Planning Scheme in their limit for the developing area of tomorrow and also a reconnaissance survey was also carried out to understand the trend of the development and that the possibility of providing essential sectors near the core sector is existing. It is already mentioned in earlier paras, this princess visit Europe and such areas were planned and orderly development is taking place and hence the renowned planners in Europe they used to be invited in our country and the Petrik Geddes has visited Kolhapur and surrounding States. Hence a few cities layout Sangli, Miraj, Kurundwad, Budgaon towns which are main area of Princely States. Hence, the Bombay Town Planning Act, 1915 has been administered in Bombay Province and therefore wherever Princely States are there and Municipal governance we can see the Town layouts reflects the concept of First Town Planning Law.

It is gathered from local residence that the Sangli was hit by the great flood of Krushna River where the entire residential area was affected and got destroyed. It is also gathered that as soon as flood situation has covered the Princely administration has been actively working on replanning of area and few new paths, colonies are planned on eastern side of Rajwada. Madhavnagr and Shivajinagar were developed and further development was towards Vishrambagh and Miraj on eastern side. This is a development during the 4-5 decades prior to independence. The main aspect of people coming from various places and settling their the cotton crops grows and so Gajanan mills were established and such small cotton activities spread with a view to develop job opportunities and

families residing at Sangli the bazar Peth, the general living stand was very cheap. The quality of life having an excellent grade which attracted even the new comers in Sangli area and there by expansion has occurred. Another reason to have main concentration at Sangli is because of student community was given an opportunity to get graduation and post-graduation degree etc. This is a most boom for the welfare of the Sangli, already Sangli's area is 2880 sqkm and having 6 tehsils geographically, while Miraj has three tehsils, Budgaon has two tehsils. We can see geographically because of Railway line came in 1887 this gave the boom to communication from the country side to the Princely urban areas.

EDUCATION AND HEALTH

It is a specific mention that in each State a care was taken by princess to provide adequate opportunity right from pre-primary education to college and with specific specializations. The Approach of Sangli Institute on Education was already progressive. Public education began in Sangli in 1861. The first Marathi school was established in 1863 and immediately two years later the Vedashala was established. In 1910, King not only did primary education free of cost throughout the institution, but also, importantly, made it compulsory. In 1919, he himself took the initiative and established the Willingdon College. Rani Saraswatidevi Kanyashala was established in 1933 only for girls. In 1947, Walchand Engineering College was established with the blessings and his active participation. High school started in 1920 in a village like Shahpur on Didekshe Mala. Walchand College of Engineering is situated midway between Sangli and Miraj cities at Vishrambag, Sangli. The WCE campus is located on about 90 acres of land on southern side of Sangli – Miraj road, headed by Maharashtra Technical Society. Dhondirao founder and a great social worker purchased 100 acres of land in Sangli, in fact he wanted to open an Engineering College in Pune, he purchased land in Erandwane, Pune but there was a Gov. college run by Educational Dept. of State and according to the policy wherever there is Government Engineering College, no private college is permissible. Hence, this great man went to Sangli and the privileges available from Bombay Gov. got the Engineering College permission and next to Pune Engineering College it was developed.

Surprisingly, during British regime Miraj has been provided with Wanless Hospital, Miraj Medical Center established in July 1894, has grown into an institution. This tertiary care center serves a 250 km radius and population of nearly 20 million. Wanless Hospital, Miraj Medical Center is committed to providing the best possible medical services to one and all, regardless of race, caste, creed or ability to pay. It was started in small rented place in the busy bazaar as a one-room dispensary in 1891, assisted by Mrs. Wanless, a trained nurse. With the help of the King of Miraj, land was acquired for a hospital. The Medical Mission took roots and this was the beginning of the Mission Hospital which over the past 100 years has grown into an institution consisting of a 400-bed teaching hospital affiliated with the Government Medical College, a College of Nursing, an Institute of Pharmacy and various paramedical programmes. Since this hospitals constructed with the aim of providing all types of treatments including cancer, T.B. along with special expertise of teachers was been provided by intuitions.

Therefore, the education and health facility is considered the important amenities to the generation readily available before the independence (30-40 decades). Hence, the student community is very much engrossed due to this present facilities.

TRANSPORTATION

A development is described specifically when such town or city is linked by the State Highway, National Highway or by Railway, it is a pride of Sangli, Miraj, Kurundwad, Budgaon area. When railway wanted to align a separate route to Goa and further it was aligned via Miraj, this was an important rail connection, initially it was Meter gauged after independence converted to Broad gauge. One can say that important railway to Bangalore, Karnataka, Kerala etc are on this route. So far as road transport is concerned NH-4 passes through Miraj up to Bangalore. It is a main communication link at national level provided by the princess prior to independence, when British rulers desired to have such linkages till Pandharpur, Kurduwadi, Barshi, Latur, Parli, Vajinath and Osmanabad were connected further. Because of this availability princess of Kolhapur extend the rail link further. Hence, this facility was also not neglected and provided to the citizens.

There is a very superior soil on the banks of Krishna with good vegetation and milk production business flourishing including Khava, Basundi, Barfi etc. there were many small industry present because of good communication link through road and rail corridor the small States was also on the maps of India within the 568 Princely States and the economy was concentrated, the general living conditions even though there were four classes but no poverty. Every land owner was well to do, though he was not called rich but subsisting himself with the income derived and the ancillary activities to agriculture.

We want to specifically comment on compact city, in the present day rule and regime we hardly find any compact city while with pride we can say that the Princely States though small by territory were compact, immigration and outmigration was considered and ultimate growth rate was not intolerable, everyone was happy. As far as social life is considered it was on the lines of neighborhood, each neighborhood was regarded because of culture and homogeneity.

TRADE, COMMERCE AND INDUSTRIAL DEVELOPMENT

So far as trade and commerce is concerned, dependent mainly on type of soil, rainfall pattern as agriculture was main occupation. Scientific studies were conducted by Kings (Chintamanrao) on the resources of the areas. He gave great importance to the work of improving agriculture. The work was given priority after the farm officials convinced him that the foundation for land reforms was to be given. He himself walked with his officers in a bullock cart and sometimes on foot to build the tali and dams. Scientific education of agriculture, animal husbandry, storage of fertilizers, Special schemes were implemented for the clauses of seeds and fruit trees. He encouraged the removal of an up-to-date milk dairy with all the tools. The central co-operative bank was set up by the institute with a share capital of Rs2lakh.

Different crop patterns has been observed in different places and a main feature was of cultivating the various grains, cereals, oilseeds, grass etc. Some of the villages were on corridors, here we are considering with a view to explain 568 Princely States were spread all over India having a minimum distance between them of 20km. Therefore, some of the trading places of peculiar agriculture crops for e.g. Turmeric at Sangli. Abundance of water from Krishna and Konya river and presence of black cotton soil, the cultivated pattern was observed to be naturally inclined to take the cash crop so that economy of each cultivator shall be sound if not uniform. So the selected Princely States in present paper – Sangli, Miraj, Kurundwad a Krishna river is main water source and has perennial flow of water there is heavy catchment where Krishna emerges at Mahabaleshwar – Vayi. While it is an interstate river which passes from Maharashtra, Karnataka and enters at Andhra Pradesh to meet the Bay of Bengal. Hence, the different trade and commerce places occurred in total stretch. For e.g. at Sangli –Turmeric (Halad), Grapes, Sugarcane, Vegetables and Dairy and milk products etc.

Chintamanrao also worked tirelessly to increase industries in Sangli. In 1908, Dadasaheb Velankar started the Gajanan Viving Mill. Then the cotton mill of the fight stood. The Dandekars, Bhide Vagre people started producing various products such as iron thick, flour mill. The Shirgaonkar brothers' sugar factory stood up. Shadji, Arwade, Athanikar Vagre entrepreneurs led to oil filtering, turmeric polishing mills. The train started in 1907. This provided a good facility for trade. With his own capital, he took the initiative to set up Sangli Bank and provided capital for the growing business. Well-known economists Dhananjayrao Gadgil and Prof. D. G. A committee of Karve was formed by Rajesaheb. The committee was entrusted with the responsibility of estimating the physical resources of Sangli institute and make recommendations for agriculture and industrial development. Noted economist P. M. Limaye was appointed. On the recommendations of the committee, He had signed an agreement with Mumbai businessman Vaman Apte to set up various factories worth Rs 2 Crore capital. Accordingly, a machinery worth a million rupees came and fell. But later the plan was dropped. The riots that erupted after Gandhi's assassination turned the burden on all hard work. He had also planned a Five Year Plan for the development of the Institute. But before it could be implemented, the institute merged with independent India. So that question was also resolved. It is always said that in the prince Princely regime, the king takes care of expert singer, instrument player, Kirtan, Pravanchan and such other folks which are described in our literature prepared by Saint Dyaneshwar, Tukaram, Ramdas Swami etc. If a respective artist is economically totally weak with his family structure and cannot concentrate on art because of responsibilities transferred of family welfare. It is a pride of Princely regime such a person is identified and detected, he and his family's welfare is looked by the funds of princes. This is described in the following manner, the Miraj were combination of artist that is singer, player etc of different caste and creed (Abdul Kareem Khan – a prime singer of Kirana Gharana and his succeeded singers – Gangubai Dustur, Bhimsen, Kapileshwar, Firoz etc) there was no hesitation to mention if attitude of prince was known such arts and traffic and transportation, intercommunication, lakes, canals, lakes

construction of railways, airways, roads etc there was no short of such things in Princely States. To give e.g. Phaltan Princely State there is an aerodrome by the Princely States.

A capital of production of all instruments particularly, Sitar, Sarangi, Tabla etc., trading at international level also. This was economic boom due to princes. Hence, there is difference in Princely States and non-princely cities and towns that art is born and spread in Princely States while in other States such another aspect of Kurundwad States that among the importance of the God Dattatreya, who is supposed to have said in place of Narsobachi Wadi, Aundumber. Hence, by religious aspect is much present in this part of States present at above areas the lord has presence in day time and their followers visiting this place occasionally creates the planned tourism, dormitory, dining places, therefore people come for living dining and for job opportunities, settle in this place-migration and therefore the migration system from one city to other does happens in principles of development plan. Therefore, Miraj is artist or players or singer come recreate and resettle to that place. Hence we may mention specifically that the growth of Princely States continuously from 303-400 B.C till the end of the foreign rule- independence has helped this country in all ways socially, economically, educationally, health, sports, flourishing.

A Budgaon small State came on map because of one Patwardhan departed and started economizing with inducing citizens for cultivation agro base industry, trade commerce, exporting and most important business is surplus milk transported to Mumbai about 30-40 trucks are daily transported from Aundumber, Bilawadi, Sangli, Miraj, Kurundwad etc. Hence, agriculturist in this area are taking advantage of perennial water and good soil that is black cotton which produces excess crops. This is a boon in the economic aspect of every family in this area.

CIVIC AND CULTURE

Civic and cultural activities, as earlier Stated Miraj is a city of paradise of singers, instruments there is a yearly meet in the month of Rajabb as per Muslims Calendar a 'Urus' of Mirasaheb Darga takes place. This is a place of emergence of Kirana Gharana and many noted and famous singers', players, there is yearly meet of 8-10 days as a festival on the lines of Savi-Gandharva. Therefore, a lot of contemplated singers gathered to this place to enhance the Mira sahib and to pay a tribute to guru. Irrespective of status in society.

As far Sangli, Miraj, Kurundwad, Budgaon and the holy Krushna river passing through this area which is an inter-state river and have importance from the point of perennial flow of water. Ganapati is a main deity of Sangli, Miraj – Patwardhan family besides the Chaturthi every month the Ganapati festival of Bhadrapad from Ganesh Chaturthi to Anant Chaturthi and various famous festival of cultural and religious activities took place. Socially, such cultural and religious activities is a boon to the new generation to demonstrate art to present before public during this 10 days. so we can say that this Ganapati festival is a qualification of budding artisan to develop the personality and stage the same before the public without any fear this is an outcome of bringing youth so distinctly inherent artistic in future.

Particularly in Marathi play, songs has been emerged in Sangli-Miraj only, by the play writer Krushnaji Kadilkar famous musical play writer Natyacharya Deol and Khadilkar are this two personalities brought in this place because of Rajashrya (kings encouragement from Sangli and Miraj).

When we were under British and Moghul rule this particular culture activities of play singing could not have any damaging impact because of this civilization attitude and religious background not only withstand but flourished during British regime. This is because each prince was endowed by some art and which he wants to promote and wanted to copy down by peoples.

SITUATION AFTER ABOLISHING PRINCELY STATES

Briefly to introduce the situation assisted because of the decision of the British Gov. to British India to transfer the power to Indian government. As regards the decision of the partition of Indian Union, the British government decided to make this country into two parts India and Pakistan. 568 Princely States are present in undivided India. The subject topic is socio-economic aspect of abolishing the Princely States and the further procedure thereof, the foremost effect is the capital town, cities of erstwhile where brought to normal town/city. The administrative decision, the economic decision and such other socio-economic aspects are considered the entire power stand transfer from prince to Union Government – Home Minister. So far as the other aspects of administrative function, the Sangli became the district place. It remained as Municipal Council, Kurundwad remain Municipal Council but headquarter is nil. Miraj city remain as a Municipal Town Budgaon amalgamated to Miraj and Sangli. The effect of the abolishing is mainly affected to social life because the financial outlet which was took from local and then expenditure was proposed is now not available. The social life is affected because of the taxes levied by State or Central Government. Therefore, this particular aspect of inflation in all commodities which was absent in previous times affecting the social budget of the citizens. Similarly, the expansion which was proposed by past princess. It was gathered that the earlier prince specifically from Sangli-Miraj-Kurundwad were thinking appointing some social, economic institute to study the socio-economic study after the independence. However, in the earlier thinking there were not envisaging the abolishing of the States, the princes were of the mind to bring the amenities and facilities to State and to full fill the requirement of people in large. Here, due to Miraj and Budgaon stands part of newly form Sangli district which was part of earlier Dakshin Satara, while Kurundwad stand in Kolhapur district. So the independence status which has been enjoyed the limitation emerged due to constitution and abolishing the States, that the prince shave no personal freedom, so far the payment to princes as a Mandhan or salary per month stands reduced to the privy purse (Tankha) fixed up by Home Minister, Central Government based on total revenue available from each State and that Tankha was revised yearly divided into 12 to receive per month. Total assets and property of princess were distinct. Wherever Gov. officers in the property exists, those property has been transferred to government and a choice was left to princess that in reaming private property, which are constructions or open land to be shown in personal property or as a government property. All

the local self –government institutions appointed by princess in their State such as district local body, municipal body etc., stands under the jurisdiction of government from the date of abolishing. Therefore, entire State stand with State Government. The recruitment board in government, municipal sector and any other sector stands cancel abolished and State rules in this respect shall come in operation. The service condition as a State service also stand change including the seniority, promotion cadre, State general cadre etc. So those were the Princely State servants and they are considered to be State government servants and their seniority will be decided by government as per rules thereof. Hence, the social life in the context – the State service is transferrable, the Princely State service is non-transferable is within the preview of State government. The infrastructure and services, education health, now stands transferred to State Gov. jurisdiction and therefore the general category stands applicable. Retiring age of Princely State services shall stand as per the retiring age of State Government. The municipal institutions stand covered under the Maharashtra Municipal, Nagar Panchayat and Industrial Township Act, 1965. Hence, all State laws which were enacted for non-Princely state areas shall applicable to abolished Princely States also. The State Town Planning Dept., was established by the then Bombay Province Gov. the Sangli Municipal Council, Miraj Municipal Council stands included in to the Bombay Town Planning Act, 1954. Hence, if this became mandatory for the Municipal Council Sangli and Miraj also Kurundwad that the Draft Development Plan is required to be prepared as per the Town Planning Act, 1954 for the Municipal jurisdiction of towns. Hence, this are the main effects of the abolition of Princely States.

So far as land and its use, disposal and such other aspects, the Maharashtra Land Revenue Code, 1966 applies to this area in place of earlier laws. Likewise all municipal schools, dispensary, hospital were there, there also Princely State jurisdiction was discontinued and State Government jurisdiction came up as a new rule. The appointment in the respective local boards in the municipality as per service condition of State government and under its jurisdiction constituted by Maharashtra State. The other change in the local governance- the general elections for Maharashtra assemble as MLA and the New Delhi parliament as MP the election commissioners has immediately constituted the voters list to be prepared on the basis of total population in the respective rural area that means the earlier absence of demographic election either in Zilla Parishad or in Mumbai assembly or Delhi parliament, an immediately composed and constitution of each MP, MLA were formed and political parties present in tehsils were informed to act accordingly. This is most important social change hence the MLA, MP are main function due to general elections and they are the functionaries and partly to take decisions in general assemble, parliament and Zilla Parishad in district. So far is physical planning is concerned the Bombay Town Planning Act, 1954 for preparation of Draft Development Plan and accordingly various surveys needs to be carried, up-to-date base map is to be prepared by City Survey Dept. including plot of land and structure existing on parcel. The jurisdiction which is fixed of municipalities initially was same as earlier Princely States. However, the district administrative officer became progressive. The administration appointed by British Gov.

stands discontinued. Therefore, the District Collector became the main functionary of district administration. Therefore all rules are applicable.

The sum an substance of abolishing of Princely State the power, performance and function of the prince himself, his staff and citizens stand transfer to Central Government this is most important change and the decision making process has to be now dependent upon the democratic setup and the budgets of the State. The sovereignty principle and that type of mindset is required to be totally hanged and initially it was difficult in arriving at day to day decisions. Socially, this is most landmark change and the whole geography of the country is connected to their Princely State area. Though homogenous life enjoyed in the State is now stands change due to this socio-economic changeover after social life of every individual may not be affected.

Due to formation of Maharashtra State the Marathi speaking on 1st May 1960, the administrative reorganization and formation of North and South Satara had come to an end. The Satara became the separate district and Sangli became separate district wherein Miraj and Budgaon Princely States stand included, Kurundwad is in Kolhapur district. This already been mentioned above we are bringing a real socio-economic impact after the merging the Princely States that is after 1950 onwards. Whether the pace of development of each village (244) is maintained in the new system, the tehsil boundaries have got changed, the education aspect right from pre-primary, secondary and thereafter is as per the new administrative setup.



Figure 2 Today's Regional Context of Sangli District



Figure 3 Sangli District Tehsil Map

The formal six tehsils of Sangli State stands reorganized and as Sangli district became the revenue administrative district there are 10 tehsils know. There are total 543 villages in the district, the new tehsils formed are below.

Table 3 Sangli District Taluka and respective Population

Taluka	Population 2011
Atpadi	1,38,455
Jath	3,28,324
Kadegaon	1,43,019
K.Mahankal	1,52,327
Khanapur	1,70,214
Miraj	8,54,581
Palus	1,64,909
Shirala	1,62,911
Tasgaon	2,51,401
Walwa	4,56,002

Source: Census 2011

In newly formed Sangli district there is no town class as class ‘A’ Nagar Parishad. Islampur and Vita are Class ‘B’ Municipal Councils and in Class ‘C’ Jath, Ashta and Palus are there, Nagar Parishad. Shirala, Kadegaon and Khanapur are three towns as Nagar Panchyatas. The above administrative towns classed as ‘B’, ‘C’ and Nagar Panchayats were not formerly within the Sangli tehsil of Sangli Princely State. The population also had a growth rate between 15-19%. However, the graph is showing the growth rate is falling down from 17% to 9.5%. This clearly shows that there is outmigration and no guarantee of development works as were granted in Princely States.

Jath, Atpadi and K.Mahankal are drought prone areas where as Shirala and Sangli Towns are over flooding areas which has are been witnessed in 1914 flood and 2019.

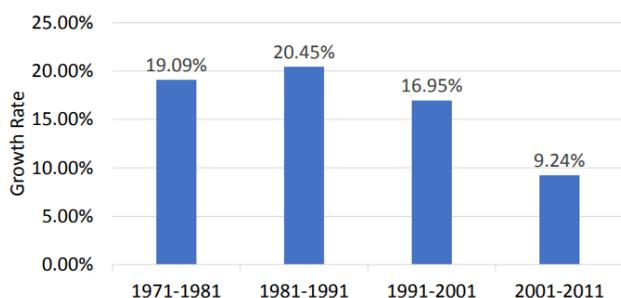


Figure 4 Sangli District Population growth rate

Source : Census 1971, 1981, 1991, 2001, 2011

Hence, the reorganization, reformation and addition, subtraction from the villages from here to there is totally disturbing the socio-economic behavior and amounting disabling of family structure. Where Municipal governance is there the old Bombay Town Planning Act, 1954 was applicable and process of preparation of Town Planning and physical planning efforts into the municipal areas were there. This will clearly shows the most important social and cultural aspect in Sangli –Miraj did not remain, while the imbalance is created in the totally new formed Sangli – Miraj district. This will show that map of today whatever development has taken

place was only at Sangli and Miraj Princely Towns.(Refer Figure No.7,8 and 9)

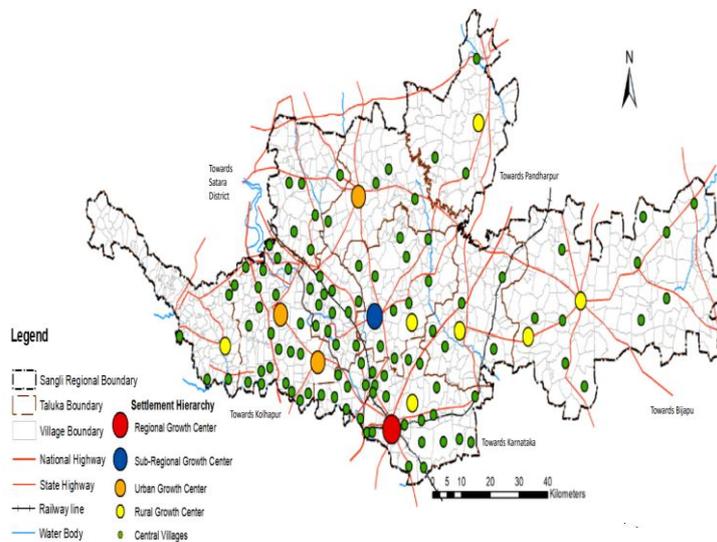


Figure 7 Sangli District Map Concentration of Population at Sangli-Miraj due to Availability Infrastructural Facilities and Amenities

Source: Census 2011

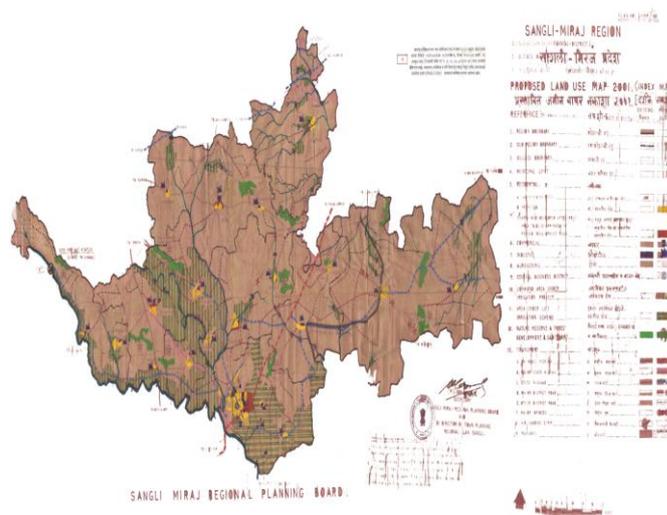


Figure 8 Sangli District Regional Plan 1976-2001

Source: Sangli Regional Plan 1976-2001 Report

So overall pictures is that there is no balanced development which was a priority in Princely States. Similarly, the revenue collection during the Princely regime was having equal distribution keeping the civic amenities, facilities and provision of essential services, water supply, drainage etc., was properly looked into. While today, if we look the picture there is no such development coming up, in spite the above industrial development, the MIDC has been actively working in following Miraj Block, Kupwad Block, Sangli IT Park, Islampur, Shirala, Jath, Kavethe-Mahankal, Kadegaon, add. Kadegaon, Palus, Add. Palus, Vita etc. Municipal Towns have sanctioned Development Plan and the District plan there is imbalance issue. If you verify the todays

Table 4 Industrial Units and Employment generated in Sangli District

Categories	No. of units	Employment generated
Agro based	1352	10452
Textile	1296	9072
Food processing	1598	12580
foundry	1000	6896
electrical	586	6202
engineering	1678	13909
other	5532	40150

Source : District Industrial Center, Sangli

Out of type of industries agro based industries are more and micro industries (4456+ 1153 small) are more whereas large (125) and medium (5) size are minimum.

This information shows that around 1lakh employment is generated. The Sangli district has 28,22,143 population and hence, the service sector to workers percentage of district is very merger of 0.5 %. This clearly shows that secondary and tertiary sector, non-agricultural sector are having backlog cleared, while the workers working in the agriculture sector are not available.



Figure 9 Sangli-Miraj MIDC Area (in Purple color)

Source : Development Plan Sangli, 1974

MAHARASHTRA REGIONAL TOWN PLANNING ACT, 1966

In the physical planning efforts which is most important aspect of visionary plan prepared during Princely State time and after the independence. The Bombay Town Planning Act, 1954 has been amended by newly formed Maharashtra Town Planning Act, 1966. Similarly, the said act has opened a vision of planning a region and not municipal areas. The Urban development Department has taken up the preparation of Sangli-Miraj Regional Plan in 1973.

This is most important step that this particular area is agro based area in predominance. The plan so prepared is finalized in 1976 and send to Gov. for sanctioned. Here our observation is mainly on increased administrative area and formation of district detached from Satara. In this particular situation we can termed as there is vast socio-economic cultural change and disturbance in the social life of the citizens. We have seen the outmigration because of abolition of Princely States, for higher education and respective jobs. This is also the degradation and perishing of yesterday Princely States and its capital is today a normal tehsil. Because of transfer of power from Princely State to Central Government there is huge

socio-economic disturbance in family structure. Hence, this situation is only because of ill planning of last 70 years.

Hence, to conclude the particular situation, what is socio-economic effect of Princely State, it is a gross out migration from the urban areas to the cities grown like Thane, Pune etc. Pressurizing those city population structure and available infrastructure, amenities etc. In 1992, the Prime Minister has already taken review of Five Year Plan results and the State of achievement of balanced development in all towns, which are classified as Census Towns (>5000 Population) and if job opportunities are not provided or graduation or higher education facilities are not available then there is constant flow of outmigration from Miraj-Sangli-Kurundwad area. On one hand we got the freedom of 1000 years but the formation of Planning Commission and the respective proposals of the Five Year Plan are not implemented properly. The Prime Minister has seen that after 40 years of freedom the degree of migration from rural to urban areas are not arrested or minimized and the theme of 73rd and 74th Constitutional Amendment achieving the rural development on one hand and also providing the urban facilities in rural area so as to look after the prosperity of the growing population in not met.

It is very important to note that Miraj was a junction in an important railway line from south center from Mumbai to Bangalore and elsewhere. Because of the up gradation from Meter gauge to Broad Gauge as mentioned in the earlier paras most of the important higher grade amenities in education, health, trade commerce and tertiary sector were available during Princely States, there was asocial relation between princess to common man accessible and because of Jamabandi system the prince used to visit every tehsil for campaign to redress all grievance at all levels and actual interaction taking between primary sector, secondary and tertiary sector people. Even though Miraj was having larger Muslim population there was hardly religious conflicts between two communities. The relation between Goa, Karnataka and Andra Pradesh State was constantly increasing. Trade, commerce and communication among the citizens and people are growing like anything, this is only because of human approach. Family structure also degraded. This is great social degradation and hence the solution for this is observance of 73rd and 74th CAA, proposals strictly with specific time limit. After the freedom it is observed that observance of time frame of starting and completion of any project has come to an end and everything is subject to views of Collector, MLA and MP. The competition which was seen between princes was most crucial social aspect of promotion and development and is totally lacking today.

REGIONAL PLAN (1976-2001) PROPOSALS

The Regional Plan of 1973-2001 proposes the entire Sangli Miraj agro based region to be provided in next 20 years period to tap the extra water source from Krushna river and excess water which is going as runoff and transferee it to Yerala river by virtue of underground Canal on the lines of Ujjain River to Sinha River. Hence, the draught prone tehsils of Sangli region would be given an additional water supply by storing Flood water on the lines of Shet tale. Because of good agriculture produce throughout the year the weekly bazars, sub-market yards and APMC at Jath, Shirala, Ashta, K.Mahankal are to be provided. The Deccan Sugar Institute may provide the institutional guidelines to increase the sugar technology and

the production of additional sugar and byproducts. Agriculture University should be proposed. Railway connection from Miraj to Ratnagiri should be provided. It is an observance that even though the graduate and post graduate institutions are present, the pass out students every year don't have enough job opportunities available. Hence, industries and such other aspect of generating job, should be thought off. MIDC is already functioning, some more efforts are required. There is IT reservation in Sangli-Miraj Development and Regional Plan which is most important proposal to shift the development from IT cities. The Dapodi-Krushni university a branch may be stabled in the area to reaping out the grapes, mangoes etc. Industries at rural growth center may have to be made an immediate necessitate copping a recommendation of 73rd CAA. The Maharashtra Chambers of Commerce and Agriculture may be requested a branch at Sangli-Miraj to catering the immediate research in this context. The Survey of India may be recommended to have service industries not covered in categories mentioned. Also, hazardous industries may not be provided in village Gaothan by a 1000m distance. The District Industrial Center (DIC) may be geared in this sector. Sangli-Miraj-Madhavanagr is large urban complex in Mahanagpalika in southern section and therefore the issues and problems of primary sector as well as secondary and tertiary sector may be entrusted immediately. The 73d and 74th CAA is an indicative alarm of 1992, we have already completed 29 years but the results of constitution amendments in this area is not being satisfactory. Even though decentralization of education, there are universities at Solapur and Kolhapur but because of lack of job opportunities in each district there is gross migration of graduate student community of both universities. Retrofitting of town which have crossed 5000 population may be taken up on the lines of back development, which is a concept taken up at Zilla Parishad but not on the lines of which Zilla Parishad is working.

CONCLUSION

In MRTP Act, 1966 once the Regional Plan is sanctioned there should be Regional Development Authority under Ch.3 A of Town Planning Act as Maharashtra Metropolitan Act 2016, this region being a agro based having a mix character of socio-economic and culture an abundance of resources and good fertile agriculture land, outmigration could have been arrested by creation of such Regional Development Authority. However, such efforts are not taken after 2001 or the revision of sanctioned Regional Plan, when 20 years is already over. Previously, every prince was very conscious and sensitive particularly Patwardhan about the Princely States and they were alert about the bringing out solution, they were socially very approachable. Economy of this region was very rich because of the good production of sugar products and cash crops etc. For this area as already stated only one MLA is cautions for unauthorized development. Sangli-Miraj Corporation because of Urban Land Ceiling Act, 1973 the unauthorized sub-division of agriculture land was going on, the developers and inserters pressurized Gov. through MLA and got the Guthewari Act, 2001. While in other sectors the Gov. has very slow approach. There is a fresh proposal of running a National Highway 166 starting from Sangli, Solapur section. We think this is an important proposal for communication to this western Maharashtra joining the

Solapur city connected to Andra-Pradesh and elsewhere. Our conclusion as the emerging urban centers identified in Regional Plan and grown towns crossing 5000 population in erstwhile Princely States are required and upgraded on priority, so that the slow progress taking place after the independence may be hastened up and the young generation be made prosperous.

REFERENCES

- i. *Administration Report of the Sangli State. 1923/1924/1935/1936-1941/1942. 1873/1874-1884/1885,1889/1890-1897/1898, 1909/1910-1934/1935.*
- ii. *Bombay Town Planning Act, 1915, 1954*
- iii. *Bowring Manuscript. Eur. Mss. G38, Volume II.*
- iv. *Census India, 1971, 1981, 1991, 2001, 2011*
- v. *Maharashtra Regional Town Planning Act, 1966*
- vi. *Maharashtra Metropolitan Act, 2016*
- vii. *Manjula (2016), Chanakya Nitti*
- viii. *Mansara – The Hindu Architecture*
- ix. *Maharashtra Land Revenue Code, 1966*
- x. *Maharashtra Municipal, Nagar Panchayat and Industrial Township Act, 1965.*
- xi. *Local Self Government Act, 1965*
- xii. *Parashuram Mahadev Limaye. Sangli State, 1910-1948, or, Monograph on the rule of Captain His Highness Raja Shrimant Sir Chintamanrao Dhundirao alias Appasaheb Patwardhan, Raja of Sangli. 1955.*
- xiii. *Rao Bahadur D.B. Parasnisi. The Sangli State. Lakshmi Printing Works, Byculla, Bombay, 1917.*
- xiv. *Sangli Regional Plan 1976-2001 Report*
- xv. *Sangli Municipal Council (1974) Development Plan and Sangli-Miraj Municipal Corporation () Development Plan*
- xvi. *Urban Land Ceiling Act, 1973*

Exploring Reasons of Load Bearing Construction Technology for Bungalow Structures Being Phased Out From Prevalent Construction Practices

Ar. Swati Godbole¹, Ar. Romeiro Silveira ²

¹M. Arch (Construction Management), Allana College of Architecture, Pune (2019-2021)

² Associate Professor (M. Arch), Allana College of Architecture, Pune

Email: arswats06@gmail.com, RomeiroSilveira@azamcampus.org, romeirosilveira@gmail.com

Abstract: *Load bearing technology was the prevalent construction technology for all structures in ancient times. With the advent of technological innovation in construction industry, gradually RCC frame structure technology became prevalent. This paper deals with exploring the reasons as to why load bearing masonry technology phased out from being a prevalent construction system for small bungalow structures.*

Scope: Reviewing the reasons for LBM structures being phased out for bungalow projects semi urban region of Pune. The review of research paper will focus on secondary and experiential sources of data.

Limitation: COVID19 Pandemic has limited the field data study.

Keywords: Construction technology, bungalows, Load bearing, RCC, environment friendly, thermal mass, local materials

Introduction

LBM technology can be seen in many ancient structures such as palaces, temples, bungalow etc. The development of the structural frame replaced the structural use of masonry in multi-storey buildings and limited its use to one or two-storey domestic buildings. The discovery of glass and lightweight partitions in the middle of the 20th century both further limited and reduced the use of masonry from many constructions. With the advent of technological innovation in construction industry, builders, architects and contractors adopted to RCC structural system for bigger structures, it being more appropriate for larger building and bigger spans. Slowly and gradually RCC frame structure technology became prevalent for small G+1 bungalow structures also. The scale of such bungalow structure is not that large that it needs to be dependent on prevalent RCC frame structure system. The load bearing system has a scope to accommodate locally sourced, locally available material and labor, utilizing traditional construction methods and local craftsmanship. Especially in semi urban and rural areas, people are opting for RCC frame structures even if load bearing structures prove to be more suitable environmentally due to greater thermal mass and insulation provided in this technology. Overall embodied energy of a load bearing structure is low as compared to RCC

frame structure. There is no harm in adapting new technology where it is beneficial, cost effective and time saving such as for multistorey buildings, industrial buildings and public buildings. However for smaller G+1/G+2 structures such as different domestic buildings such as residences, farm houses and bungalows which have lesser loading, lesser spans the use

of technological advancements is not necessary. With the use of LBM technology small structures can be made that can provide better performance in terms of indoor air quality, thermal comfort, and acoustic insulation and achieve sustainability by being environment friendly as compared to their RCC framed technology counterpart. Due to lack of awareness, the LBM technology has slowly phased out from being a prevalent system for small structures, instead it is being put up as an imperfect technology as compared to RCC frame structures.

Understanding LBM technology:

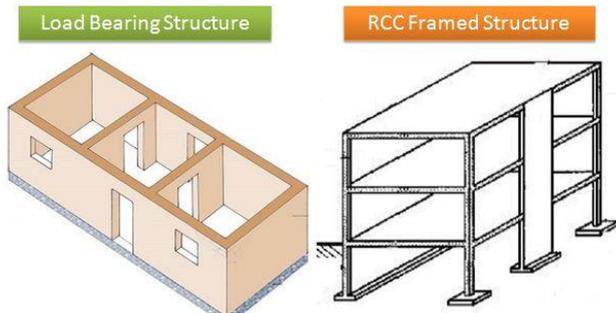
LBM technology refers to Load Bearing Masonry construction systems in which all components i.e. masonry walls, strip foundations, piers, arches and the roof transfer loads to the ground as opposed to frame technology where only the main structural frame made of columns, beams and footing transfer the load to ground.

The LBM technology is a structural system where the floors and walls work together as a system, each giving support to others (Brick Industry Association, 1997) the system is designed to support the building loads by the roof, upper floor slabs, dead load and lateral loads for example wind load.

LBM technology primarily has thick walls (ranging from 230 mm to 600mm or more depending on the floor height, loading and span) standing on masonry foundations. The walls are generally made in masonry blocks (Stone, stabilized mud blocks, burnt clay bricks etc.) The masonry components are joined together using mortar (mud mortar, lime mortar, cement mortar). The floors are created using different floor systems such as jack arch floors, wooden beams and mud/RC slab, steel girders with precast concrete panels above or RCC slab resting on load bearing walls. The roof can be either wooden truss with clay tiles/ GI sheets or RCC slabs.



Figure- 1 Example of a Load Bearing Masonry Building
(Source- <https://theconstructor.org/construction/masonry/load-bearing-masonry-construction/2143/>)



The LBM structures which use masonry walls and do not have any reinforcement though masonry are called as Unreinforced Masonry (URM) buildings.

Figure- 2 Load bearing building and RCC frame building (Conventional) (Source- <https://civiconcepts.com/blog/difference-between-load-bearing-and-frame-structure>)

any reinforcement though masonry are called as Unreinforced Masonry (URM) buildings.

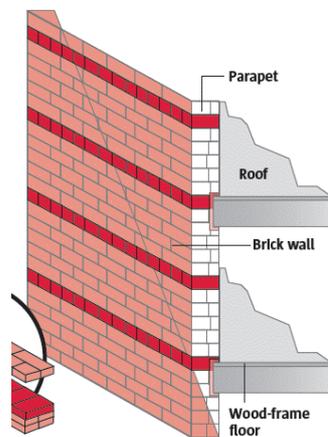


Figure 3 Unreinforced Masonry Wall

(Source- [https://www.seattle.gov/emergency-management/hazards/unreinforced-masonry-buildings-\(urm\)-](https://www.seattle.gov/emergency-management/hazards/unreinforced-masonry-buildings-(urm)-))

Some of the construction techniques like thatch roof using local materials, flooring with mud and cow dung plaster etc. are region specific and have more vernacular relevance to it. In today's time new innovations like Ferro cement LB house, plastic bottle house are also an extension of load bearing construction system.

Material & methodology:

Different literature on the topic, live & book case studies, views of architects, engineers, contractors and prospective clients on the subject matter has been studied, reviewed to get an in-depth understanding of the topic

Literature Review:

In the paper 'Load Bearing Masonry (LBM) System in a Developing Country' explains about the development of the system, masonry productivity, sustainability and advantages of the masonry system. Despite its benefits the masonry structures have become the alternative method for the construction, and the factors influencing the adoption of this system among the industry players are not deeply investigated. An understanding of the factors influencing the adoption in the construction organization would help the

practitioners and government in enhance the usage of the system in construction activities

In the paper 'A Study of Potential Load Bearing Masonry' (LBM) System in Malaysia Construction Industry, 'it is described that the load bearing masonry structures are advantageous over conventional system.

- Economic as compared to conventional structures by 10 to 20%
- Less construction time (30 to 40% less than conventional) needed as no buffer time needed for strengthening of slab etc.
- Durable & sustainable.
- Brickwork can provide acoustic comfort, thermal comfort, and good indoor air quality and fire resistance.
- Brickwork also meets the requirement of many certificated rating systems in the area of development of density, storm water management, heat island effect, improve energy performance, construction waste management and low maintenance.

The paper concludes that even with so many advantages over conventional system it not used majorly. It suggests that the government mainly has to take initiates to promote the usage of this system. Implementation of this system can be great platform to improve the method and demands for the housing projects.

In paper 'Masonry structures confined with concrete beams and columns' gives various details for confined masonry work so as to prevent damage to buildings in seismic events. Providing tie columns, ring beams, RC belts on interior walls and near windows are some of the measures that can be taken to confine the masonry work and prevent seismic damage.

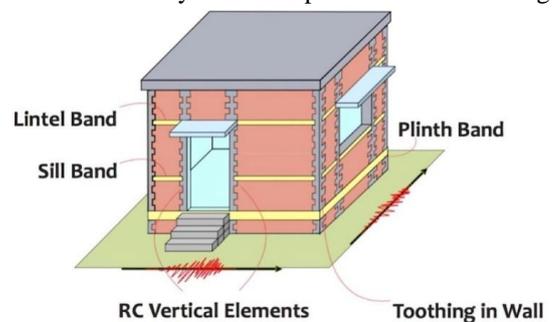


Figure- 4 Confined Masonry Structure

(Source- <https://www.aboutcivil.org/confined-masonry-building-components>)

The paper 'Sustainable housing using confined masonry buildings' compares seismic performance of CM building in comparison with URM and RC frame building with infill walls is examined. From the study, it is clear that low-rise CM structure exhibits better in-plane and out-of-plane resistance in comparison with URM and infilled RC frame structures under any seismic event. URM structures provide very less lateral strength in comparison with CM structures, and because of the brittle behaviour, they have no reserved strength after cracking. Confined masonry can be a useful construction technology because this practice does not require new or advanced construction skills or equipment. Same materials are used which are available in the country, that is, concrete, masonry and steel. It only requires nominal care in design and construction and yet performs very well in earthquakes.

Therefore, confined masonry is a better alternative for sustainable housing in seismic-prone regions of India.

The paper 'Comparative study of load bearing block masonry work in housing' it is mentioned that the quality of bricks available in India are of much poor quality as compared to other countries, the crushing strength of brick in India is only 7N/mm² to 10N/mm² while in western countries the strength of bricks is ranging from 30N/mm² to 50N/mm². There is need and considerable scope in this country of intensifying experimental, research and study in the field of load bearing masonry in order to make better and more economical use of this wonderful and versatile building material, the brick. In India, we have been trying to keep pace to some extent with the development taking place in other countries in regard to masonry.

Reasons & issues that led to disappearance of LBM structures:

The reasons leading to LBM structures phasing out from prevalent construction practices can be classified into different heads.

Design Issues:

- There is a limitation to floor rise in LBM structures as floor rise is directly proportional to wall thickness. The further extension needs to be pre-planned so as to keep the wall thicknesses accordingly.
- Major alterations cannot be done to masonry walls as they are load carrying components and such changes could damage the structure.
- The floor plans on every floor need to be same or in such a way that walls continue at same location from ground to top.

Issues related with commercial viability & public mindset

- The LBM structures are gradually vanishing from the urban & semi urban context majorly due to huge rise in the cost of land and cost per sq.ft carpet area.
- The need to achieving maximum possible carpet area to fully optimize the land use has led to use of frame construction technology in which the walls can be reduced to half the thickness as compared to LBM structure masonry walls.
- With continuous developments in urban regions and urbanization, it has become a public mindset that an RCC house is a "pucca" house (permanent) in nature as compared to its masonry counterparts leading to extensive use of RCC frame technology for small structures also.

- The masonry wall thickness in LBM structures vary from 230mm to 600 mm or more depending on the material used for masonry, soil conditions, loading on walls etc. which is almost double to the wall thickness used in LB masonry walls. Additionally for LBM structures internal and external wall thicknesses are same unlike RCC frame structures where internal walls are thinner up to 150 mm.

Issues related to construction quality:

- The bricks having poor strength will require thicker walls to transfer the same amount of load to the ground thus increasing the wall area in the process and reducing carpet area.
- In a LBM structure services such as plumbing and electrical are mostly not concealed as it may hamper the wall strength and might not be possible in some roofing types such as timber, steel girder & stone, precast panels etc. The open services i.e. conduits for plumbing pipes, electrical wires

affects the aesthetic appearance of exterior and interiors and demands for additional design measures such as wall cladding etc. adding to extra expense.

- In the current urban and semi urban context due to extensive use of prevalent technology, contractors and their workers are unfamiliar with LBM technology. The workers skilled to work in masonry for LBM structures are not easily available in current urban setting. The unavailability of skilled labor for the work or training the existing labor may prove uneconomic and time consuming which further leads to discouraging the use of LBM technology for small structures.
- In LBM structures where stabilized mud blocks, mud plaster, thatch roof etc. are used in construction, maintenance of such components & surfaces is needed at regular intervals which may create a nuisance or inconvenience to the end user.

Issues related to seismic performance of structure:

- The LBM structures do not perform well in seismic events. LBM structures having non-reinforced masonry walls have shown to fail in seismic events in the past. The masonry wall are good in taking compression loads but not in lateral loads which are induced on the building in ground vibrations in the earthquake.

Conclusions:

The reasons for phasing out are majorly dependent on public mindset, Sq.ft area economics, construction quality and seismic performance of LBM structures. While explorations a possibility is seen to rejuvenate LBM technology that has potential of proving beneficial by giving better indoor & outdoor environment, sustainable dwelling & cost effectiveness as compared to prevalent RCC practices.

Acknowledgement:

I would like to express my deep gratitude from the bottom of my heart to my guide Ar. Romeiro Silveira for his valuable guidance, inspiration and encouragement.

References:

- Nor Azlinda Ramli, Che Sobry Abdullah and Mohd Nasrun Mohd Nawawi - Load Bearing Masonry (LBM) System in a Developing Country - https://www.researchgate.net/publication/273125432_The_Study_of_Load_Bearing_Masonry_LBM_System_in_a_Developing_Country*
- N.A. Ramli, C. S. Abdullah, and M.N. Mohd Nawawi - 'A Study of Potential Load Bearing Masonry (LBM) System in Malaysia Construction Industry' - https://www.researchgate.net/publication/265376524_A_Study_of_Potential_Load_Bearing_Masonry_LBM_System_in_Malaysia_Construction_Industry*
- Da-hai Liu and Mao-Zheng Wang - 'Masonry structures confined with concrete beams and columns' - <https://www.iitk.ac.in/nicee/wcee/article/2720.pdf>*
- Bonisha Borah, Vaibhav Singhal, Hemant B. Kaushik - Sustainable housing using confined masonry buildings - https://www.researchgate.net/publication/330881654_Sustainable_Housing_using_Confined_Masonry_Buildings*
- M.T.S. Lakshmayya, R. Chiranjeevi Rahul - Comparative study of load bearing block masonry work in housing - International Journal of Engineering and Technology (IJET)-*

ISSN (Online) : 0975-4024-

https://www.researchgate.net/publication/309625988_Comparative_study_of_load_bearing_block_masonry_work_in_housing

- vi. Yogendra Singh , Dominik H. Lang , JSR Prasad, and Rajesh Deoliya- 'An Analytical Study on the Seismic Vulnerability of Masonry Buildings in India' - *Journal of Earthquake Engineering*, 17:399–422, 2013-
https://www.researchgate.net/publication/263718789_An_Analytical_Study_on_the_Seismic_Vulnerability_of_Masonry_Buildings_in_India
- vii. Braj P. SINHA- 'Development and potential of structural masonry' -
https://www.researchgate.net/publication/237120848_DEVELOPMENT_AND_POTENTIAL_OF_STRUCTURAL_MASONRY
- viii. Ajay Chourasia- 'Confined Masonry Construction for India: Prospects & Solution for Improved Behaviour' -
https://www.researchgate.net/publication/264540273_Confined_Masonry_Construction_for_India_Prospects_Solution_for_Improved_Behaviour

Comparative Analysis of Awareness Towards Green Buildings Amongst Common People And Building Professionals

Nidhi Shah¹, Archana Gaikwad²

M-Arch, Student (Sustainable Architecture), Bharati Vidyapeeth (deemed to be university), College of architecture¹. (HOD-M-Arch) Bharati Vidyapeeth (deemed to be university), College of architecture².
arnidhishah19@gmail.com¹, avg@bvcoa.in²

Abstract - The construction industry is one of the main energy consumer and emitter of greenhouse gases. Therefore, it is important to integrate green principles to buildings. In spite of promotion of green building assessment systems and guidelines, it is observed that very few buildings adopt these principles. So, it is worth knowing the reasons for lack of acceptance towards green building principles. This paper tries to find level of awareness of green buildings concepts among professionals and common people taking a case of city of Indore in India. The findings have implications for policy to focus on awareness for effective implementation of green building assessments.

Keywords: - Green buildings, Awareness, building professionals, common people

1. Introduction –

In the present scenario there has been a continuous increase in the environmental degradation like global warming, depletion of the ozone layer, sea level rise, climate imbalance, etc. This is because of the rapid urbanisation and increasing built environment. According to the various researches and reports construction sector consumes more than 30% of the energy and 40% of the resources (Jat, 2018). Simultaneously 40% of the waste and 35% greenhouse gases are generated from the building (Jat, 2018). It is said that, between 2010 and 2040, the expected increase in the global energy usage is 56% (Joseph, 2018). Therefore, it is important to integrate green principles to newer buildings and also in the existing buildings. According to the Indian Green Building Council (IGBC), a building which can function using an optimum amount of energy, consume less water, conserve natural resources, generate less waste and create spaces for healthy and comfortable living, as compared to conventional buildings, is defined as a green building (Indian Green Building Council, 2020). The Energy and Resources Institute (TERI), a non-for-profit organisation working in the field of sustainable development defines it as, “A green building is designed, constructed and operated to minimize the total environmental impacts while enhancing user comfort and productivity” (Grover, 2015).

From the literature it has been found that people are not adopting the green building concepts because of several reasons such as Perception, awareness, attitude etc. So, these three

factors that is Perception, awareness and attitude affect the decision making related to green buildings out of which awareness is the important aspect. However, Awareness would differ between the common people, that is the customers and the one who are providing them services that is the building industry which has not been studied. While cost, voluntary participation, expertises are some reasons focused in the literature, less is known about level of awareness amongst professionals and common people about the concept of green buildings. So, this paper tries to find out the level of awareness of green buildings concepts among professionals and common people taking a case of city of Indore in India. The study findings highlight the difference in the awareness among the two study groups. The findings have implications for policy to focus on awareness for effective implementation of green building principles in the building.

2. Green buildings – Rating systems and Aspects

In India the green building movement started with the establishment of the IGBC in 2001, which was an initiative of the Confederation of Indian Industries (CII) with the World Green Building Council and the USGBC (Jat, 2018). The objective of IGBC Green New Buildings rating system is to facilitate a holistic approach to create environment-friendly or sustainable buildings, through Sustainable site selection and planning, architectural design, water efficiency, effective handling of waste, energy efficiency, sustainable building materials, and focus on occupant comfort & well-being (Indian green building council, 2020). Also, TERI has developed a tool for measuring and rating a building's environmental performance according to the India's varied climate and building practices. This rating system is known as 'Green Rating for Integrated Habitat Assessment' (GRIHA) which quantifies parameters like energy consumption, waste generation, renewable energy adoption over the entire lifecycle of the building. LEED, IGBC and GRIHA are the most recognized rating systems in the Indian green building industry (Joseph, 2018). The various aspects of green building according to these rating systems are sustainable site selection and planning, water efficiency, energy efficiency, Indoor environmental Quality and occupant Comfort, solid waste

management and sustainable building materials and resources. By implementing the principles of all these aspects in a building it will not only become more energy efficient but will also reduce the carbon footprints on environment.

Also, there are many benefits of green buildings such as reduced energy and water consumption, reduced air pollution, increased material efficiency, increased productivity and health benefits. Green Building is a promising construction approach through which the construction industry contributes to sustainable development. However, the adoption of Green Building has been hampered in many parts of the world by numerous barriers (Darko, 2017). The various barriers are Lack of Information, Education and Research, Knowledge, Awareness, and Expertise, cost, Lack of Incentives/Support, Lack of interest and demand, Lack of building codes and regulations, Scarcity of Materials/Labourers, Lack of seriousness and leadership, Protection from change and Green certification processes.

3. Methodology –

The target population for this study is divided into two groups. One is a common people group which includes housewife, business man, student's, computer engineers etc and other is professionals which includes architects, engineers, contractor and builder from the Indore city. An online questionnaire survey which was formed based on the secondary data was conducted to measure awareness at three levels using Likert scale for various criteria suggested by green rating systems. Before sending the survey, questionnaire pilot study has been conducted and modifications has been done accordingly in the questionnaires. The sampling technique used is convenient sampling because of the covid-19 pandemic it is not possible to do random sampling. The information gathered from the respondents were analysed through calculation of means and percentages. Data presentation was done through pie charts and Bar graphs.

4. Data Analysis and Interpretation –

There are 52 respondents for professional and 55 respondents for common people. The scores were summated and the possible ranges of scores were divided into four categories as slightly aware, moderately aware, very aware and extremely aware.

Overall analysis –

Professionals - There were total 6 sections in which total 31 questions were asked out of which maximum respondents have scored 27 marks. So, 50% of the professionals are Extremely Aware, 42% are Very Aware and 8% are Moderately Aware.

Common People - There were total 6 sections in which total 26 questions was asked out of which maximum respondents have

scored 21 marks. So, 16% of the common people are Extremely Aware, 60% are Very Aware and 24% are Moderately Aware.

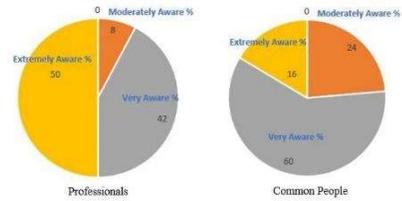


Figure 1

Section 1 Analysis – Site Selection and Planning –

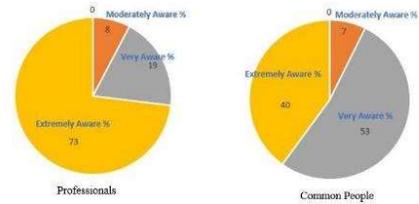


Figure 2

Section 2 Analysis –Water Conservation –

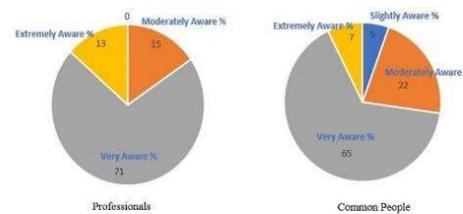


Figure 3

Section 3 Analysis –Energy Conservation –

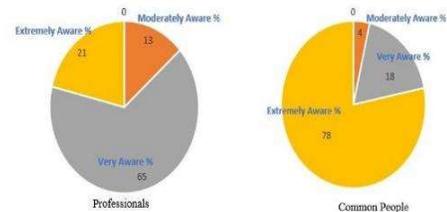


Figure 4

Section 4 Analysis –Sustainable Building Material –

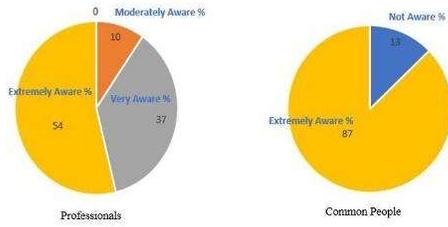


Figure 5

Section 5 Analysis – Indoor Environmental Quality–

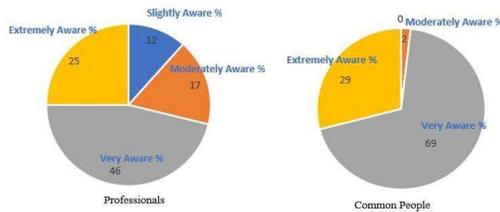


Figure 6

Section 6 Analysis – Solid Waste Management–

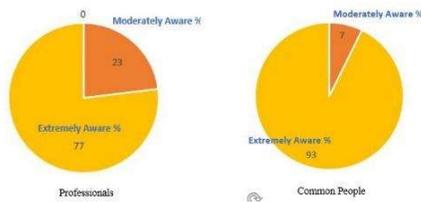


Figure 7

Barriers in green buildings –

Following Barriers were asked only to the professionals and after analysing the results it is observed that 60% of the professionals are facing higher cost, 58% are facing lack of technical knowledge and awareness, 42% are facing scarcity of resources, 33% are facing Lack of green building codes and regulations and 27% professionals are having problems in green certification process.

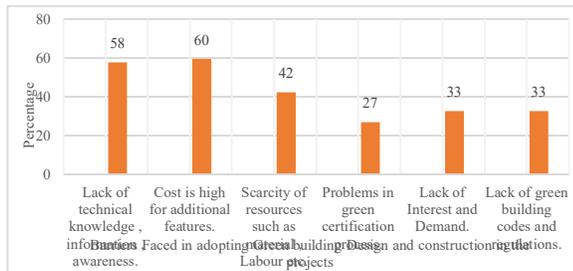


Figure 8

Green Building Certification Awareness –

Following Green building certification systems were asked only to the professionals and after analysing the results it is observed that 38% of the professionals are aware about the GRIHA rating system, 31% of the professionals are aware about the IGBC rating system.

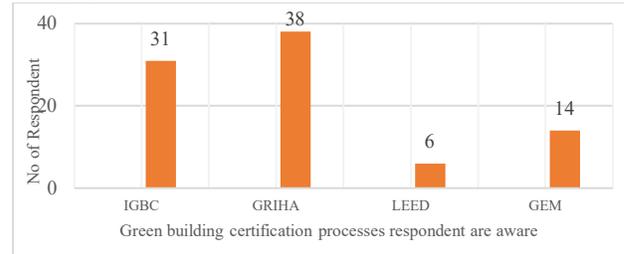


Figure 9

5. Conclusions and Recommendations –

Professionals - Only 50% of the professionals are extremely aware while 50% are still completely not aware about all the criteria's. Out of all the criteria's the Section 1- Sustainable site selection and planning, Section 4 – Sustainable Building materials and section 6 – Solid waste management are the ones in which the professionals were extremely aware while other criteria's such as Section 2- Water conservation, Section 3- Energy conservation, Section 5- Indoor environmental quality the awareness level is less as compared to other sections. The most known concepts were rain water harvesting, Metering of water consumption, renewable energy systems and integration of passive features. The least known concepts were limited lawn area, cfc free refrigerants, green certified materials and co2 monitoring and control.

The professionals in the built environment play very important role so they should translate their awareness into practice. They need to explore and adopt concepts at project design stages and implementation phase. The government should start obliging all professionals to include some green building concepts in all of their future projects before providing building permits. In this way, clients and architects have no choice but to comply with the requirements. Many green materials are imported from abroad. Local suppliers and manufacturers should be encouraged and strengthened through government incentives and also by the professionals so that the cost for the materials will be reduced as well as the scarcity of the materials will be reduced and local labourers can also be easily be available.

Common People - Only 16% of the respondents are extremely aware while 84% of the respondents are still completely not aware about all the criteria because of which the concept of green building is lacking. Out of all the criteria's the Section 3-

Energy conservation, Section 4 – Sustainable Building materials and section 6 – Solid waste management are the ones in which the professionals were extremely aware while other criteria's such as Section 1- Site selection and Planning, Section 2- Water conservation, and Section 5- Indoor environmental quality the awareness level is less as compared to other sections. The least known concepts were limited lawn area, voc paints and basic amenities nearest to site.

Since common people are not aware about many of the green building's concepts, so it is the responsibility of the professionals to make people know the benefits of having green buildings so that they will be willing to implement it into their buildings. Also, education programmes should be conducted in college, schools and universities so that the youngsters of the nation would come to know the different green building concepts and will be aware about it.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Prof. Archana Gaikwad for guiding me and channelizing my thoughts in right direction throughout this research. Lastly would like to thank my dearest friend Tushar for his support always and all the respondents for their valuable time, help and support.

REFERENCES

- i. Council, G. (2019). *GRIHA v.2019 Abridged manual*. New Delhi: The Energy and Resources Institute (TERI). Retrieved from <https://www.grihaindia.org/sites/default/files/pdf/Manuals/griha-v2019-abridged-manual.pdf>
- ii. Darko, A. (2017). *Review of Barriers to Green Building Adoption*. Wiley Online Library, 25, 167-179. Retrieved from <https://onlinelibrary.wiley.com/doi/abs/10.1002/sd.1651>
- iii. Grover, D. P. (2015, March). *Analysing Market Feasibility of Residential Green Buildings in Tier-II Cities in India*. *IOSR Journal of Business and Management*, 17(3), 62-69. Retrieved from <http://www.iosrjournals.org/iosr-jbm/papers/Vol17-issue3/Version-1/G017316269.pdf>
- iv. Indian green building council. (2020, November). Retrieved from igbc.in: <https://igbc.in/igbc/redirectHtml.htm?redVal=showAboutusnosign>
- v. Jat, A. K. (2018). *CONSUMER'S ACCEPTANCE TO GREEN BUILDING CONCEPT FOR SUSTAINABLE CONSTRUCTION IN INDIA*. *International Journal of Advance Research, Ideas and Innovations in Technology*, 4(1), 1-17. Retrieved from <https://www.ijariit.com/manuscripts/v4i1/V4I1-1163.pdf>
- vi. Joseph, M. K. (2018, May 5). *A Review on various Green Building Rating*. *International Journal of Scientific & Engineering Research*,

9(5), 1851-1859. Retrieved from <https://www.ijser.org/researchpaper/A-Review-on-various-Green-Building-Rating-Systems-in-India.pdf>

- vii. Komolafe, M. O. (2018, March). *Awareness and Perception of Office Property Users on Green Building in Lagos, Nigeria*. *INTERNATIONAL JOURNAL OF BUILT ENVIRONMENT AND SUSTAINABILITY*, 5(3), 208-213. Retrieved from https://www.researchgate.net/publication/327895114_Awareness_and_Perception_of_Office_Property_Users_on_Green_Building_in_Lagos_Nigeria
- viii. Laeeq, M. Y. (2017, July). *GREEN BUILDING: CONCEPTS AND AWARENESS*. *International Research Journal of Engineering and Technology (IRJET)*, 4(7). Retrieved from <https://www.irjet.net/archives/V4/i7/IRJET-V4I7614.pdf>
- ix. Sichali, M. (2017, October). *Awareness, Attitudes and Perception of Green Building Practices and Principles in the Zambian Construction Industry*. *International Journal of Construction Engineering and Management*, 6(5), 215-220. Retrieved from https://www.researchgate.net/publication/323417297_Awareness_Attitudes_and_Perception_of_Green_Building_Practices_and_Principles_in_the_Zambian_Construction_Industry
- x. Umar, U. A. (2012, June). *Determined the Level of Green Building Public Awareness: Application and strategies*. Kuala Lumpur: 2012 International Conference on Civil, Offshore and Environmental Engineering. Retrieved from https://www.researchgate.net/publication/227488442_Determined_the_Level_of_Green_Building_Public_Awareness_Application_and_Strategies

Insight Into Tensegrity Structures

Ar.Madiha Patel, Prof. Tushar Bokhad

Priyadarshini Institute of Architecture & Design Studies, Nagpur
madiha5.mp@gmail.com

Abstract : *The tensegrity framework consists of both compression members (struts) and tensile members (tendons) in a specific topology stabilized by induced prestress. Tensegrity plays a vital role in technological advancement of mankind in many fields ranging from architecture to science. This paper would review topological classification of elementary cells of tensegrity structures including rhombic, circuit and Z type configuration. Further, different types of tensegrites created on the basis of these configurations are studied and analysed, for instance Tensegrity prism, Diamond tensegrity, and Zig-zag tensegrity along with their classification. This paper would also overview form finding methods that could create a stable structure.*

Keywords: *Tensegrity, compression, tension, form finding geometry*

Introduction

Buckminster Fuller has coined the term tensegrity to name a spatial structure such as X-Piece built by Kenneth Snelson in 1948. Tensegrity structure consists of a set of compression elements (discontinuous struts) and tensional elements (continuous cable) which formed in self-equilibrium condition since they are 'equilibrated omnidirectional stresses'. Tensegrity structures have been suggested for many applications such as medication engineering, treatment strategies, automation and robotics. This paper summarizes the up to date knowledge on tensegrity structures and presents some of their non-conventional applications in computational design and modelling in various technical fields. The tensegrity structures mimicking biology system or biotensegrity has also been proposed. Owing to the needs to find stable and self-equilibrium configurations, exploration on efficient form-finding methods for tensegrity structures are very essential.

1. Features of tensegrity

Fuller coined the term 'tensegrity' by combining two words 'Tensional + Integrity'; it means the integrity of a structure consisting of tension and compression components. His definition of tensegrity structures was 'A tensegrity system is established when a set of discontinuous compressive components interacts with a set of continuous tensile components to define a stable volume in space'. If we apply this definition in broader sense, then the entire universe can be viewed as a tensegrity structure. Planetary systems at a space level or atomic systems at a microstructural level, all of them consist of discontinuous compressed members; for instance, planets (spheres) are connected by gravitational (tensional)

forces that symbolize tensile members. It is evident, that this definition is too broad, and a more precise one is needed. K. Snelson describes tensegrity as a closed structural system composed of a set of three or more slender compression struts within a network of tensioned tendons, the combined parts mutually supportive in a way, that the struts do not touch one another, but press outwardly against nodal points (vertices) in the tension network to form a firm, triangulated, prestressed, tension and compression unit. In short, he defined tensegrity as discontinuous compression, continuous tension structures. In technology, tensegrity principle is used widely in building new structures (fig. 1), shelters, bridges, etc.



Fig.1 Kurilpa Bridge, Brisbane

1.1 Characteristics of tensegrities

Characteristics of tensegrities can be summarized as follows:

- They have a higher load-bearing capacity with similar weight.
- They are light weight in comparison to other structures with similar resistance.
- They don't need to be anchored or have to lean any surface as they don't depend on their weight or gravity. They are stabilized in any position by equilibrium of compressive forces in struts with tensional forces in prestressed cables. Prestrain in the cables can be transformed into prestress only if the structure is statically indeterminate.
- They are enantiomorphic i.e. exist as right and left-handed mirror pairs.
- Elementary tensegrity modules can be used (such as masts, grids, ropes, rings etc.) to make more complex tensegrity structures.
- Higher the pre-stress, stiffer the structure would be, i.e. its load bearing capacity increases with the increasing pre-stress. In a tensegrity structure the compressive members are short and discontinuous, hence

they do not undergo buckling easily and no torque is generated in them.

g)The resilience depends on the structure assembly and material used.

h) They work synergically i.e. their behaviour cannot be predicted by considering the behaviour of any of their components separately.

1.2 Advantages of tensegrity over conventional (continuous)structures

a)As the load is distributed in whole structure there are no critical points of weakness.

b) They don't suffer any kind of torsion and buckling due to space arrangement and short length of compression members.

c)Forces are transferred naturally and consequently, the members position themselves precisely by aligning with the lines of forces transmitted in the shortest path to withstand the induced stress.

d) They are able to vibrate and transfer loads very rapidly and hence, absorb shocks and seismic vibrations which makes them applicable as sensors or actuators.

e)Construction of structures using tensegrity principle makes it highly resilient and, at the same time, very economical.

1.3 Disadvantages of tensegrity over conventional (continuous)structures

a)They show relatively high deflections and low material efficiency as compared to with conventional continuous structures.

b) Fabrication complexity is a major barrier in developing floating compression structures.

c)Adequate design tools are not available for their design.

d) At large constructions the structure cannot withstand loads higher than the critical, related to its dimensions and prestress.

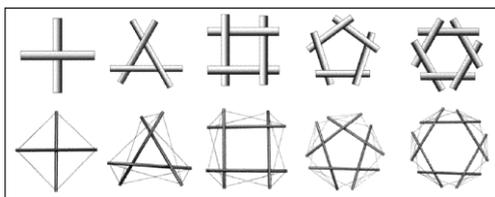


Fig.2 : Primary weave cells & equivalent basic tensegrity modules

2. Topological Classification of elementary cells of tensegrity structures

2.1 Rhombic configuration

The name of tensegrity patterns is based on the way they are constructed (tendon patterns). In Fig.3, each strut of a system represents the longest diagonal of a rhombus formed by four

corresponding tendons and can be folded following these diagonal. Generally, this configuration corresponds to the diamond tensegrity. T-prism and T-icosahedron tensegrities are well known examples of the rhombic configuration where rhombus represents a non-planar quadrilateral formed by tendons

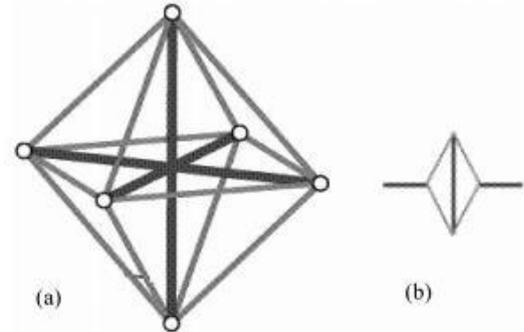


Fig.3: (a) Assembly of Rhombic Configuration and (b) its pattern

2.2 Circuit configuration

In this system, the compressed members are formed by close circuits (Fig. 4(a)) which do not comply with standard definition of tensegrity. This can be constructed by closing the rhombus generated by struts and tendons of the diamond pattern tensegrity, such as T-icosahedron.

A new tendons-struts relationship is established by joining the struts to form the circuit pattern which gets compact in size and able to withstand greater external load compared to the tensegrity structure built using diamond pattern for the same number of struts.

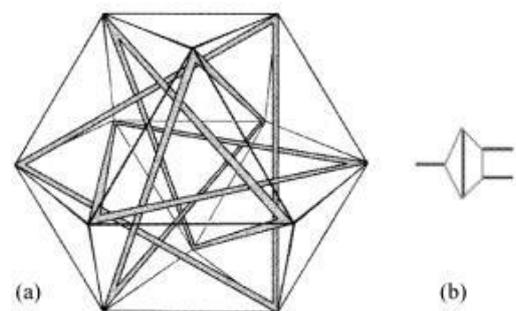


Fig.4: (a) Circuit configuration of Cuboctahedron tensegrity having 4 non-touching triangular circuits and (b) its pattern

2.3 'Z type' configuration

A 'zig-zag' configuration (also being an enantiomorphic) is obtained from the rhombic configuration as the basic structure. Both ends of any strut should be connected by three non-aligned tendons arranged to form a 'Z' shape. Truncated tetrahedron (Fig. 5) is a classic example of Z type configuration obtained from truncated icosahedron which belongs to the class of rhombic configurations.

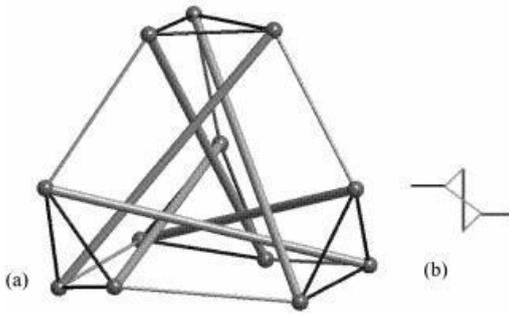


Fig.5: (a) Truncated Tetrahedron (T-tetrahedron) using Z type configuration, (b) its pattern

3. Form finding methods

Tibert and Pellegrino has classified the form- finding methods into kinematical and statical methods. This section discussed the form- finding methods for tensegrity structures based on these two categories. Both categories aims in finding the configuration of the structure in self-stress condition.

3.1 Kinematical Methods

Kinematical methods determine the geometry of a structure involving maximization of strut lengths with unchangeable of cable length or minimization of cable lengths with unchangeable of strut length. These methods do not acquire the cables in a pretension condition similarly as general method to build tensegrity structures. Typical kinematical methods are dynamic relaxation method, finiteelement method and Monte Carlo method. In Dynamic relaxation method is applicable for small scale projects in finding new shapes of a structure which was introduced by Motro. This method employs nonlinear equilibrium equations with damping (i.e. irregular motion) in form-finding of tensegrity structures. Iteration steps by mimicking a pseudo dynamic in time process which involve repetitive formulation of velocities and nodal forces begins with an initial configuration until satisfaction of equilibrium condition.

3.2 Statical Methods

Statical methods determines a stable configuration for tensegrity structure which involves both topology of the structure (i.e. nodes and elements) as well as forces acting on the structures. Common statical methods are force density method, advanced density method and novel linear approach.

4. Numerical Examples of Form-Finding

Every structure has been modelled by various design or shape. By using the form-finding method explained on previous section, the configuration of new structure can be designed easily in a stable condition. Therefore, there are many numerical examples of form finding that has been developed by previous researcher which can be categorized as regular design, irregular design.

3.3 Regular Design

This section presents numerical example of form-finding for regular tensegrity such as hexagonal, prisms, octahedron, icosahedron, tetrahedron, cylindrical, tower and arch tensegrity. Tensegrity is considered as regular design when the structure is in symmetrical shapes which have equal sides and angles. Most of researchers have studied on this type of design because the equilibrium condition of the configuration could be found easily compared to irregular one. Figure 6.1 shows symmetry configurations are regular and satisfied the nodal equilibrium.

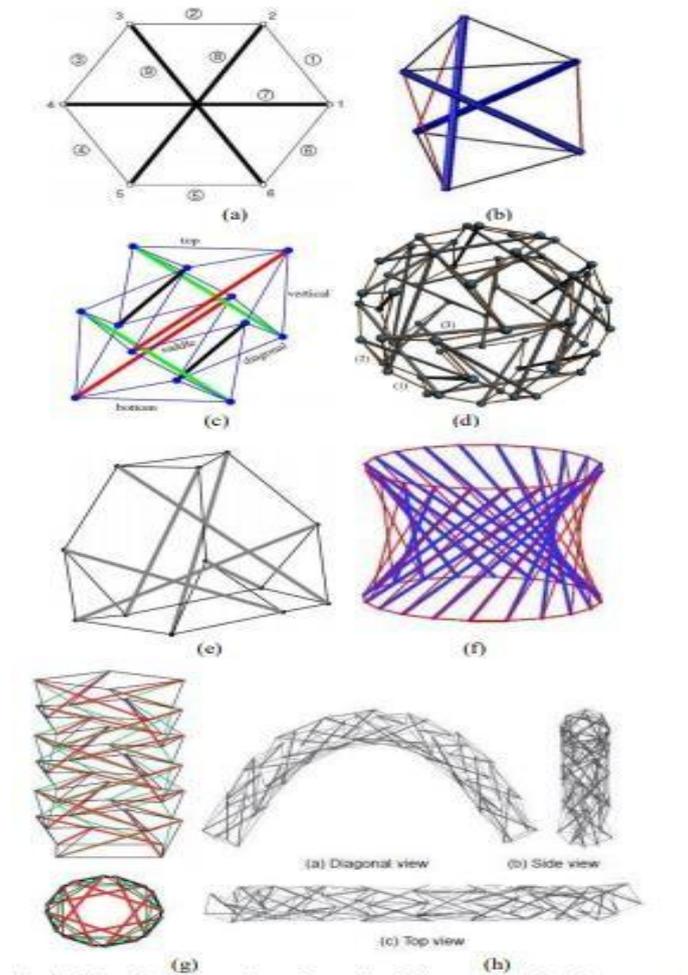


Fig.6.1: Numerical examples of regular design produced using several methods

3.4 Irregular Design

This section presents numerical example of form- finding for irregular tensegrity such as in Figure 6.2 Irregular design is the structures produced are asymmetrical shapes (not having equal sides and angles). There are not many researchers studied on this type of design because a more complex formulation involved in obtaining self-equilibrated configuration.

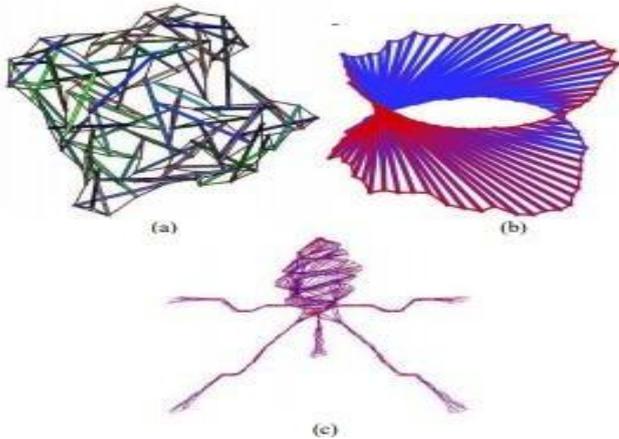


Fig.6.2: Numerical examples of irregular design produced by using several methods

4. Conclusion

This paper introduces the tensegrity principle and its unique features over conventional solid structures. Further, the topological classification of elementary cells (tendon patterns) and tensegrities based on these types of cells were presented here. The tensegrity structures have a wide range of applications specifically in structural engineering such as domes, bridges, and towers, as well as in biological sciences for computational modelling of human anatomy, eukaryotic cells, etc. This paper also reviews form-finding methods that were classified under two categories (i.e. kinematical method and statical method).

Each method presented previously have different advantages but focusing on similar goals. However, not all methods are suitable for certain cases such as for irregular configuration or for structures with more members.

To this end, there is always a need to continuously investigate and apply form finding methods which are either a new one or the modified method to improve the process especially in form-finding new form of tensegrity structures.

References

- i. Snelson K.: *The art of tensegrity*, *International Journal of Space Structures*, 27, pp. 71–80, (2012)
- ii. Jauregui V.: *Tensegrity Structures and Their Application to Architecture*, submitted to school of architecture, Queen's University, Belfast, pp. 1–12, (2004)
- iii. Ingber D.: *The Architecture of Life*, *Scientific American Magazine*, 278 (1), pp. 48–57, (1998)
- iv. Maina J.: *Spectacularly robust! Tensegrity principle explains the mechanical strength of the avian lung*, *Respire. Physiol. Neuro.*, 155 (1), pp. 1–10, (2007)
- v. Levin S.: *Continuous tension, discontinuous compression, a model for biomechanical support of the body*, *Bulletin of Structural Integration*, pp. 31–33, (1982)
- vii. Tibert A., Pellengino S.: *Review of finding methods for tensegrity structures*, *International Journal of Space Structures*, 18 (4), pp. 209–223, (1996)
- viii. Snelson K.: *Arts & Ideas*, E-Book, New York, (2004)
- ix. Koohestani, "Form-finding of tensegrity structures via genetic algorithm," *Int. J. Solids Struct.*, vol. 49, no. 5, pp. 739–747, 2012.
- x. Yasushi K.: *Tensegrity Precision*, Research blog, also available on <http://synergetics.jp/tensegrityblog> Ingber D.: *Tensegrity.wikispaces.com*, available on <http://tensegrity.wikispaces.com/>
- xi. Fuller B., Buckminster R., Marks R.: *The Dymaxion World of Buckminster Fuller*, Garden City, New York, (1973)

Role of Toys for Improving Physical & Mental Health of Children

Kuheli Roy, Prof.Tushar Bokad

Priyadarshani Institute of Architecture & Design Studies, Hingna Road, Digdoh Hills, Nagpur, Maharashtra
Email:kuheliroy99@gmail.com

Abstract: *Toys are not just an object but it has a major impact on child's development. Different toys affect children in a different manner. This paper aims to understand the role of toys in child's physical and mental development and explores various categories of toys and its impact on children's development. The data has been collected by study of research papers and market survey analysis. The inferences of the study provides a guideline for toy designers to design toys to stimulate a particular growth area of a child i.e. physical, cognitive or imaginative area that lead to the overall physical and mental development of children.*

Key words – Toys, play, childhood, skill development, growth, health

1 INTRODUCTION

In the field related to the development of the child the studies has been made to understand the stages of development of a child right from infancy, childhood, and to the adolescence till the adulthood. The development of a child is divided into various areas- physical, cognitive, emotional, and social.

The child learns the basics from nature and from their surroundings. They tend to listen, observe and act and learn from their experiences during the childhood period. Thus, direct experiences are an important part of a child's learning stage, they make use of senses to learn and understand their surrounding world.

Toys act as a medium to help them learn and interact with surroundings using their senses. Example: An infant doesn't know anything about the gravitational force. They don't know that if an object is dropped on the ground it will fall. They learn this, by playing with toys. Babies may drop a toy accidentally, and observes it when it falls. When you give it back, they may deliberately drop it to see if it falls again. And this is how the complex concept of gravity is simply introduced to an infant playing with toys is an integral phase of childhood development. Children develop cognitive principles such as object permanence, the understanding that objects continue to exist even when they are out of sight, through their toy based play.

1.1 OBJECTIVES

The following paper attempts to explore the importance of play and toys on physical and mental health development. The researchers have framed the following objectives for the analysis:

1. To understand the importance of play in the overall development of a child.

2. To understand the impact of toy in child's physical and mental health development.

3. To study the different categories of toys available in the market.

4. To understand the effect of colors on child.

1.2 RESEARCH QUESTIONS

The following research questions have been framed for study of the chosen topic based on the objectives mentioned above.

1. What is the importance of play in the overall development of a child?

2. What is the impact of toys on child's physical and mental health?

3. What are the different categories of toys available in the market?

4. Is there any effect of colors on child's behavior

1.3 METHODOLOGY

The study makes use of research paper analysis, study of various articles and details of some personal experiences of the researchers, in an attempt to answer the research questions. The findings obtained are summarized and stated in this paper.

2. LITERATURE STUDY:

For the purpose of literature review here the researcher has studied some books related to the topic importance of play, and play equipment on children health. The researcher have also gone through some previous research papers related to the topic to understand how they have conducted the research what conclusion did the researchers have drawn from their work.

Mentioned below are the study of some research papers their methodology & results of the studies

a)Role of Toys & Play in Developmental Stimulation of children-Yadav Yogesh(2017)

Inferences: This paper gives an idea of benefit of play from immediate benefit to long-term benefits, e.g. development of different skills, social development and development of imagination and creativity. It also gives an information about the negative effects of staying indoors on kid's- poor health, poor social skills, dependency on electronics, lack of creativity. This review deals with the knowledge of ideal toys according to different age group it covers modern as well as Ayurvedic Literature.

b)The influence of the number of toys in the environment on toddlers play-Carly Dauch, Michelle Imwalle,Brooke Ocasio,Alexia E. Metz (2018).

Inferences: In this paper, the researcher has studied the quality of play when children are provided with fewer toys and with number of toys. The methodology adopted by the researcher is the case study of different child and observation of that study. The researcher has conducted a play session of the child. Each child participant (n = 36)was observed under two conditions i.e. Condition 1: when they were provided with four toys only, and Condition 2: when they were provided with sixteen different toys. It was observed that with few number of toys ,the child had a longer duration of play and played in a variety of manner. The results show that when child are provided with fewer toys they play in a better manner it also improves the focus of the child on few number of toys only, and they can play in more creative way. This can be used as a recommendation ,while designing the children's toy to encourage children's development and focus.

c) Designing Toys to Support Children's Development Tom Page, Gisli Thorsteinsson (2017)

Inferences:The paper consist of a study that is aimed to understand the concept of good toy design for influencing the development of a child. Here, the study has been conducted to understand the different ways in which a child plays and the variety of toys that are commonly used by child with respect to how it has affected their adulthood.

Methodology: The authors conducted a literature survey on different aspects of toy design, and then carried out an interview with an experienced toy designer regarding various aspects of toy design. A questionnaire survey has also been conducted of adults of age 18-25 year with the aim of understanding the impact of toys on the adult's life. The results of the study have shown that using toys in our childhood not only influence the skill development but, also, shape the negative or positive point of view during childhood.

3.IMPORTANCE OF PLAY:

Play is not just an activity, but they also have an important role in skill development of a child. Play helps in development of various skills during childhood which are important during adulthood period, such as fine motor skills, creative skills, emotional and social skills and cognitive skills, etc. It also helps to develop the planning and problem solving skills. Thus, each and every type of play i.e. physical play, cognitive play, pretend play, creative play holds an important place in a child's life. Various studies have shown the impact of lack of play in overall physical and mental growth of a child. The children who have been given adequate opportunities to play performs well in every aspect of life and are healthier and happier in life.

3.1 SOME BENEFITS OF PLAY:

1. Play helps to develop the physical health of child by developing fine and gross motor skills, cardiovascular fitness, eye hand coordination, etc.
2. Play also improves the social and emotional skills. Sharing of toys becomes the first stage of learning the social skills.
3. Play is the best way to teach educational lessons to a child in a fun and learn manner.

4.THE ROLE OF TOY IN DEVELOPMENT OF A CHILD:

Toys are specially designed equipment for children's play, toys also allows play and prolong play. If a child is allowed to play with a suitable toy the child plays for a long time and gains the greatest benefit from that play. There are special categories of toys known as educational toys which helps to develop the learning skills of a child by developing the problem solving skills, organizing skills. There is another category of toys which develops the fine and gross motor skills of a child, improves the eye hand coordination. Certain category of toys are designed to nurture the creative skills of a child from the early childhood days. Thus, toys are that tool that improves physical skills, helps child to learn the concept of sharing and sparks the imaginative skills of the children. Toy is not merely an object to have fun with it is an important tool which is used correctly can affect the children's development hastily. It can be used to develop any specific skill or to improve the mental health of child or to nurture the creative side of a child. A toy can be used as an element to shape children in the best possible way

5.CATEGORISATION OF TOYS:

After doing a lot of research and market survey on various types of toys. The researcher has classified different categories of toys according to 3 major parameters:

1. Toys for specific skill development.
2. Toys according to the age group.
3. Toys according to interest/behavior of a child

5.1. TOYS FOR SPECIFIC SKILL DEVELOPMENT:

These types of toys are specially designed to develop specific skills of children. Skills can be physical, cognitive, creative etc. The types of toys for different skill development are mentioned below:

A. Toys for Physical development:: Stacking toys like toy blocks and rings help in development of eye hand coordination and fine motor skills. The child grasps the block, picks it up, and places it on top of another block. Physical play using toys helps to build strength in the limbs, neck and back.

B. Fine motor skills, eye hand coordination and balance development: In this category various rocking toys like rocking horse, push and pull toys develops the fine motor skills, promotes balance and coordination, improves muscle

control such as toy bikes, push and pull train. There are certain toys that encourage the child to climb, swing, ride; and there are some toys meant for physical development, strength gain and encourage the child to perform physical activities like hop, jump, climb etc.

C. Toys for Creative & Imaginative Skill Development: Open ended play toys promote imaginative power and creativity in the child and encourage “pretend games.” Toys for make — believe games develops social and emotional skills.

D. Cognitive development: Cognitive development is the development of brains. Cognitive development includes the thinking capacity of a child, the way a child explores and figure out things. Toys like shape sorter allows a child’s brain to identify shapes. And it allows the kid to learn and differentiate between the different shapes.

E. Confidence Boosters: Self-confidence is a quality that can be achieved by children when they complete a task. Task can be a bicycle ride, constructing a block tower or solving a puzzle. All these toys help to boost up the confidence of a child.

F. Social & Emotional development: Toys make children learn the basics of sharing and caring and this in turn builds the bond of friendship between children. Attachment of a child in the early age with their favorite soft toys regulates the emotions of a child. Toys which allows group play introduces the child with the concept of teamwork from the early childhood age.

G. Educational skills development: This category of toys educates the children about the alphabets, colors, basic mathematics, shapes, etc. Such concepts can be taught through educational boards.

H. Sensory Toys (sense of touch, sound, taste, smell) development: When the senses are involved in learning the child learn in the most easiest way. Any activity that stimulate the senses of child comes under the category of sensory plays. There are number of toys that stimulates the senses of children.

5.2. TOYS ACCORDING TO THE AGE GROUP OF CHILDREN:

Children of different age group need different toys according to their development stages. For examples infants needs some simple basic toys, toddlers will need toys that stimulate their senses, pre-schooler are full of energy thus needs physical toys and school going kids needs more challenging and learning toys to promote their overall development. Hence the nature and type of toy keeps changing according to the development stages of a child.

A. Toys for Infant (0-12 months): Infants has a tendency of exploring their surrounding like touching, grasping putting objects in their mouth. As they grow up their activities also develops. Thus toys designed for infants helps them to engage and explore their surroundings by touching, pushing, banging,

throwing and grasping and dropping the toys. As babies grow up they start to stretch and move their arms and legs and starts gaining strength to perform difficult challenges during play. Toys that rotates and revolves, play mats help them in simple activities like crawling, grasping, standing with the help of toy support sitting. From birth to five months of age, babies starts showing affection to their toys. During this time the toys needs to be very safe and of proper size because babies have a tendency to put objects in mouth. Infants give reaction to the toys that produces some sound or the toys that are moving.

B. Toys for Toddler (1-2 years): During this stage the child gains enough strength to move, stand with the help of support and crawl. Thus to improve the muscle strength the child at this stage should be allowed to play with the toys that involve simple physical activities like push toys and pull toys. Toys such as stacking blocks can also be introduced to the toys during this stage which develops the eye hand coordination of a child and gives them an idea of colors, shapes and sizes.

C. Toys for Children of early childhood Stage (3-6 years): When child enters this development stage he becomes aware of his surroundings. This is the stage when child loves to play in group rather than playing solo. At this stage the child should be allowed to play with the toys that promotes group play such as dollhouses, doctors sets, race cars, toy vehicles, This is the perfect age of learning new things thus toy musical instruments like xylophone, toy guitar can be introduced to child to develop their interest in this field. During this time the child also start showing the preferences according to their gender. For example, a girl child generally shows her preference playing with soft toys, whereas the boys show their interest in some mechanical toys such as Robots or cars.

During this stage as the child prefers to play in group, this is the right time to introduce child with such toys that promotes team work. So, the important concept of Team building can be introduced to a child in such an early age.

D. Pres-School-er and School going Children’s Toys: (8 to 10): This is the stage where child should be introduced with the educational toys. Toys that are fun to play as well as teaches numbers, shapes, alphabets simple mathematics, and any other academic things to a child. School going kids can also be provided with the science kit or game that let child learn history or mythology in a play way method

5.3. TOYS ACCORDING TO INTEREST / BEHAVIOR OF A CHILD:

Every child has a different behavior pattern. Some can be full of energy, some does not like to be active all the time and is interested in small interesting activities, and some child can be very creative. Thus, there are different types of toys available in market for every type of child.

A. Activity toys: These toys are for hyperactive kids, those who are full of energy and likes to jump around everywhere. These toys are specially designed to utilize the energy of the

kids into physical development. Some examples of this type of toys are skipping ropes, tricycle, skating boards, etc.

B. Creativity toys: These types of toys are for those kids who are not that active but are creative. There are different type of toys that encourage the creativity of the child by allowing them to design something according to their imagination. It can include art and craft kits, toy instruments to enhance the musical skills etc.

C. Learning toys: As the name suggests the type of toys are for the kids who love to learn something even when he/she is playing. This type of toys comes in a variety of range and categories. The simplest kind can be numeric toys which help kids learn the calculations in a play way manner. Some other types may include the toys that are based on history (for example Kitki Samrat a board game based on Indian History) or science. It can be in the form of a card and dice games or can be a physical toy.

6. EFFECT OF DIFFERENT COLORS OF TOYS ON CHILD

Colors affect the body as well as the mind and emotions of each and every human being. Research conducted on colors has shown the impact of colors on development of brain, colors promote creativity and productivity of mind. Colors has a major impact on child's mind. Children are more sensitive to colors. Thus, choosing a color for children's toy is a very important thing which is to be considered while designing a toy. Child reacts to different colors in a different manner. If an incorrect color is used in a child's surrounding it can create a negative impact on child's behavior and performance. Whereas, if the correct colors are used the productivity of child can be improved in a better way.

6.1 HOW COLORS AFFECT CHILDREN?

Till the age of 5 to 6, years a child's brain is not developed enough to read or write anything properly. Thus, child mostly uses vision as a tool to explore the surroundings. That is why color plays an important role during this time period. Colors become an important tool to express their thoughts. Like any other human being children are "psychological as well as physiological" beings. A Child uses their senses as a medium to develop a communication with their surroundings. Studies have shown that colors are important when it comes to the cognitive development of a child, especially during the early childhood days.

6.2 EFFECT OF COLORS ON CHILDREN'S OF DIFFERENT AGE GROUP:

Color affects the children of different age group in a different way. That is why different color pallets are used for toys of different age group. The effect of colors on different age group is mentioned below:

A 0 to 3 months: A lot of research has shown that the newborn babies during their first few months can see

colors only in the shades of black, Grey and white, and they cannot see bright colors. Thus, to provide stimulation to the newborn babies the toys, and the surroundings of the newborn should be of monochromatic color scheme.

B 3 to 6 months: As the child grows they start reacting to colors. From the age of 3, months the babies are able to see colors. At this stage the baby should be introduced to the toys that are bright in colors such as yellow, orange, green, etc. These colors help to stimulate the brain.

C 6 to 12 months: At this stage the child's vision fully developed. At this time the child can see all types of colors and thus this is the correct time to introduce different colors, shades, and tints to a child. At this stage the child could not differentiate the colors, but they can observe the different colors in its tints and shades.

D 1 to 2 years: It is during this time that a child will also begin to differentiate between colors (around 18 months). During this time there should be multiple opportunities for a parent to actively engage in color recognition games with their toddler.

E 3 to 4 years: By this age the child starts to recognize the difference in colors they can even name different colors. At this stage simple color stacking games can be introduced to a child. So that they will begin to identify, differentiate and name those colors.

7. DESIGN GUIDELINES FOR DESIGNING A NEW TOY FOR 3 TO 6 YEARS OF AGE GROUP

Since, the age group is 3 to 6, years this is the time when the child is very energetic. Thus, the design should focus on the physical and motor skill development area. The toys should promote physical activity such as jumping, climbing, rolling, etc. so that the energy of the child can be utilized to improve the physical health. The toy should be safe, affordable and are developmentally appropriate.

The toys should promote learning and growth in all areas of development. The toys should not be overstimulating and encouraging children to use their imaginations. Social emotional and cognitive skills should be developed

An ideal toy does not have to be fancy or costly, the idea behind the toy needs to be original and simple, and it should teach something to the child. Bright vibrant color scheme can be used for the toys, so that, the child should not get bored and can use the toys according to their mood.

Finally, the design should include all the above mentioned factors in such a way that it should be beneficial for the child's physical and mental development.

8. CONCLUSIONS

Toy develops various skills of a child such as, motor skills, cognitive, and emotional, social & imaginative skill development. The use of color scheme in a toy should be done according to the age and gender of the

children. An appropriate smart toy can lead to physical and mental development of a child.

9. ACKNOWLEDGEMENT

I would like to thank my guide Prof. Tushar Bokad for his valuable time, guidance, and encouragement. He has inspired me a lot to progress with my work. I would also like to thank Prof. Archana Bele for her constant support, and valuable advice that had helped me to achieve my goal.

10. REFERENCES

- i. i Werner ,Greve, “Does Playing Pay? The Fitness-Effect of Free Play during Childhood”, *www.epjournal. net*, Available from: <https://journals.sagepub.com/doi/pdf>, 2014, Internet Accessed: 19 July 2020.
- ii. Wonderly, Kimberly, “The Importance of Physical Play in Child Development”, *hellomotherhood.com*, Available From: <https://www.hellomotherhood.com/article/86563-importance-physical-play-child-development/>, 2017, Internet Accessed : 18 July 2020.
- iii. iii IPA (International Play Association), “Children’s Right to Play and the Environment”<http://ipaworld.org>, Available From:<http://ipaworld.org/wp-content/uploads/2016/05/IPA-Play-Environment-Discussion-Paper.pdf>, 2016, Internet Accessed: 19 July 2020.
- iv. Whitebread, David & Neale, Dave, “The role of play in children’s development: a review of the evidence”, 2017, *legofoundation.com*, Available From:https://www.legofoundation.com/media/1065/play-types-_-development- review_web.pdf, ,Internet Accessed : 27 July 2020.
- v. Ginsburg, Kenneth R., “The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds”, *aappublications.org*, Available from :<https://pediatrics.aappublications.org/content/pediatrics/119/1/182.full.pdf>, Internet Accessed: 27 July 2020.
- vi. vi.Prachom Thangthong , Chaturong Louhapensang , Panrapee Suttiwan, “Factors in the Design of Good Toys for Kids Aged 0-3 Years”, *Mediterranean Journal of Social Sciences*, 2019, Available from:https://www.researchgate.net/publication/336066973_Factors_in_the_Design_of_Good_Toys_for_Kids_Aged_0-3_Years, Internet Accessed: 7 Jan 2021
- vii. Arif Sirinterlikci, Linda Zane, and Alea L. Sirinterlikci, *Active Learning Through Toy Design and Development*, *The Journal of Technology Studies*, Available from: <https://scholar.lib.vt.edu/ejournals/JOTS/v35/v35n2/pdf/sirinterlikci.pdf>, Internet Accessed: 9 Jan 2021
- viii. Sonia A. Fernandes , Denis A. Coelho, “Toy Design: A Methodological Perspective”, *The International journal of designed objects*, 2013, Available from: https://www.researchgate.net/profile/Denis_Coelho/publication/258283284_Toy_Design_A_Methodological_Perspective/links, Internet Accessed : 9 Jan 2021
- ix. ix.Nuri Kara, Kursat Cagiltay, “Smart toys for preschool children: A design and development research” *Electronic Commerce Research and Applications*, 2019, Available From:https://www.researchgate.net/publication/337775616_Smart_Toys_for_Preschool_Children_A_Design_and_Development_Research, Internet Accessed : 9 Jan 2021
- x. x.Aleeya Healey, Alan Mendelsohn, *Selecting Appropriate Toys for Young Children in the Digital Era*, *PEDIATRICS* Volume 143, number 1, January 2019, Available From:<https://pediatrics.aappublications.org/content/pediatrics/early/2018/11/29/peds.2018-3348.full.pdf>, Internet Accessed: 9 Mar-2021
- xi.

Adaptation Device: Toilet Accessories for Disabled

Ar. Komal S. Jumade

M.des III sem, PIADS, Nagpur

Mail: Komal.jumade@gmail.com

Abstract –In homes, problems in daily functioning of older people often occur in the bathroom, especially in the transfers to the toilet and/or shower/bath. Assistive products have the potential to maximize functional independence (i.e. performance without assistance from another person) in everyday activities; however, more research is needed to better understand the impact of this technology on independence in the transfers in the bathroom. Additionally, little is known about the role of the environmental factors in the

process of implementing bathroom adaptations. Therefore, this cross-sectional study aimed to examine the relationship between the use of assistive products and independence in the transfers in the bathroom.

Keywords – Adaptation device, toilet accessories, basic utilities for toilet, Disabled Persons, Toilet Facilities

INTRODUCTION

Managing toileting activities is an essential but very personal daily living task. Where possible, everyone would choose to maintain independence, privacy and dignity. There are many elements to consider including access to toilet facilities, transferring on and off the toilet and tending to oneself. If you have a problem, solutions can generally be found by altering your approach to the required tasks, using special equipment, or if a simpler solution cannot be found, altering the home environment. The aim of this factsheet is to provide some basic information and suggestions.

1. WHAT IS AN ADAPTATION DEVICE?

Adaptation device are devices that are used to assist with completing activities of daily living for disabled person. Bathing, dressing, grooming, toileting, and feeding are self-care activities that are including in the spectrum of activities of daily living (ADLs).

Examples of adaptive equipment or assistive technology are wheelchairs, lifts, standing frames, gait trainers, augmentative communication devices, bath chairs, and recreational items such as swings or tricycles."

A growing market for adaptive equipment is in the use of mobility vans. In this case, adaptive equipment, also known as assistive technology, can help a person with a disability operate a motor vehicle when otherwise they would not be able to.

2. OBJECTIVE:

- To study the available toilet accessories for disabled person.

- To study the various materials used in creation of accessories.
- To study the design factors of the available accessories.
- To analyze the construction details of the accessories.
- To analyze the available material or accessories applicable to all types of disabled persons.

3. TYPES OF ADAPTATION DEVICES

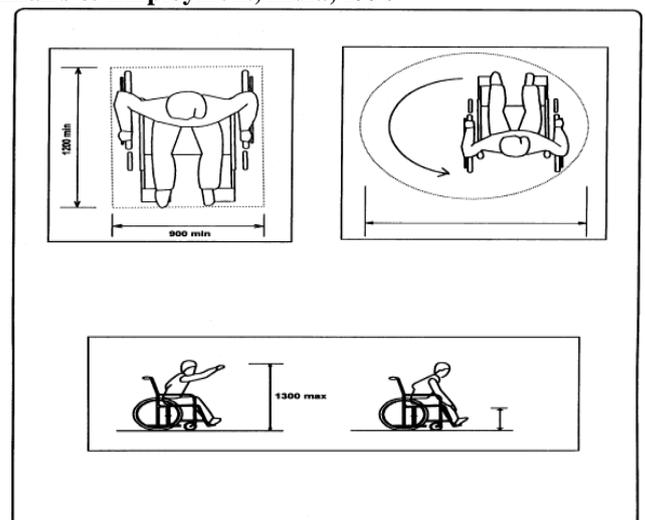
4. NEED OF TOILET ACCESSORIES FOR DISABLED PERSON

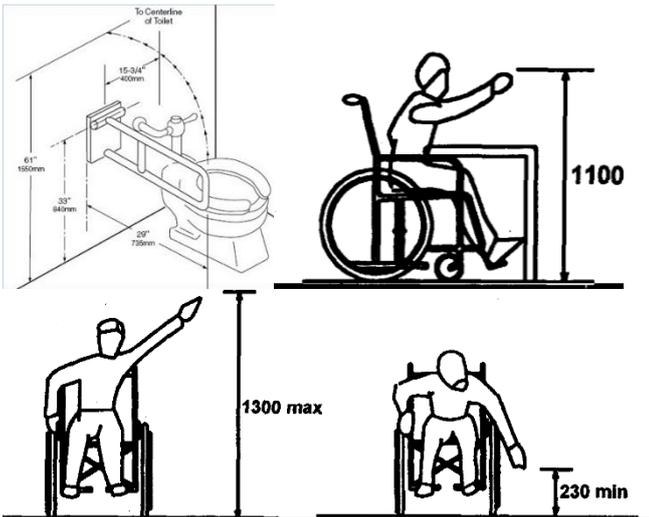
Using the bathroom as a disabled person is not always straightforward. There is a lot of aspects to take into account apart from the disabled toilet seat. It may feel awkward to need help in this area, but thankfully there is equipment available, which can make using the bathroom a more streamlined experience. We might feel like there is some difficulty attached to needing help with matters related to the toilet, but in reality, there is no difference between disabled toilet accessories and other accessibility tools: they are all designed to help disabled people to live independent lives.

They wanted some items that will help you to remain independent and look after yourself, will increase your confidence and help you to live your life in the way you want to.

5. GUIDELINE AND SPACE STANDERDE FOR BARRIER FREE BUILT ENVIRONMENT FOR DISABLED AND ELDER PERSONE.

Central Public Works Department Ministry of Urban Affairs & Employment, India, 1998





Grab bars are safety devices designed to enable a person to maintain balance, lessen fatigue while standing, hold some of their weight while maneuvering, or have something to grab onto in case of a slip or fall. Grab bars next to a toilet help people using a wheelchair transfer to the toilet seat and back to the wheelchair.

Grab bars are made of metal, plastic, fiberglass, and composites. Stainless steel, nylon-coated mild steel, epoxy-coated aluminum, ABS plastic, and even vinyl-coated metal and plastic.



Swing Grab Bar



Straight Grab Bar



L Shaped Grab Bar



U Shaped Grab Bar



4 Size Available
12" - 16" - 20" - 24"
30 cm - 40 cm - 50 cm - 60 cm

6. TYPES OF PARALYSIS

Complete paralysis is when you can't move or control your paralyzed muscles at all. You also may not be able to feel anything in those muscles.

Localized paralysis affects just one specific area, like your face, hands, feet, or vocal cords.

MONOPLÉGIA

It affects just one limb.

HEMIPLEGIA

Affects just one side of your body and which damages one side of your brain.

DIPLEGIA

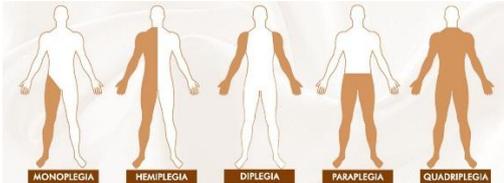
Affects the same area on both sides.

PARAPLEGIA

Paralysis from the waist down.

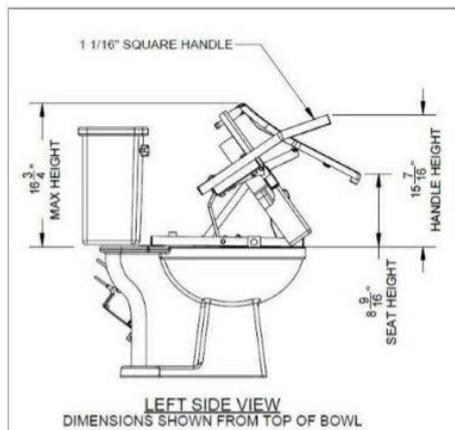
QUADRIPLEGIA

(Tetraplegia) is when all four limbs are paralyzed.



7. THE AVAILABLE TOILET ACCESSORIES FOR DISABLED PERSON.

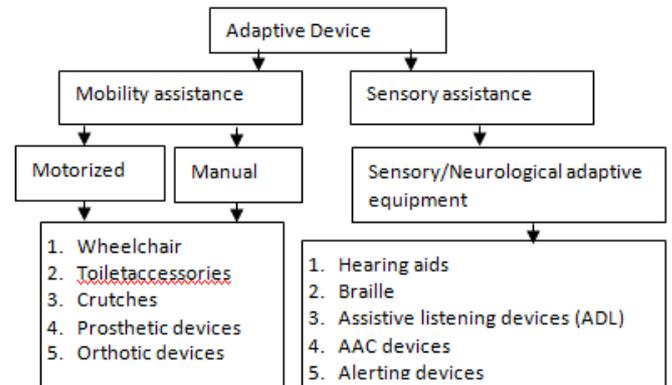
a. Grab bars



b. Seat Riser

Toilet seat risers or toilet risers are assistive technology devices to improve the accessibility of toilets to older people or those with disabilities.

A lift mechanism which attaches to the rear edge of a toilet bowl including a lever which pivots at a base in a rotational plane parallel to that of the target element, such as the toilet seat. The lever may be flexed so as to permit insertion of a tang between the toilet seat and the bowl and includes a stabilizer which, in combination with the tang, complementarily receives the element throughout articulating the element to a raised position.



c. Raised Toilet

Raised Toilet Seat is made from heavy-duty molded plastic and raises the height of the toilet as per requirement. It helps individuals with joint pain issues, knee injury, and back pain issues to sit and stand from the toilet with comfort.

The comfortable raised toilet seat is made of heavy-duty molded plastic material and has a weight bearing capacity of 135 kg. The Raised Toilet Seat helps the individual to use the toilet with ease.

The seat is available in three variants, i.e. 5 cm (2 Inch), 10 cm (4 Inch), and 15 cm (6 Inch).



e. Bathtub Lift

A bathtub lift is basically a type of bath lift chair or seat that can lower or raise a person in and out of the tub. Bath lifts are typically installed in disabled bathrooms or bathrooms that require some sort of assistance to users who may be elderly, handicapped or otherwise who live with some sort of mobility issues.

A bath lift is a power operated lift that raises and lowers you in and out of the tub. The lift charges through a battery pack which is charged before and after using. Bath lifts are operated with a hand-held pendant remote. Suction cup feet secure the lift into the bottom of the tub

Here are the four basic types of bath lifts available:

1. Battery powered
2. Manual Bath Lifts
3. Air-powered
4. Water-powered Bath Lift



f. Medical Water Taps



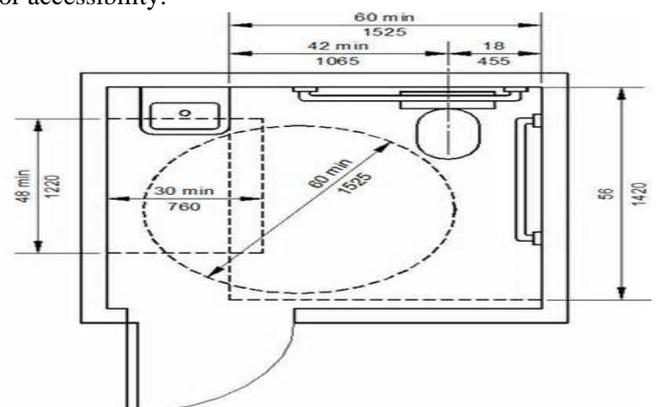
g. Wheelchair Accessible

Accessibility construction guidelines defined by the ADA, Veterans Affairs and other relevant groups range from the width of doorways and hallways to the height of cabinetry and tabletops required to accommodate wheelchair users.

Any wheelchair-bound patient in a residential facility will benefit from having access to a shower designed for their use. However, one doesn't have to be confined to a wheelchair to benefit from a bathroom shower designed for safety. Hospital patients, nursing home residents, members of fitness centers, and hotel guests are all beneficiaries of bathrooms designed for accessibility.

d. Shower Stalls

Bathing is a fundamental need. An accessible shower makes independent bathing possible for elderly or aging bathers, or people with a disability.





8. CASE STUDY.

Name -SunithaThrippanikkara (36)

Occupation- foot and mouth artist, (Kerala)

She has been using a wheelchair from the time she was affected with polio as a child. She suffered allot due to unavailability of accessible toilets.

Then she took part in **Swacch Bharat Abhiyaan**and she prides herself on leading for assessable public toilet.

The **Swacch Bharat Abhiyaan** program clearly outlines rules and regulations that must be implemented in public toilets. This includes proving a wheelchair ramp, wide doors for a disabled person to move their wheelchairs, accessible water supply for people with all kinds of disabilities and so on. But these remain on paper.

- Summery

- Due to lack of availability of accessible toilets in India Handicapped people are suffering.

-So, the awareness of these accessible toilets are of high priority.

9. CONCLUSION.

Results showed that the Conclusions Regarding the health sector, the access of disabled persons is still incipient, since architectural barriers are easily observed in health care services, constituting obstacles to health care. Awareness and commitment of leaders, managers, and professionals need to be established to create favorable spaces to universal health care.

10. REFERENCES:

- <https://newzhook.com/story/20630/>
- <https://www.handicare.com/en/product-cat/bathroom-adaptations/>
- <https://ukcareguide.co.uk/toilet-adaptations-helping-you-stay-in-your-own-home/care-costs-and-fees-2/>
- <https://www.dlf.org.uk/factsheets/adapting-the-home-bathroom>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6453482/>

Drone Technology in Construction Project Management

Ar. Govinda S. Bhutada¹, Prof. Gayatri Mahajan²

¹2ndYear M. Arch, Allana College of Architecture, Pune, India

E-Mail ID: govimbhutada@gmail.com,

²Assistant Professor, Allana College of Architecture, Pune, India

E-Mail ID: gayatrimahajan@azamcampus.org

ABSTRACT: *The world is continuously deploying new technologies in construction industry for the speed, accuracy and safety in the construction projects. Advanced modern technologies are entering construction industry for the faster execution of projects. At the same time to cope-up with the execution speed monitoring methods are also getting modernized. Drones do not contribute for the actual execution but make a huge contribution in faster monitoring of the projects which help in faster decision making leading to lower the time lag in the projects too from the stage of land purchase till the post construction stage of the project.*

Keywords: Drone technology, Unmanned Aerial Vehicle, Advance construction methods, Construction project management

INTRODUCTION:

Engineering and Technology are two inseparable technologies with this day's engineering to achieve a far better life. Rapid growth and increased need of multifaceted technical applications induces us to keep abreast regarding the power of various associated subjects in general and construction industry. (Gayatri Patil, 2018). The use of Drones or Unmanned Aerial Vehicle has increased in the field of construction engineering and management in recent years, mostly due to the potential of the technology for improving construction speed, performance, accuracy and safety. In order to achieving a comprehensive understanding of the research of the research work on this subject, this paper include review of existing literature on use of drones in construction management on the last decade.

Drones can be used from Pre-Construction, Construction to Post-Construction stage of the Engagement of conventional methods for site survey, contour mapping, site progress monitoring, construction quality management, etc. can be questionable, whereas drones can perform the same jobs with almost no risk and more accuracy and with lesser manpower too.

The monitoring of project progress w.r.t. the planning and scheduling is practically tedious and time consuming for site engineers as to keep real-time check on every corner of site and builders/contractors need to rely on these engineers for taking further decisions. The use of drones will be giving real

time progress on all parts of site and help contractors and other stakeholders to manage large number of sites by knowing proper data and take necessary decision within less time.

Consequently, some research has paid attention to the potential applications of drones in construction engineering and management, compared to some other fields. It is worthwhile to raise awareness of the use of multirotor drones by analyzing the benefits that they can bring to the current and future construction industry (Chunlu Liu, 2018). Therefore, this paper aims to comprehensively investigate the drone technology in construction management and their applications from pre-construction stage to post construction stage and explore their and allied sensors, softwares and contribution and limitations in field of construction management.

LITERATURE REVIEW: Several references have been mentioned by many authors based on Drones in Construction, Construction Monitoring and Reporting using Drones, Impact of Drones in Construction industry, Applications and Issues of Unmanned Aerial Systems in the Construction Industry. It is observed that a maximum number of articles appeared in literature, in last decade. Therefore, this article is compilation of information on recent aspects of use of drones in construction management from year 2015 onwards. (Vikas L. Kumavat, 2019) and (Prafulla M. Jain, 2019) has explained about the role of drones in various stages of construction project and the benefits achieved by deploying drones. Naveed Anwar (2018), Muhammad Amir Izhar (2018), Fawad Ahmed Najam, (2018) have discussed about smart construction monitoring aspects achieved using drones and how this reformation resulted in better operations, planning and effective on-site adjustments. The applications and issues of using drones for construction management in construction industry are illustrated by Ibrahim Mosly (2019).

DRONE TECHNOLOGY:

Drones referred as an unmanned aerial vehicle (UAV), is an aircraft without a human aboard. UAVs are a component of an unmanned aircraft system (UAS); which include a UAV, a ground-based controller, and a system of communications. The flight of UAVs may operate with various degrees of autonomy: either under wireless control by a operator or

autonomously by onboard computers. (Vikas L. Kumavat, Prafulla M. Jain, 2019)

DRONES IN CONSTRUCTION: THE PAST AND THE FUTURE:

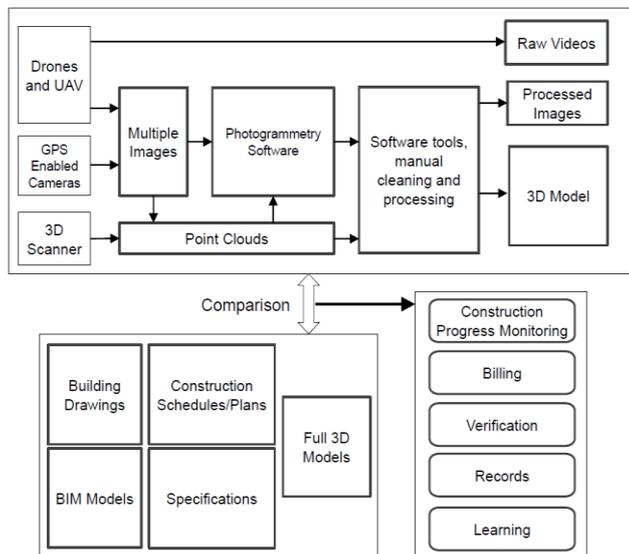
Before the aerial drones, the traditional method to get the site data was carried out on-foot or via manned aerial vehicles.

Using drones, the construction professionals have leveraged the opportunity to get up-to-date images as often as they like in real-time.

In future there will be AI-software powered drones. The AI will omit the unstructured data and will give an end to the errors.

TYPES OF DRONES IN CONSTRUCTION INDUSTRY:

While there are many types of drones, commercial drones are the standard used in construction. Some models are fixed wing while other models have rotating blades. With their airplane-like design, fixed-wing drones can glide on a set path and reach higher altitudes, making them efficient for mapping topography and surveying greater distances. However, fixed drones are only able to fly forward. For closer aerial inspections and photography, rotary drones are the better option since they are easy to control, and their rotor design allows them to hover and remain stable. (Liam Stannard, 2018)



Flowchart-1 Overall concept of construction monitoring and management using drones.

(Naveed Anwar, Muhammad Amir Izhar, Fawad Ahmed Najam, (2018))

DRONE TECHNOLOGY IN CONSTRUCTION MANAGEMENT:

The traditional approach for monitoring of construction projects involves a strict execution of plan without the possibility for any last-minute changes. On the opposite hand, a sensible monitoring system is predicted on organized real

time data which is collected using various advanced tools e.g. drone- or UAV-mounted sensors (photo/video camera, thermal imaging camera and IR sensors,etc.). The data is then analyzed using advanced software which allow for better management of construction activities. Following flowchart shows the overall concept of construction monitoring and management using drones.

APPLICATION OF DRONE TECHNOLOGY IN VARIOUS STAGES OF CONSTRUCTION PROJECT:

1 Pre-Construction Stage

1.1 Property purchase decision making:

Aerial images and videos of such parameter can cut short the time of actual site visit and provide comprehensive information to help with deciding on purchasing a property.

1.2 Site Mapping:

If drones are deployed, they give us live 0images of site from which we can get idea about current situation of site without going anywhere. Overlapping aerial images processed with photogrammetry software provide a outputs like contour maps at a fraction of the time and price.

2 Construction Stage

2.1 Earth work estimations and stockpile volumetric analysis



Image- 2 3D models created from drone images make volumetric measurement very easy.

(<https://wingtra.com/drone-mapping-applications/drones-in-construction-and-infrastructure/#drone-applications-construction-industry>)



Image-4 Drone spotting location of machinery on site

(<https://wingtra.com/drone-mapping-applications/drones-in-construction-and-infrastructure/#drone-applications-construction-industry>)

Photogrammetry outputs acquired using data from drones, like point clouds and digital terrain models enable precise volume calculations of earthwork estimations and stockpile calculations.

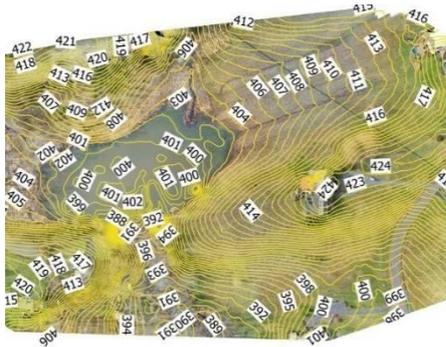


Image 1: Contours marked by overlaying on orthomosaic in QGIS (<https://www.constructionworld.in/latest-construction-technology/drones-a-valuable-tool-for-the-construction-jobsite/25924>)

2.2 Construction Inspection

By using drone, we will be able to observe all the work progress by sitting at one place and stop the off-track activity before it's too late. Overlays of the orthomosaic with site drawings help with site inspection and detecting deviations and taking early corrective action.

2.3 Realtime construction progress Tracking

A drone operator can provide contractors and managers the clear aspects of site. Contractors or architects performing on large scale use drones to watch their regular work.

2.4 Labours safety and surveillance

Drone can keep eye on the labours and confirm that they are doing their work. We can conduct surveillance on specific person or group of workers to trace their activities.

2.5 Inventory management Document registry: Search tag and find equipment on site

Counting of various site assets using orthomosaic and RFID readers helps with speed tracking the inventory management process.

3 Post-Construction

3.1 Maintenance



Image- 3 Drone images of a building under construction with overlaid plans

(<https://wingtra.com/drone-mapping-applications/drones-in-construction-and-infrastructure/#drone-applications-construction-industry>)

Drone technology gives ease to collect data from inaccessible area like top of building, huge vertical facades etc., without additional safety risks to personnel. Marketing and promotion

making video and images from drone with different angels is one of the great ideas, to show clients how your imaginations is transferring on ground is extremely effective way to ensure them.

DATA COLLECTION, PROCESSING AND DESIRED OUTPUTS FOR CONSTRUCTION

MANAGEMENT:

The summary of applications in construction management by processing data using sensors and softwares to give desired outputs is given in table below.

CONCLUSIONS:

The use of new innovative technologies like drones in the construction industry from pre-construction to post construction stage has become need of time as to develop various aspects of construction projects like reduction in cost and time and increase in quality, speed, accuracy and safety of construction projects. The drones are were used since long time in war fields but the use in construction sites are relatively new but gaining is getting advanced day by day minimizing the limitations.

Finally, the study in this paper is a compilation and is a part of an ongoing research, which will eventually attempt to further enhance the practices and implementations of the construction technology it may cover the methods and means of reducing issues in drone technology being one of the significant innovative construction collaborations- tools towards a smart construction industry.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Prof. Gayatri Patil and for her valuable guidance, inspiration and encouragement. I would also thank Prof. Prachi Aiyyer for sharing her valuable insights.

REFERENCES:

- i. Yan Li and Chunlu Liu,(2018) *Applications of multirotor drone technologies in construction management*, <https://www.researchgate.net/publication/324365476>
- ii. Robert Elitzer DeYoung, (2018), *An industrial overview for the standardization of drones in construction*, https://www.researchgate.net/publication/329541612_AN_INDUSTRIAL_OVERVIEW_FOR_THE_STANDARDIZATION_OF_DRONES_IN_CONSTRUCTION
- iii. Ar. Gayatri Patil, (2018), *Applications of Artificial Intelligence in Construction Management*, https://www.researchgate.net/publication/343722991_Applications_of_Artificial_Intelligence_in_Construction_Management
- iv. Vikas L. Kumavat, Prafulla M. Jain, (2019), *Use of Drone Technology in Infrastructure Projects*, <https://www.irjet.net/archives/V6/i3/IRJET-V6I31055.pdf>
- v. Naveed Anwar, Muhammad Amir Izhar, Fawad Ahmed Najam, (2018), *Construction Monitoring and Reporting using Drones and Unmanned Aerial Vehicles (UAVs)*, https://www.researchgate.net/publication/326264559_Constr

- uction_Monitoring_and_Reporting_using_Drones_and_Unmanned_Aerial_Vehicles_UAVs
- vii. Yaseen Srewil, (2015), *Feasibility of use UAVs (drones) in construction*,
https://www.researchgate.net/publication/306237285_Feasibility_of_use_UAVs_drones_in_construction
- viii. Ibrahim Mosly, (2017), *Applications and Issues of Unmanned Aerial Systems in the Construction Industry*,
https://www.researchgate.net/publication/322309322_Applications_and_Issues_of_Unmanned_Aerial_Systems_in_the_Construction_Industry
- ix. Huda Mahmood, (2021), *Use Of UAVS (Drones) In Construction Sites "From A War Weapon To Construction Equipment"*
- x. https://www.researchgate.net/publication/348522650_USE_OF_UAVS_DRONES_IN_CONSTRUCTION_SITES_FROM_A_WAR_WEAPON_TO_CONSTRUCTION_EQUIPMENT
- xi. MatúšTkáč and Peter Mésároš, (2019), *Utilizing drone technology in the civil engineering*
- xii. <https://content.sciendo.com/view/journals/sspjce/14/1/article-p27.xml?language=en>
- xiii. Stannard, L. (2018, October 9). *6 Profitable Ways Drones in Construction Are Changing Projects.*
- xiv. [https://www.bigrentz.com/blog/drones-construction.](https://www.bigrentz.com/blog/drones-construction)

Table -1 Applications, allied sensors, softwares and outputs

(Chunlu Liu, 2018), (<https://huviair.com/Using-Drone-Data-Each-Stage-Construction-Project.html>), (<https://www.propelleraero.com/blog/>)

Construction Stages	Parameters	Deliverables	Drone Info			Output
			Data	Sensors	Data Processing	
Pre Construction	Site Survey	Property purchase	Aerial Videos and Images	Digital camera and infrared camera	123D Catch, Pix4D	Seamless aerial videos and Images
		Site Mapping	Nadir Overlapping images	Camera 3D scanner, LiDAR Laser Scanner	Photogrametry, CAD, QGIS, Pix4D, PhotoScan, 123D Catch, BIM	Orthomosaics Digital Surface Models 3D Models Contour Maps, Boundry and feature maps Point Clouds
Construction	Excavations	Earthwork Estimations	Images	Camera 3D scanner, LiDAR Laser Scanner,	3D Point Cloud using Photogrametry Softwares	Precise Volume measurements Point Clouds
		Stockpile Volumetric Analysis	Images	Camera 3D scanner, LiDAR Laser Scanner	3D Point Cloud using Photogrametry Softwares	Precise Volume Point Clouds
	Site Monitoring	Construction Inspection	Aerial Videos and Images	Digital camera and infrared camera, Camera 3D scanner, LiDAR	Photogrametry, CAD, GIS, Pix4D, PhotoScan, 123D Catch, BIM	Seamless aerial videos and Images Digital Surface Models
		Realtime construction progress Tracking	Aerial Videos	Digital camera and infrared camera, CMOS	DJI GO 4	Realtime Videos
	Safety	Labour safety and surveillance	Aerial Videos and Images	Digital camera and infrared camera	123D Catch, Pix4D, GPS	Seamless aerial videos and Images
	Documentation	Measurement of actual site data	Images	Camera 3D scanner, LiDAR Laser Scanner, RGBD Sensor	3D Point Cloud using Photogrametry Softwares	Digital Surface Models, Orthomosaics
		Quantity take-off and estimation	Images	Camera 3D scanner, LiDAR Laser Scanner, RGBD Sensor	3D Point Cloud using Photogrametry Softwares	Digital Surface Models, Orthomosaics
	Inventory management	Document registry: Search tag and find equipment on site	Tag Location, Images	RFID Reader	GPS, RFI, BIM	Asset location
Post Construction	Maintenance	Detecting defects (external cracks)	Aerial Videos and Images	Digital camera and infrared camera	123D Catch, Pix4D	Seamless aerial videos and Images
	Marketing	Marketing and promotion	Aerial Videos and Images	Digital camera and infrared camera	123D Catch, Pix4D	Sweeping dramatic shots of landscape and other parts of Project

Life Cycle Assessment of Greenhouse (GHG) Emissions from Existing and Proposed Municipal Solid Waste Management Strategies

Pranjal Jagtap

Department of Environmental Architecture Email – pranjaljgtap399@gmail.com

Abstract: *In developing Asian countries, greenhouse gas (GHG) emissions from conventional solid waste management contribute significantly to global climate change. The third largest anthropogenic methane emission source is from open dumping and landfilling. These two methods are the most common methods of waste management in Asian countries at present. The GHG emissions from the handling of waste, transport and operation of machinery are an important part. There is however, a potential for indirect GHG savings from waste management through materials and energy recovery. Unfortunately, the linkage between waste management and climate change is not well recognized by the local authorities responsible for waste management. A number of Life cycle assessment (LCA) based reports have reported on the environmental efficiency municipal solid of mixed waste (MSW) management, but little is known about the relative contributions of individual fractions of waste to the total projected mixed waste impact capacity. An analytical model has been used in this paper to quantify the pollution from each of individual waste fractions to the atmosphere.*

Key words – Life Cycle Assessment (LCA), Municipal solid waste (MSW), Greenhouse Gas (GHG)

INTRODUCTION

Waste generation has risen rapidly, along with the rising urban population in India in recent years. With income, urbanization and population, waste production also increases. The quantity and complexity of solid waste produced is being increased by economic growth, urbanization and improve living standards in the cities. Several researches in various cities in developing countries have documented improper management of solid waste [1]

Some types of waste are well known when addressing solid waste. In general, municipal solid waste (MSW) is a mixture of household and commercial refuse created by the living population [3]. The continuous indiscriminate disposal of MSW is accelerating and is linked to poverty, poor governance, urbanization, population growth, poor standards of living, low environmental, awareness and inadequate management of environmental knowledge. MSW generally includes degradable wastes like disposable napkins, wood and sludge while non- degradable materials like leather, plastics, rubbers and metals.

The purpose of this study is to model the GHG for a range of municipal solid waste (MSW) management scenario for a particular area that is Baramati. Baramati is a town in the city of Pune, which produces about 810030 tons per month (tpm) of municipal solid waste (MSW). The transportation and disposal of waste is undertaken by the local municipal

authority, Baramati Municipal Corporation (BMC). All the waste is taken to the landfills situated on the outskirts of the area. Currently all the landfills situated in Baramati have reached their capacity and are receiving waste in excess of their capacities. In most developing countries around the world, landfills are common land disposal methods. There is question that local governments, in order to address the needs of local populations and future generations, will play an important role in improving the situation and meeting sustainable waste management goals. In Baramati, management for domestic and municipal waste, largely arising from domestic premises, is responsibility of local governments.

The aim of the study is to assess the potential GHG emissions of different waste management operations, particularly from existing and proposed MSW strategies in a life cycle perspective. The purpose of this study is to contribute to our knowledge of environmental accounting for waste management regarding practices in this area and the results of the study will be useful for the government regulators and environmental researches to discover opportunities for and barriers to the environmental accounting in local governments to encourage the development of environmental accounting approaches for local governments. This study includes unit processes associated with waste management, including production and consumption of energy, collection, transport recycling, and extraction of raw materials, composting and landfilling. The waste to be managed is dictated by the quantity and composition generated in the years studied.

MATERIAL AND METHODOLOGY

The goal of the analysis was to measure and quantify the contribution of various feasible municipal waste management systems to GHG emissions and savings, taking into account up to date technology and systems managing the same typical municipal management schemes. First-hand knowledge was requested about how the waste is handled and the obvious gaps in management system was sought. The two data collection techniques used in this analysis were personal observation and data from the local government. The current conditions on how each refuse dump is handled have been found in the process. In 2011, the city had a population of 45525 residents and the town has undergone strong economic growth and urbanization in recent decades. The spike in urban solid waste in Baramati is easily seen a consequence. Approximately 27,001 tons / day of MSW was therefore not sufficiently extracted and handled.

Therefore the MSW method of disposal in Baramati at present is primarily landfill and open burning.

Table -1 Composition of municipal solid waste in Baramati.

Component	Percentage (%)
Food waste	47.43
Garden waste	6.2
Plastics	11.23
Paper	8.13
Textile	4.49
Leather/rubber	2.4
Glass	1.01
Metal	0.5
Hazardous waste	4.5
Others	14.11
Total	100

The productivity of separation has not been strong in recent years. MSW's mixed method of selection and transport remains dominant. The growth pattern of MSW management systems in Baramati will be the source separation, collection, transportation and disposal of MSW with the development and enforcement. Therefore, composting and recycling of natural materials is required to be parallel to the landfill and incineration in order to respond to waste separation, the proportion of landfills will eventually decrease with increase in waste separation.

This research approaches, including the GHG calculator method to determine Co2e emissions and savings from waste management practices. The GHG calculator was used to measure pollution from urban waste management activities, including transportation to more disposal sites from transfer stations. For the whole waste treatment scheme, the GHG emissions and savings have been measured. Transport operations and events at intermediate and final treatment facilities were considered for this reason. The waste is sent to intermediate facilities after processing, where it is processed for further storage and final disposal. Furthermore, the following procedures for waste have been considered: landfilling, incineration, anaerobic digestion, composting and recycling.

To build this simulation, the life cycle analysis (LCA) has been modified using GHG calculator. This model can be used by selecting or entering country specific or location specific parameters at the desired locations. In this simulation, IPCC recommendations have been implemented to measure GHG emissions from different waste management technologies. This tool is useful for a bottom up approach to the national inventory or greenhouse gases, direct emissions can be recorded for this purpose. The simulation estimates both the cumulative GHG emissions and the total capacity of particular technologies for GHG avoidance.

Data Collection: The whole household MSW was the waste data considered here, which included recyclables, organic waste, and residual amounts. Any waste that is not treated, either by recycling, composting or AD, refers to residual type. It should be remembered that most recyclable and compostable waste must be sacrificed for residual treatment

(landfilling and incineration) because it is polluted or combined with residual waste. Its fuel usage per tons of waste collected was modelled on the collection. Five distinct waste collection technologies were considered; these technologies absorb diesel tone, residual waste, paper, glass and agricultural waste, and plastic waste. Waste processing is further discussed with regards to GHG problems.

RESULTS AND TABLES

Scenarios can help determine and evaluate the potential of multiple solutions for waste management. This report suggests scenarios that take into account the current MSW management, existing treatment facilities and feasible alternatives. This study aims to compare performance in between five different technologies with on being specified here. Scenarios for use of amount of waste as the same data on the characterization of waste, thus the findings obtained are comparable to those of the proposed scenarios.

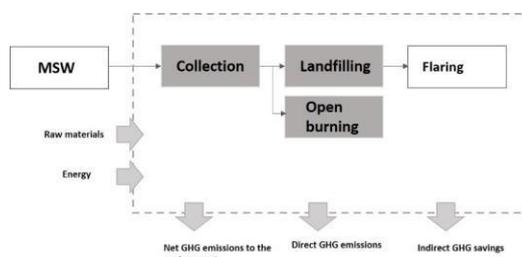


Figure- 1 : S1, Baseline scenario

Scenario 1 (S1): mixed waste + landfill + open burning: The baseline scenario (S1) is based on the current MSW management in Baramati: according to the current scenario landfill and open burning ratio in Baramati, part of waste was landfilled (21596t/d), with landfill gas (LPG) flaring because economic conditions make landfills the most desirable option and part of the waste was burned (5405t/d) with no separation at the source.



Figure- 2 : S2, Proposed scenario

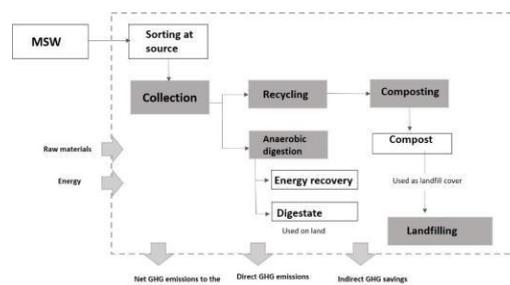


Fig – 3 GHG Emissions from MSW under 2 Scenarios

Scenario 5 (S5): classified waste + landfill +composting + recycling + AD with energy recovery

This scenario explains 11% of the total collected waste sent for anaerobic digestion; and biogas generated is used to generate electricity, separation of source applied, composting rate is 34%, recycling rate to be 2.4%, with landfill rate 52%, with system for energy recovery.

This scenario presents future reductions as the city improves the handling of organic waste treatment by way of biological alternatives. Sorting with energy recovery along with recycling and anaerobic digestion is considered at the source. Waste control includes sorting separation prior to the AD treatment. The efficiency of source isolation by individual waste components is presented in the supplementary material. The average output of electricity is about 244 kWh/tonne (based on arrange of 184–299 kWh/tonne) with engine conversion efficiency of 36%.production consumption of energy at 49kWh of electricity and 0.9 l of diesel fuel per tonne of organic waste is utilized. Digestate is used in land use as a substitute for fertilizer. The data is taken based on an average bio gas plant.

Scenario	Landfill (t/d)	Open burning	Compositin g (t/d)	Recycling (t/d)	Anaerobic digestion
Scenario 1	21,596	5405	-----	-----	-----
Scenario2	12,360	-----	10884	667	3,090

Table -2 MSW disposal quantity by treatment way in scenarios

The scenario (S1) reveals emissions related to the management of waste of MSW of Baramati. In this situation, the cumulative emissions amounted to 4,884,08.91 tonnes of CO₂e, and landfills added up to 80% that is because organic waste was a large volume of collected waste which was sent to landfill.

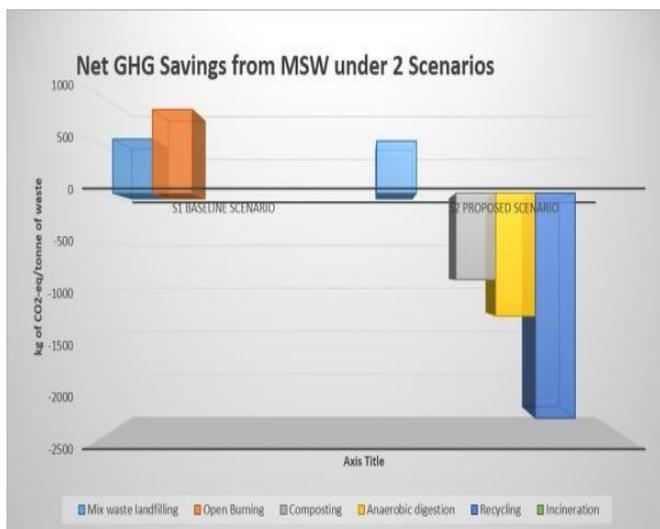


Fig – 3 (a) Net GHG Savings from MSW under 2 Scenarios

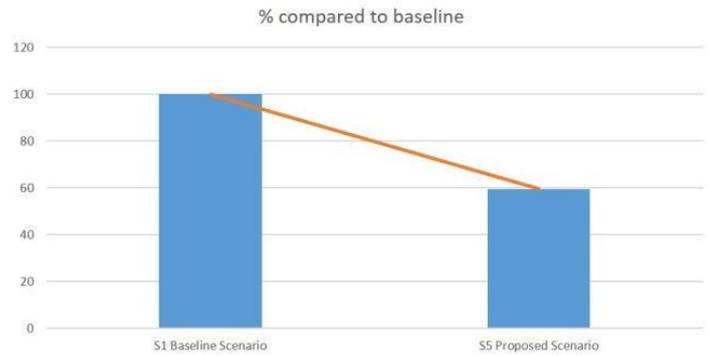


Fig – 3 (c) % compared to baseline

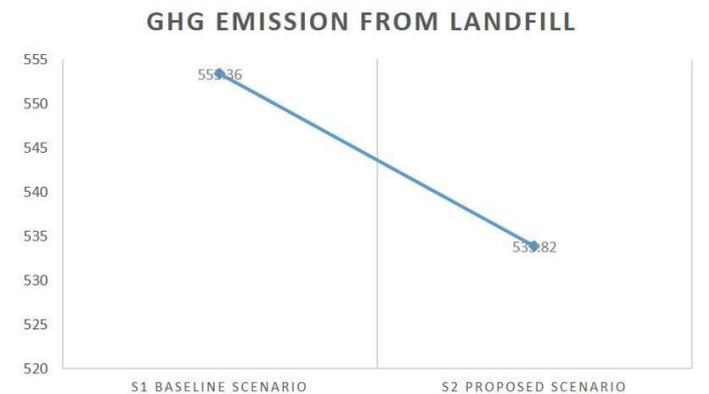


Fig – 3 (d) GHG Emission from Landfill

CONCLUSION

In this analysis, it is defined that the sum of GHG emissions correlated with the new management techniques of waste considering the present MSW management system in Baramati. The improper management of MSW has indeed led to a large volume of GHGs released into the atmosphere. The calculation of GHG emissions suggests that landfills are the major contributor to waste treatment emissions. From the mitigation problem of climate change, any technology improving waste management in Baramati has a positive effect on lowering emissions. It is implied, on the basis of the proposed scenarios, that integrated waste management is the best solution for minimizing emissions. In the evaluation of waste management options, the LCA was used towards defining alternative optimal integrated systems. The highest environmental consequences have been related to scenario that include landfilling and open burning with minimal material and energy recovery. It is possible to gain environmental benefits under scenarios that maximize recycling and composting whereby savings in emissions reached up to 40% - 50 %, depending on the selected technology. Material recycling and incineration is important because of its avoided impacts. Analysis of the sensitivity of LPG capture efficiency indicates that recovery of methane generated in landfills is a priority for the MSW management system to achieve the GHG reduction goals. For sustainable waste disposal, however the other solutions, such as recovery of organic waste from composting and anaerobic digestion, processing of biogas are appropriate considering environmental benefits and economic benefits they may bring

to society. Therefore, in this analysis solutions to waste management were explored only from an environmental point of view. Other decision making tools which consider the economic and social consequences of solid waste management could support it.

REFERENCES

- i. Xin, Chunlin Zhang, Tingting Tsai, Sang Bing Zhai, Yu Ming Wang, Jiangtao,(2020) "An empirical study on greenhouse gas emission calculations under different municipal solid waste management strategies ", *Applied Sciences*, 11, Page no 2-4.
- ii. Ahsan N (1999). *Solid waste management plan for Indian megacities*, *Indian Journal of Environmental Protection*, 19 (2), Page no 90-95.
- iii. Zhang, Chengliang Xu, Tong Feng, Hualiang Chen, Shaohua,(2019) "Greenhouse gas emissions from landfills: A review and bibliometric analysis ", *Sustainability*, 11, Page no 2-5.
- iv. Christensen, Thomas H.Simion, Federico Tonini, Davide Møller, Jacob,(2009) "Global warming factors modelled for 40 generic municipal waste management scenarios ", *Waste Management and Research* , 27, Page no 871-872
- v. Neha Gupta, Krishna Kumar Yadav, Vinit Kumar, A review on current status of municipal solid waste management in India,(2014) "Institute of Environment and Development Studies" ,
- vi. Kausal R K, Varghese G K& Chabukdhara M (2012). *Municipal solid waste management in India - current state and future challenges: a review*. *Int. J. Eng. Sci. Technol.* 4 (4), Page no 1450-1480
- vii. Bhide A D and Shekdar A V (1998). *Solid waste management in Indian urban centers*International Solid Waste Association Times (ISWA). (1), Page no 25-28.
- viii. Gupta S, Krishna M, Prasad RK, Gupta S and Kansal A (1998). *Solid waste management in India: options and opportunities*. *Resource Conservation and Recycling* 24, Page no 137-154.
- ix. Mor S, Ravindra K, Visscher A D, Dahiya R P and Chandra A (2006). *Municipal solid waste characterization and its assessment for potential methane generation: a case study*. *Journal of Science of the Total Environment*, 371 (1), Page no1-10.
- x. Jha MK, Sondhi OAK and Pansare M (2003). *Solid waste management-a case study*. *Indian Journal of Environmental Protection*, 23 (10), Page no 1100-1155.
- xi. Peavey H S, Donald R R and Gorge G (1985). *Environmental Engineering* Mc Graw-Hill Book Co, Singapore.
- xii. EPA (2004). *EPA. Municipal Solid Waste Basic Facts* U.S. Environmental Protection Agency, 2004
a. <http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm>

Study of Street Vending & Different Types of Vending Carts

Baba Meshram, Prof.Rupesh Surwade

Priyadarshini Institute of Architecture and Design Studies, Hingna Road, Digdoh Hills, Nagpur, Mah.

Email: babameshram@gmail.com

Abstract: *Street vending is the most common activity of informal economy and creates employment opportunities for a lot of people. This paper discusses about the present condition of the street vendors in India, the focus is on the types of vending carts and their issues. A questionnaire survey of street vendors has been conducted and their problems have been identified. The survey reveals many untold facts and gives a good idea about the needs of the street vendors. The inferences of this study give a guideline for the designers to design vending cart that can overcome all the present issues of existing vending carts.*

Keywords: Street Vendors, Mobile shops, Vending Carts, Smart Vending Carts

1. INTRODUCTION

The existence of Street vendors dates back to the ancient era. The previous civilization has shown acceptance towards the street vendors and that is the reason they flourished during that period. In present day street vendors are an important part of economy, they offer a wide range of goods to the public in an affordable range. The range of products offered by the street vendors includes everything from organic vegetables and fruits, street foods, cosmetics to garments and crafts, Accessories to daily needs.

But during present day it can be seen that the tolerance of public for the street vendors has been decreasing drastically and they are not treated in a same manner. They are exposed to a lot of legal issues related to the municipalities. A lot of time they have to face issues with police in public area as illegal traders. The common public often complains about the traffic congestion because of the area occupied by these vendors. New government regulations regarding land use also create a lot of mess in the life of street vendors.

In a developing country like India due to lack of literacy rate migration of people from rural to urban area leading to the the

increase in the informal means of occupation like street vending and this activity has become a primary means of livelihood especially for the population in the rural area. Street vending has also become popular for the urban people of less economy because it requires small financial investments and does not require any special skills. Thus street vending plays a vital role in the life of a lot of people in the developing country like India.

1.1 OBJECTIVES

The following paper attempts to explore the needs of the street vendors and their present issues related to the vending cart. Mentioned below are the objectives of the study:

1. To conduct a survey and study the need of the street vendors.
2. To study various categories of vendors selling different goods in India and their special storage and display need.
3. To study the already available Vending carts and stalls and their special features if any.
4. To study different types of vending cart and their pros and cons.
5. To study and understand the storage facility of different vending carts.
6. To study the display provision of different vending carts.
7. To study various materials for the design of cart.

1.2 RESEARCH QUESTIONS:

1. What are the different types of street vendors?
2. What are the issues, and challenges & opportunities that are faced by the street vendors?

3. What are the different types of a street vending cart?
4. How the display of goods is done in a vendor's cart?
5. Are the storage spaces available in a vendor's cart sufficient?

1.3 METHODOLOGY

Data were collected using both quantitative methods and qualitative methods. Around 100 street vendors were studied alongside 50 consumers were also covered street vendors were selected from different parts of the city and sells different types of products, qualitative methods such as personal interviews of street vendors & consumers. This questionnaire survey focuses on the needs of the vendors, and also to the type of vending cart they are using. The results of the survey reveals an interesting ground situation of the street vendors they type of vending carts they use and the issues related to that vending cart. The data from these discussions were very useful to understand the needs of the street vendors and to form design guidelines to create innovative vending carts for them.

2. WHO ARE STREET VENDORS?

Street vendor is person who selling a variety of goods to the public at affordable range and does not have built a shop or place to sell the goods. Sometimes, the street vendors are also called as hawkers. The term hawker is usually used for the category of the street vendors who sells the goods by wandering one place to another.

In the last few decades, there is drastic increase in the number of street vendors, especially in the urban areas. There are two major reasons for this sudden growth in the number of street vendors in the developing countries these are as follows:

1. Firstly, there is lack of better employment opportunities in rural areas and a low literacy rate too leading them to migrate to the urban areas.
2. Secondly in the urban areas lot of industries are getting closed where lot of people work, and the family responsibility and lack of opportunities make them work in the informal sector of the street vending.

2.1 OPPORTUNITIES IN STREET VENDING:

There is a lot of opportunities in the field of street vending, since the goods are available at the door steps it is convenient for the people with busy schedule to get the goods delivered at home, the street vendors offers the goods at an affordable

range thus a lot of time good quality products are available in the street vending market. There are a category of vendors who sells the traditional rural crafts to the urban areas making a connection between the urban consumers and the rural art.

2.2 ISSUES & CHALLENGES IN STREET VENDING

Despite having a lot of opportunities in the sector of street vending there are lot of problems which needs to be solved to provide healthy environment to the street vendors. The issues in street vending includes: Lack of space especially in the urban areas with heavy traffic flow the street vendors faces a major problem to get a spot for selling their goods. They do not even have basic facilities like availability of water, toilets, protection of their goods from rain. All these problems have become a big challenge for the survival of the street vendors.

2.3 PROBLEMS FOR OTHER STREET USERS:

As already mentioned above, the street vendors need a lot of space for selling their goods. It creates a major issue of traffic congestion as most of the busy roads and the pavement blocks are occupied by the street vendors. There is a lack of parking space in the major cities like Mumbai, Delhi etc. This situation becomes worst during the peak time of festivals like Ganesh Utsav, Diwali where people become stuck in traffic for hours.

3 TYPES OF STREET VENDORS:

Street vendor can be defined as person who sells a variety of goods to the public at affordable price without having permanent space or a shop to sell the goods. On the basis of the mode of selling goods the street vendors can be classified into following types:

Stationary Vendors: This are the category of vendors who are static. In other words the type of vendors who sell their goods in one a place by sitting on ground or standing for most of the times are known as a stationary vendors. This type of vendors is mostly found occupying space on the pavements or on the corners of the road.

Mobile Vendors: This is the category of vendors that move from a place to another carrying the goods to be sold. This type of vendors usually carries the goods that are not easily perishable. The mobile vendors are further classified into 5 types:

1. Vendors that carry on the goods on their head
2. Vendors that use pull & push carts

3. Vendors using a cart attached to the bike
4. Vendors using the minivan as mobile shop
5. Vendors using good carriers as vehicle to transports.

4. ABOUT VENDING CART/VEHICLE

Street Vendor's cart is a vehicle designed to carry goods that are to be sold by the vendor. The main function of this cart is to transport, with the help of wheels from one place to another this vehicle are usually of push and pull type.

Carts have been in existence from the ancient time manually pushed carts have been used all over the world right after the discovery of wheels.

Over the years these carts has been developed with the development in technology. The advanced cart of today is equipped with a lot of facilities and are motored driven. But all these carts are not affordable for the street vendors, especially in the rural areas. The old form of carts is in use till the present day.

5. CLASSIFICATION OF VENDING CARTS :

After in depth analysis of various studies and documents on vending carts & after conducting a survey on field the following inference can be drawn about variety of vending carts. The vending carts can be classified Based on 4 major parameters:

1. Based on the Mechanism of the vehicle or on the type of the vehicle that is used to pull the cart.
2. Based on the Material used for making the cart.
3. Based on arrangement of the display of goods in a cart.
4. Based on available storage facility in a cart

5.1 BASED ON MECHANISM OF THE VEHICLE OR THE TYPE OF VEHICLE USED TO PULL THE CART:

In this category the vending carts are classified Based on the mechanism on which it works or Based on the vehicle that is attached to the cart. Here the vending carts are divided into 4 subdivisions:

A Push & pull carts: These are most popularly used carts because of its simple mechanism and affordability factor. These carts are mostly made of a wood and easy to maintain. The traditional carts only had a platform for display, and small storage space below. Disadvantage: No weather protection, lack of proper display storage space.

B. Bicycle or tricycle carts: Traditional bicycle drawn carts in a developing country like India is nothing, but a simple bicycle in which the goods are tied here and there and are carried from one place to another. Disadvantages: No proper planning of storage and display area, difficult to carry the goods because of improper arrangement.

Modern Bicycle or Tricycle drawn carts: These are basically a combination of push cart and bicycle cart. This type of cart is the modified version of the traditional bicycle drawn cart. These carts and not commonly used in India. Disadvantages: Expensive

C) Motor bike drawn carts: These are a modified form of bicycle drawn cart. Here instead of manual power the motor drawn bikes are attached to the cart or the container carrying the goods. These are somewhere getting popular in India in big cities. Disadvantage: here again the major disadvantage is the acceptance due to the cost of the vehicle and petrol cost.

5.2 BASED ON THE MATERIAL USED IN THE CONSTRUCTION OF CART

In this category the vending carts are classified based on the materials by which it is made. Here the vending carts are mostly classified into 3 types:

A. Wooden Vending carts: Most commonly used cart because it is easily available, affordable, and easy to construct. These are mostly available in 5'x4'x4' size and have a storage facility near the base. These are available with or without cover. The carts require maintenance because these are not weatherproof

B. Metal vending carts: These are made of stainless steel, Mild steel or iron. Mostly SS is used. The metal vending carts provides a lot of flexibility in its design. These are better than wooden cart. These are long-lasting, durable and requires low maintenance

C. Fiber glass vending carts: Nowadays a new material that is being used in the making of vending carts is Fiber glass. This is a light weight and durable material. It gives a lot of designs flexibility. It appears better in look than

the traditional material. It is very durable and easy to install material and cuts down the installation charges.

Material by which the cart is made is also a major topic of concern. Since the vending cart is a “Mobile Shop” thus it needs to be protected from adverse weather condition. Second important thing related to the material of the cart is the affordability. The cart is used by street vendors, so the materials used should not exceed the cost of the vending cart. The material of cart should be light and can be carried easily with simple vehicles and manpower.

5.3 BASED ON THE DISPLAY OF GOODS TO BE SOLD:

In this category the vending carts are classified based on the facility of the arrangement of goods in a cart. Here again the vending cart is sub classified into 3 major subgroups:

A. **Open Display carts:** In this type of cart the main focus is on display of all the variety of goods he wants to sale. Here the display is of major concern because that is the only eye-catching thing for the consumer. The arrangement of display for different goods is different. Sometimes it is properly managed display sometimes it is mismanaged.

B. **Closed or covered display carts:** This type of carts is used where the display does not play an important role for the selling of the goods. This type of carts is mostly used for ice cream vending or sometimes for juice. To protect the goods to be sold from weather conditions. In this type of display, the primary good (ice-cream) is not displayed instead of that the secondary good (ice-cream cone) is displayed to attract the attention of the consumers.

C. **Partially open display carts:** This is the type of cart where ample amount of storage area is provided for storing a lot of goods to be sold. Hence, only few selected goods are highlighted in the display, and the other goods are stored and when needed they are shown to the consumer. This is the most appropriate and convenient type of display cart. It gives an organized storage area and planned display area to the vendor which reduces the haphazard condition of too many goods displayed and is easy to manage all the goods while moving from one place to other.

5.4 BASED ON AVAILABLE STORAGE FACILITY IN A CART :

The major point of concern with the street vendors is the storage facility. As we can see in the following pictures that the road side street vendors have a lot of goods which are not stored or stacked properly and are haphazardly placed in road. Thus while talking about a vending cart the primary concern

should be an organized way of storage of goods. Here based on the provision of storage provided in a cart the vending carts are categorized into 2 types:

A. **General Storage Vending Carts:** This type of storage is a general storage which is provided below the cart. Regardless of the type of the good to be sold this type of cart has a typical storage area which is adequate for some type of vendors whereas it is not adequate for the others.

B. **Especially Designed Storage Vending carts:** These are the type of carts where the storage is properly designed according the storage need of the goods. A special provision of drawers and container is provided according to the sizes of the goods to be stored in the cart. These are the best options for storing the goods while moving from a place to another because the goods are easily manageable.

6. QUESTIONNAIRE SURVEY AND ANALYSIS:

For the purpose survey 50 vendors of rural as well as urban area were selected and interviewed. The survey gives an insight on the types of the street vendors their present condition, the vending carts used by them and the issues and challenges related to the vending carts. The responses are formulated in the diagrams shown below:

1. What is the type of your existing vending cart?

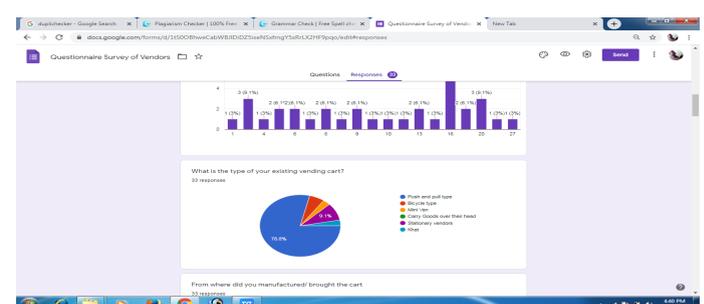


Figure 1: Image showing the type of existing vending carts used by the street vendors

3. Are you satisfied with your existing vending cart?

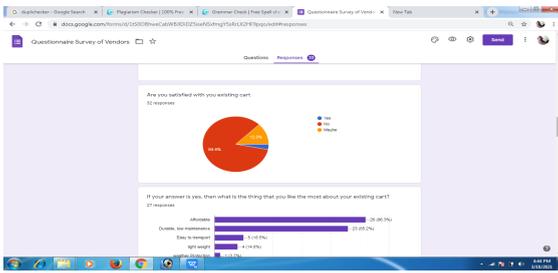


Figure 2: Image showing that most of the street vendors are not satisfied with their existing vending carts.

3. Is it easy to transport from one place to another with your existing cart?

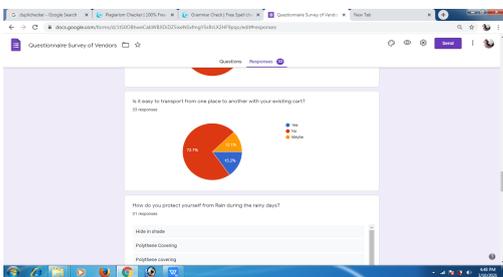


Figure 3: Image showing that the existing carts are not easy to carry the goods from one place to another.

4. How satisfied are you with your existing cart regarding the following aspects?

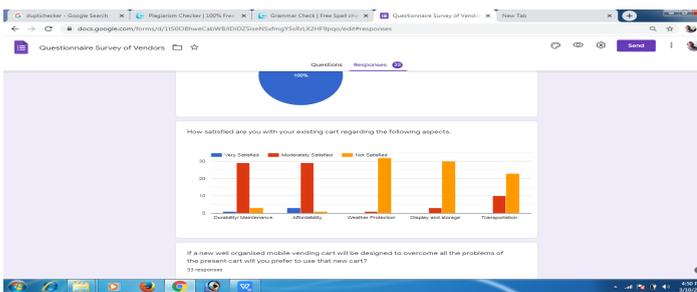


Figure 4: Image showing the level of satisfaction of the vendors with different aspects of the vending carts.

5. If a new well organized mobile vending cart will be designed to overcome all the problems of the present cart will you prefer to use that new cart?

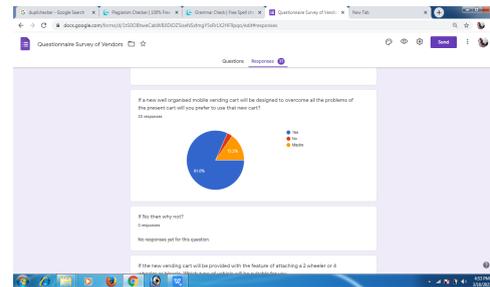


Figure 5: Image showing that most of the vendors are ready and are looking forward for better vending carts on affordable range.

7. DISCUSSIONS

The questionnaire survey reveals a lot of facts about the life of the street vendors. It can be observed from the diagrams and the study that the existing conditions of the street vendors is not satisfactory. The existing vending carts do not provide the basic needs for vending such as storage, display and protection from rain. Thus there is a need of smart vending carts that can resolve all the problems of the street vendors and should be affordable for the street vendors.

8. CONCLUSION

Street vendors struggle every day for their occupation. Mobile Street vending offers large area to the vendors in different parts and does not occupy the streets. The major 2 obstacles of mobile vending is: 1) Affordability of cart & 2) Ease of transport

Thus affordable smart vending cart is needed for Vendors.

9. DESIGN GUIDELINES FOR A MOBILE VENDING CART

Street Vendors cart should be designed in such way that it should be easily manageable by single person and should be capable of carrying a heavy load of goods. The cart should be smart cart and should be well equipped by the smart methods of storage. Foldable carts with enough storage facility, and well-designed display areas should be provided so that a large amount of goods can be stored in smaller area. The material to be used for the cart should be durable material which can be easily handled and a low maintenance. Protection from weather is also major concern while designing cart. Out of all these points the main point is the affordability. The carts should be affordable with a proper display, and storage areas.

10. ACKNOWLEDGMENT

I would like to thank my guide Prof.Rupesh Surwade for encouraging me and showing me the right path to conduct this research. I would also like to thank Prof.Tushar Bokad for his constant guidance and support throughout the work. The valuable guidance provided by faculties has helped me to achieve my goals.

11. REFERENCES

- i. Parikshit Chakraborty , Samarpita Koley, "Socio-Economic View on Street Vendors: A Study of a Daily Market at Jamshedpur", *Journal of Advanced Research in Humanities and Social Science*, 2018, Available From: <https://journals.indexpopernicus.com/api/file/viewByFileId/392334.pdf>.
- ii. P.B.Narendra Kiran, Dr.G.N.P.V.Babu, "PROBLEMS AND PROSPECTS OF STREET VENDORS: A STUDY WITH REFERENCE TO VISAKHAPATNAM CITY", *International Journal of Management, Technology And Engineering*, 2019, Available from: https://www.researchgate.net/publication/338230727_PROBLEMS_AND_PROSPECTS_OF_STREET_VENDORS_A_STUDY_WITH_REFERENCE_TO_VISAKHAPATNAM_CITY
- iii. Harpreet Kaur, Sanpreet Kaur, "A Study On Quality Of Work Life Of Street Vendors Of Khanna", *Biz and Bytes*, 2017,
- iv. Available from: http://cbasmohali.org/img/Journal_1-59-63.pdf
- v. Debdulal Saha, "WORKING LIFE OF STREET VENDORS IN MUMBAI", *The Indian Journal of Labour Economics*, Vol. 54, No. 2, 2011, Available from: http://www.unikassel.de/einrichtungen/fileadmin/datas/einrichtungen/icdd/Research/Webster/1st_Workshop_Kassel_Saha_Street_Vendors_Mumbai.pdf
- vi. SALLY ROEVER and CAROLINE SKINNER, "Street vendors and cities", *International Institute for Environment and Development (IIED)*, 2016, Available from: <https://www.wiego.org/sites/default/files/publications/files/Roever-Skinner-streetvendors-cities-2016.pdf>
- vii. Nidan, "Study on Street Vendors at Patna (Bihar)", Submitted to Centre for Civil Society (CCS), New Delhi, 2010,
- viii. Available from: http://nidan.in/nidanwp/Documents/Study_on_Street_Vendors_at_patna.pdf
- ix. Ar. Manoj Panwar, Vikas Garg, "ISSUES AND CHALLENGES FACED BY VENDORS ON URBAN STREETS: A CASE OF SONIPAT CITY, INDIA", *International Journal of Engineering Technology, Management and Applied Sciences*, 2015, Available from: https://www.researchgate.net/publication/280310189_ISSUES_AND_CHALLENGES_FACED_BY_VENDORS_ON_URBAN_STREETS_A_CASE_OF_SONIPAT_CITY_INDIA
- x. Renuka Garg, Aishwarya Kulkarni, Priti Garg, "Challenges Faced By Micro Entrepreneurs: A Study of the Street Vendors of Surat", *IMED*, Vol. 7, No. 2 (2014), Available from: <http://spbemcc.com/wp-content/uploads/2020/02/3.3.4.10.pdf>
- xi. ix. I. Dr. V. Jaishankar, Mrs. L. Sujatha, "A Study on Problems Faced by the Street Vendors in Tiruchirappalli City", *SSRG International Journal of Economics and Management Studies*, 2016, Available from: <http://www.internationaljournals.srg.org/IJEMS/2016/Volume3-Issue9/IJEMS-V3I5P119.pdf>
- xii. x. Dr. SHIBULAL A.L, "NEEDS AND PROBLEMS OF STREET VENDORS: AN INQUIRY", 2018, Available from: <https://kile.kerala.gov.in/wp-content/uploads/2019/07/Shibulal.pdf>.

Precast Concrete Construction technology for CIDCO Housing in Navi Mumbai.

Ar. Varun N Sarang¹, Ar. Aniruddha Sane²

1. Post Graduate Student, Allana College of Architecture, Pune, Maharashtra

2. Thesis Guide, Allana College of Architecture, Pune, Maharashtra

Email: varunsarang6@gmail.com info@asa-architects.in

Abstract - *Housing shortage is one of the major issues India is facing today. In order to meet the huge housing demand in India, it is necessary to go for mass housing construction, which can deliver affordable houses. CIDCO in Navi Mumbai, Maharashtra is coming up with housing schemes in different nodes of Navi Mumbai. CIDCO has started using precast technology for Mass housing projects. Precast construction can be carried out by two methods first by transporting the precast components form factory to site and secondly by building a temporary factory adjacent to site which will cut off the transportation. So, this paper will try to understand “How does one can decide whether to go for Precast Construction adjacent to worksite or Precast Components manufactured in a factory and then transported to the worksite?”*

Keywords – Precast Construction, On-Site vs Off-Site Precast Plants.

Introduction

To tackle the housing shortage government is coming with the various affordable housing schemes. Recently in year 2015 government of India launched “Pradhan Mantri Awas Yojna”. The main objective of this scheme is providing “Housing for all by 2022”. States individually are taking this scheme forward and are providing the housing. In Maharashtra, various bodies are already working on the housing crisis, one of which is a CIDCO (City and Industrial Development Corporation of Maharashtra) they are coming with the Lottery Schemes for about 95,000 flats in different nodes of Navi Mumbai for EWS, LIG and MIG Sector.

Role of CIDCO

The City and Industrial Development Corporation (CIDCO) was established on 17th March 1970 by the Government of Maharashtra. CIDCO majorly functions in Navi Mumbai, Aurangabad, Nashik, Latur and Nanded regions of Maharashtra. Out of these locations Navi Mumbai is the oldest and very well developed and planned region. For the first ten years of the project CIDCO was the planning and administrative body, and as the developer and builder for the project. CIDCO majorly generates revenue through the lands, most of the land in Navi Mumbai is owned by CIDCO which is rented or given on lease, in its new development plan, CIDCO land was allocated to builders for housing in exchange of various schemes. Private Developers get the land on lease and rents. Also, the other sources are through the tax collection in return of services. Residents living in Navi Mumbai have to pay the property tax, water tax to the CIDCO

Other major sources of revenue generation are via taxes on property, land, commercial and water which are payable to CIDCO. Revenue for Mass Housing schemes is funded by central government to Individual states and then states individually plans the funding distribution according to the location and planning authorities. In Maharashtra there are other sub authorities of government like MHADA, SRA, CIDCO, MIDC Housing, etc. which are working on shortage of housing. Government’s Initiative on Housing Shortage.

Construction of CIDCO Houses

CIDCO is building houses since 1970 in Navi Mumbai, over the years they have been using conventional methods of Construction, which consumes lot of time. Recently, CIDCO has planned launched 95,000 flats lottery scheme in different locations of Navi Mumbai. This scheme is specially for LIG MIG and EWS Sector. Construction of this houses is planned in phases. Kharghar, Airoli, Talaja, Dronagiri, Kalamboli are the planned locations for this scheme. Construction of this projects has already been started; they are using advance methods of Constructions. Precast Technology is one of the advance technologies they are using for construction.

B. G. Shirke Pvt. Ltd is the major supplier of Precast Elements for this Mass Housing schemes. They have their Factory based in Talaja, Navi Mumbai. For CIDCO Mass housing, Precast Columns, Precast Beams and Precast Slabs are used.

The planned locations for this mass Housing projects are within the range of 5 to 30 KMs. Precast Construction can also be time consuming if there are problems in logistics which can turn into cost overrun issues. In Such cases building a temporary casting yard can be useful.

Aim

To find the effective and efficient methods of Precast Construction for upcoming CIDCO Lottery Housing Schemes in Navi Mumbai.

Objective

- To present a cost model in comparison of two process of Precast construction technology for a residential project within CIDCO guidelines.
- To compare the feasibility of two precast methods i.e.
- On-Site Precast Plant (Building a temporary casting site

for precast elements.)

- Off-Site Precast Plant (Transporting precast elements from factory to construction site.)

Scope & Limitation

- Comparing two processes of Precast Concrete technology for Residential Development with respect to Time and Cost.
- Research will be limited to Navi Mumbai Region & Precast Concrete Technology

Material and Methodology

Precast Construction for Affordable Housing in India

Precast construction is a stage wise process consisting of producing elements in a factory set environment (as per the required dimensions taken from the drawings), transporting these elements to the site, erecting them at the site and assembling them. Precast is a preferred method and has flexibility in planning and production process until the precast components are delivered as per the schedule. Numerous benefits are associated with adoption of precast on a construction site when compared to conventional systems. Main advantages of precast construction are: reduction in time, reduction of wastage in materials, the lesser requirement of labor at the site, improved quality of the product, enhanced safety at the site, etc. These benefits can help the project in delivering effectively and efficiently.

Attributes to decide the adoption of precast are numerous and would vary from project to project as the other project factors vary. The actual value of precast is not understood when it is measured in terms of direct cost, and a simple cost comparison would always push precast to the downside. At the same time, if precast is applied from the design stage with the right planning, it has also resulted in significant cost and time savings.

In most of the developing countries like India, the cost of executing the project with conventional method is always cheaper than the cost incurred in adopting emerging technologies (such as precast) due to various reasons such as labour dominated industry with low wages, lack of research and development, logistics issues, lack of congenial relationship between stakeholders, lack of technological advancement in construction and inadequate training of labour for working with emerging technologies.

The Construction of Precast Technology can be carried out by two methods. Firstly, transporting the precast elements from the factory and then assembling them on-site and in second method a temporary Precast Casting Yard can be built adjacent to the site where the transporting cost would be cut off completely. Each method has their own pros and cons.

Barriers to Precast Construction Technology

1. Onsite Precast Construction barriers

High initial investment: to prepare precast yard at site, it requires huge initial investment. And most of the contractors won't show much interest to invest all the mobilization cost in precast yard preparation.

Lack of space availability at site: space must be available at site for the preparation of precast yard and for the storage of manufactured precast elements. Due to the rapid urbanization, it's becoming difficult to find space availability.

2. Off Site Precast Construction (Factory based) barriers

Taxation: There is tax on concrete items precast/ manufactured at a location outside the site, which is quite inimical to the use of precast items. 18% Goods & Services Tax (GST) Rates is Applicable on Precast in India.

Transportation: The transportation cost of precast components from the plant to the site is directly proportional to the transportation distance between the plant and site. And another constraint related to transportation is the allowable weights and sizes of loads that are limited by the carrying capacity of bridges and pavements and by the horizontal and vertical clearances in tunnels and underpasses. The project has to be handled in such a way that the component sizes do not exceed the weight and size limitations specified by highway agencies. These transportation related limitations might constrain the creativity of the designer.

Result and Tables

Precast through factory based or Precast through building a temporary casting yard near the Site

The question this research tries to answer is "How does one decide whether to use Precast Construction adjacent to site or precast Construction via a factory". Here we are considering two alternatives:

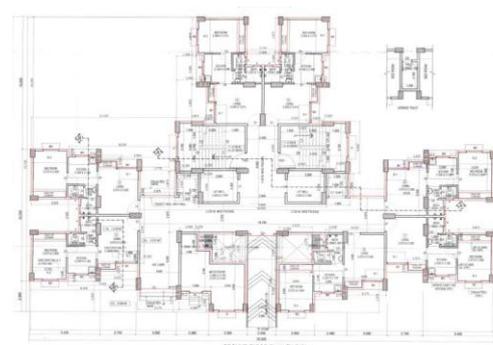
1. On Site (Building a temporary Casting Yard near the Site)
2. Off Site (Transporting a Precast Elements from the factory)

The main three factors in any construction are Time Cost, Quality. This study will provide the Quality, Time and Cost differences between Onsite and Offsite precast method.

Case Studies

For Analysis, two types of Floor Plan of 'T' type and 'H' type are used which are implemented in CIDCO Mass Housing Proposals

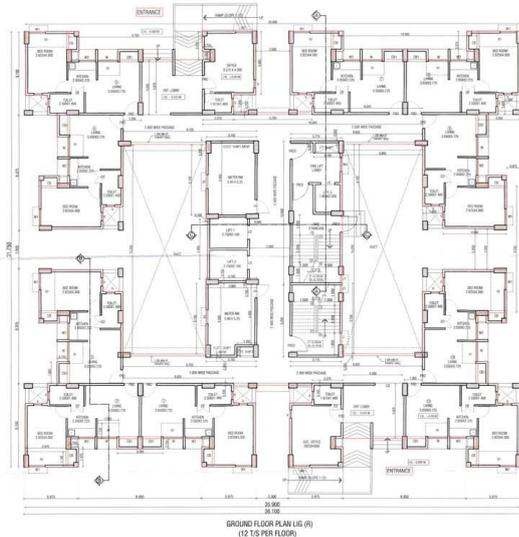
'T' Type Floor Plan



Building Height is G+14 Floors

Columns	560 Nos.
Beams	840 Nos.
Slabs	1316 Nos.

'H' Type Floor Plan



Building Height is G+14 Floors

Precast Construction Cost through Off-Site Precast Plant. (Factory Based)

Transportation Cost

Transportation - On a 30ft trailer

- Maximum Columns - 20 Columns can be transported at a time.
- Maximum Beams - 20 Beams can be transported at a time.
- Maximum Slabs - 12 Slabs can be transported at a time.

To Complete the Precast Construction of Single Building

	T Type	H Type
Columns	28 Trips	63 Trips
Beams	42 Trips	67 Trips
Slabs	110 Trips	136 Trips
Total Trips	180 Trips	266 Trips

Per trip Cost = Diesel Cost + Driver Per Day Salary + Trailer Rent Per Day

Cost of per trip can be further calculated by adding the Diesel Cost which will completely depend on the location of the site from the factory, in case of CIDCO Mass housing the projects locations vary from 4 KMs to 30 KMs, also the KMs should be considered for both ways. For e.g., if the distance is 4 KMs then the total travel distance will be 8 KMs.

Other than Transportation Cost, Loading and Unloading cost of Precast Elements form trailers which will require cranes will be other major financial heads in Off Site Precast Plant.

Further Depending on a number of Buildings in a project total Transportation Cost can be calculated.

Precast Construction Cost through On-Site Precast Plant. (Site Based Precast Plant)

Precast Plant cuts of the direct transport cost of Precast components, but requires other resources on Site.

Land Cost - First and most important resource is the Land required to setup a temporary Casting Yard. Generally, the site immediate adjacent to the development site is required. Around 15,000 Sq/mt land is required to setup a Temporary Casting Yard.

Labour Accommodation - Labour require on production plants will be more than required on site.

Machinery on Site - For Production along with Raw Materials machineries like Cranes of different Specification e.g. Tandon 70 MT, LTM 100, Mobile Crane 120 MT, Farhana 23 MT, RMC Plant P30, Boom Placer, Comcasters, Automatic Stirrup Making Machine, weld mesh Plant etc. will be required. All this machinery needs to be transported in Site.

Services Cost - It includes the electricity and water required for production of Precast Components.

Cost Comparison for both alternatives

Onsite Precast Construction (Co)

Columns	1260 Nos.
Beams	1340 Nos.
Slabs	1624 Nos.

Temporary Precast plant preparation cost (Cy)

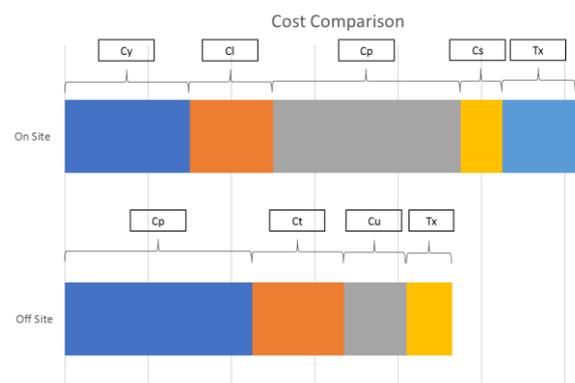
- Labour Accommodation Cost (Cl)
- Production Cost (Cp)
- Services Cost (Cs)
- Tax on Precast Elements (Tx)

$$C_o = C_y + C_p + C_l + C_s + T_x$$

Factory based (Off Site) Precast Construction (Cf)

- Production Cost (Cp)
- Transportation cost (Ct)
- Unloading/ Loading Cost (Cu)
- Tax on Precast Elements (Tx)

$$C_f = C_p + C_t + C_u + T_x$$



Time Comparison for both alternatives

Total time for construction with onsite Precast Construction (To)

Here the total time (To) includes

- Temporary Precast plant preparation time (Tpp)
- Production time (Tp)

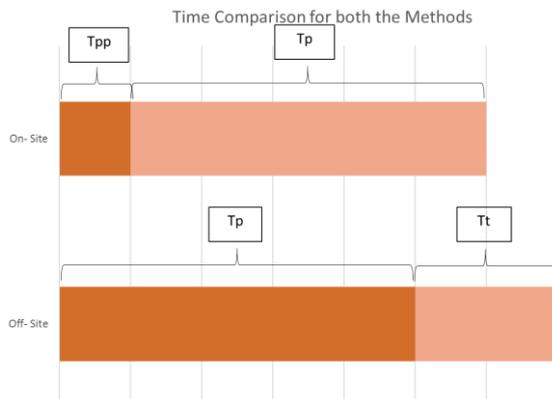
$$T_o = T_{pp} + T_p$$

Total time for construction with factory-based Precast Construction (T_f)

Here the total time (T_f) includes

- production time (T_p)
- transportation time (T_t)

$$T_f = T_p + T_t$$



The above mention head of Cost and Time for both the Precast typology On-site and Off-site will provide a financial detail as well as the time required to execute the Precast Components on Site.

Conclusion

Precast Construction Technology definitely speeds up the construction time without any delays specially in Mass housing projects. As the Precast Construction can be carried out in two ways on site and Off site, comparing these two methods will give an idea which are the major financial heads and which method can be more feasible.

If we look at the cost, on site precast plant will require huge initial funds to set up the casting yard and labour accommodation, but on the other hand it will completely cut off the transportation cost, Transportation Cost for any project is directly proportional to the distance of the factory and site.

Setting up a temporary casting yard will also depend on the quantum of work, it will not be feasible for small projects. For such scale projects transportation of precast components will be more feasible.

Transportation cost will be less when compared to building a temporary casting yard, unless the distance of site from factory is more which will be rare in most cases. Therefore, Off-Site Precast Plant will be more feasible.

Considering the time, the only extra time will be required in On Site Precast Plant to Setup the casting yard, otherwise production time will be the same in both the methods.

Before choosing any of the precast technology aspects mentioned below can help in deciding to adopt any of the technology.

•**Site Location** – Location of the site is very important aspects, if the location of site is far from the permanent factory setup the transportation kilometer will increase, so the total transportation cost can be on higher side.

•**Scale of the Project** – The total requirement of the tonnage can be identified from the scale of the project which can help in choosing the methodology.

•**Precast Components Sizes** – If the dimensions of Precast Components are bigger in sizes which can be problematic during transportation, then production with on-site precast plant can be considered.

•**Land Availability** – If the project is planned for On-Site Precast Plant, then Land required to setup the temporary precast plant should be adjacent to the on-going site or within 200 to 300 m radius.

•**Local Scenario** – Sometimes even if the on-site method comes out to be cheaper method, project is completed using off-site Method as the building a temporary precast plant sometimes is chaotic as every resource needs to be assemble on site and there might be local and political problems.

Acknowledgement

The author acknowledges to the various industrial expert from the Precast Industry, CIDCO officials and academic guides who took part in interviews and allowed site visits and provided a valuable inputs and suggestions.

References

- i. "A Blueprint for Addressing the Global Affordable Housing Challenge." by Jonathan Woetzel, Sangeeth Ram, Jan Mischke, Nicklas Garemo and Shirish Sankhe.
https://www.mckinsey.com/~media/mckinsey/featured%20insights/Urbanization/Tackling%20the%20worlds%20affordable%20housing%20challenge/MGI_Affordable_housing_Executive%20summary_October%202014.ashx
- ii. Smith, R. and Narayanamurthy, S.,(2008). "Prefabrication in Developing countries: A case Study of India".
https://www.researchgate.net/publication/311303717_A_Case_study_on_use_of_Precast_Technology_for_Construction_of_High-Rise_Buildings
- iii. D. Bendi, M. Arif, A. Sawhney and K.C. Iyer, "Offsite Construction in India - An Exploratory Study", *Int. Conf. on Structural and Civil Engineering*, pp. 64-67, (2012).
<https://old.amu.ac.in/emp/studym/99994784.pdf>
- iv. Krish R. Villaitramani, Dhruv P. Hirani, "Prefabricated Construction For Mass Housing In Mumbai", *International Journal of Innovative Research in Advanced Engineering (IJIRAE)*, Volume 1 Issue 9, ISSN: 2349-2163, pp.134-138, (October 2014).
<https://www.ijirae.com/volumes/vol1/issue9/OCCE10087.22.pdf>
- v. Raja Bhushan Kumar Mogadala1, Dr. C. Rajasekaran2 (2012) *Study on Methods of Precast Systems for Indian Construction Industry*.
<https://www.ijser.org/researchpaper/Study-on-Methods-of-Precast-Systems-for-Indian-Construction-Industry.pdf>

Investigating The Effectiveness of Passive Design Strategies in Mosques At Gulbarga

Rahin Khan¹, Priya Bangle²

Bharati Vidyapeeth deemed to be University College of Architecture¹, Bharati Vidyapeeth deemed to be

University College of Architecture²

1, prb@bvcoa.in²

Abstract: *The number of mosque buildings around the globe is tremendously increasing with the increase in the Muslim community population, as its one of the fastest growing. As a result the mosque buildings are becoming overcrowded and many researches are conducted in addressing the issues of thermal comfort within the premise. Also, the most unique feature of a mosque building is its occupancy, intermittent operation and its variant users which require heating and cooling strategies. This research aims to explore the sustainable techniques for traditional and contemporary mosque buildings in hot and dry climate zone of India.*

Keywords: *mosque, sustainable principles, thermal comfort, strategies, overcrowded, climate*

Introduction

A mosque building is majorly served as a place for divine worship and recitation of the holy book 'The Quran' by the Muslim community around the world. Mosque buildings have a dual purpose; they not only serve as a place of worship but also as a socializing area. At present, some mosques are used for performing prayers as well as school for Quranic studies. Also, the mosque buildings are unique because of its duration of use and variety of users which have a different approach to thermal comfort. This research aims to explore the sustainable techniques for mosque buildings in hot and dry climate zone of India. This research assesses a number of traditional as well as contemporary mosques building in hot and dry climate; and investigates the strategies employed to cool or heat these buildings depending on the climate and season. The effectiveness of the building features in relation to each climate is carefully analysed. The research focuses on sustainable design strategies used in designing the mosques of hot and dry climate for the city of Gulbarga, Karnataka as a case study.

What is a Mosque

A mosque is an important part of the circuit-worship rituals of Islam. For Muslims, the role of a mosque is not only a place of worship but also as place for social gatherings. It also functions as a public building. The main areas of a mosque building are as follows: prayer hall, where worshipers perform their daily prayers; domes and minarets, which represent the typical architectural features of a mosque; services blocks for toilets and ablution; and residences for the imam and muezzin.

Historical Evidence

The emergence of Islamic architecture was when the Prophet Muhammad immigrated to Medina. The building consists of a rectangle with a six colonnaded portico. The very first kind of mosque in Islam was a place to protect one from the hot sun and create a place for prostration. The mosque building was spacious, covered with dried leaves of palm trees.

Lessons of sustainability from early mosques

The Prophet's mosque is an appropriate example of sustainable building practice. The most remarkable character of this mosque was its simple method of construction, using locally available materials and vernacular construction technology without hampering the balance of the surrounding environment.

Current Scenario

A more stress has been given recently on mosque design in terms of its scale, power, ornamentation and use of fancy materials. A very less importance is given to the user comfort.

Objectives

To identify sustainable design strategies incorporated in mosque buildings of Hot and dry climate. To analyse the passive design strategies incorporated in traditional mosques building of hot and dry climate – Gulbarga city.

The sustainable principles to be studied and

analysed have been listed below:

- ❖ Passive design features
- ❖ Site Development
- ❖ Sustainable materials
- ❖ Day lighting

Gulbarga (*city of flowers and gardens*) was renamed Kalaburagi (Kannada) (Kal-means stone in Kannada, bur means thorns in Kannada the whole name represents "The Land of stones and thorns"). This city is located in the northern Karnataka formed part of the domains of the Kkatyas of Warangal before the Islamic conquest. When the Bahaman dynasty ended in 1527, the kingdom received five independent Sultanates, Bijapur, Bidar, Berar, Ahmednagar and Golconda. The district of Gulbarga was partly under Bidar and partly under Bijapur.

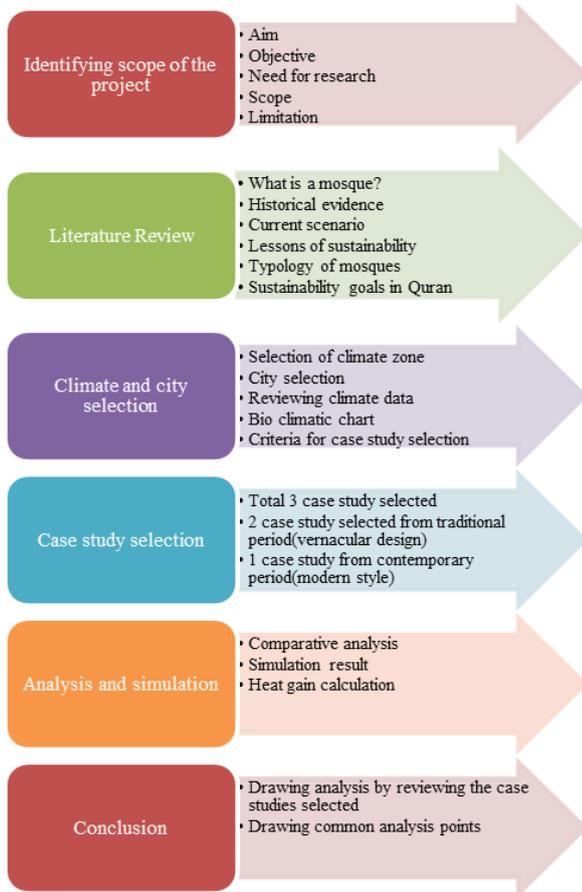


Figure 1: Research Methodology flow chart 2

named. The Jami masjid is one of the rare examples of an Indian origin mosque without a courtyard, the entire mosque is covered with a domed roof. The architectural style of the mosque is neither Persian nor Indian. This mosque is unique in it and has no replications found elsewhere in India. The Sahn is completely roofed with a pillared hall covered with small domes. The only source of illumination or daylight in the mosque is from the open side aisles. The structure measures 66m X 54m, with cloisters on three sides and a spacious sanctuary with a dome on the western side. The central prayer hall is flanked by rows of aisles forming bays and each roofed by a cupola. The mosque has an East -West elongated plan. *Mihrab* on the western side with no openings, thick wall (marked in black) to reduce the direct harsh radiation from the west direction. The other three sides are open to allow wind access. 75 nos of small dome covering the main prayer hall or sahn. The purpose of covering the sahn was to keep the interiors cooler, as Gulbarga city has severe summers.

The hot air having a high pressure moves upward whereas the cooler air at lower pressure moves downward, which in return substitutes the warm air.

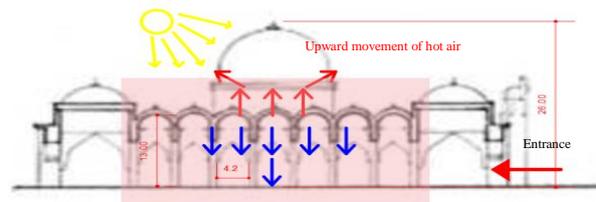


Figure 4: View of the masjid showing the wind direction

Research Methodology

Introduction to city selected

Climate analysis

The climate of Gulbarga is predominantly Hot and Dry. The solar radiation received for the summer months is very high with predominantly hot and dusty winds. The maximum temperatures recorded during the day are in the range of 32 – 43 degree Celsius with an approximately lower night temperature. The solar radiation experienced during the monsoon month is lower with diffused radiation only. The predominant wind direction is west and south west.

Case study 1: Jami Masjid, Quila – E – Hasham, Gulbarga

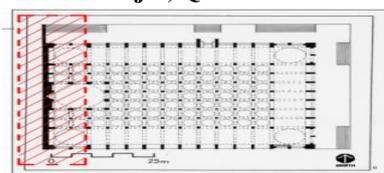


Figure 3: Sectional elevation of the masjid

Gulbarga fort has double walls of 16m thick from all sides and also surrounded by a moat which is 30m in length with bastions. The one major structure standing intact within the walls is the Jami Masjid, built in 1367 by a Persian architect

The semi-open cloister with barrel vaulted roof is coated with white plaster, which minimizes heat absorption and provides a very cool and shady place for a summer afternoon. The semi open cloisters also direct cool air to the main prayer hall.

Use of a domed roof



Figure 4: View of the masjid showing the wind direction

Gulbarga city has a hot and dry climate, use of flat roofs is not appropriate in this region because the entire surface of a flat roof is always exposed to the sun throughout the day. The construction technology adopted in this mosque design is domed roofs. Domed roof when exposed to solar radiation, only a small part of its surface areas receives the radiation directly at incidence. The rest of the surface not exposed to radiation is either self-shaded or receives the radiation at much greater incidence angles. Only a small area of the roof is exposed to the full intensity of the sun for a shorter amount of

time. Therefore the heat received by the domed roof is a lot less than flat roofs as it helps the roof to cool faster.

Case study 2: Shah Bazaar Masjid, Gulbarga

Figure 5: Plan of Shah Bazaar Masjid

This mosque building was constructed during the rule of Mohammed Shah I for the members of the royal family of the Bahamani kings and has unique Turkish and Persian style of architecture.



Figure 5: Plan of Shah Bazaar Masjid

Orientation is as per the Islamic location of *qibla* along the western side and entrance is planned in the same direction. This mosque was built after the Jami masjid of the Gulbarga fort.



Figure 7: View of prayer hall

The unique feature about this mosque is, it has a courtyard and a similar domed ceiling prayer hall as the Jami masjid. The courtyard was covered with landscape which in turn will help in eliminating glare and offers visual aesthetic value. Green cover helps in reducing heat island effect. This enclosed prayer hall space is protected from radiation and creates a pleasant microclimate which provides comfort for the worshippers. Also the entry to the prayer chamber is open which allows wind movement and partial daylight to enter.

Figure 6: courtyard - Shah Bazaar Masjid

The mosque is east-west elongated with *Mihrab* on the western side with no openings. Thick wall (marked in red) to reduce the direct harsh radiation from the west direction. The northern and southern side have smaller openings to allow cooler winds to enter the covered prayer chamber. The construction technology used in this mosque is domed roofs which were inclined to the sun's radiations.

The mosque is located in the main core city area of Gulbarga, near the Shah bazaar masjid. It is very recently constructed and is only a small phase of the proposed mosque design has been completed. The construction work came to a halt during the pandemic situation prevailing in the country. The mosque is currently in use with only basement and first level being in use and completed partially. The structure measures 24m X 16m, with a raised platform. The central area is used as the main prayer hall. The mosque is of a rectangular shape with

no openings on the west side. Orientation is as per the Islamic location of *qibla* along the western side. The entrance to the

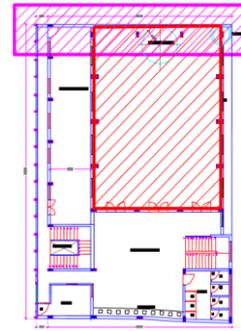


Figure 8: Plan of Masjid

mosque is from the basement level and the prayer hall is approached after taking a flight of steps. The south side has a school for kids adjacent to the prayer hall. The provision of daylight is from the south and north side in the form of diffused light. North-south elongated plan with *Mihrab* on the western side with no openings. The northern and southern side have smaller openings to allow cooler winds to enter the covered prayer chamber. Flat roofs are not appropriate for hot and dry regions because they receive the direct radiation.

Comparative study of case studies

<u>Passive design feature</u>	<u>Mosque 1</u>	<u>Mosque 2</u>	<u>Mosque 3</u>
Orientation (E-W elongated)	Yes	Yes	NO
<i>Qiblat</i> direction	West	West	West
Openings on western facade	No openings	No openings	No openings
Predominant wind direction	SE/SW	SE/SW	SE/SW
Openings in the Predominant wind	Semi open cloisters	Small openings to allow cooler wind inside	Semi open arched windows

direction			
Mutual shading courtyard	NO	Yes	NO
Ventilation strategy	Natural/cross ventilation	Natural/cross ventilation	Mechanical ventilation
Natural ventilation	Partially	Yes-through courtyard	NO
Cross ventilation	From the south west – east direction	From the south east – east direction	From the south east direction
Cooling strategies	Chimney effect	Partial chimney effect and evaporative	NA
Materials(locally available, colour and texture)	Lime Brick	Lime Brick	RCC framed structure
Type of roof	Domed ceiling(completely covered)	Partial Domed ceiling with courtyard	Flat roof
Roofing material	Stone + lime brick	Stone + lime brick	RCC Slab
Vegetation(type of trees/native or wild)	No	Native trees planted in the open courtyard	No
Wall	350mm	300mm	4 inch thick

assembly	thick wall(thermal mass property)	thick wall(thermal mass property)	concrete block wall
Form and shape of building	Rectangular	Rectangular	Rectangular
Shading elements	Self-shaded aisles and passage ways	Courtyard	Chajja projection
During winters, a lower sun angle allows the sunlight to penetrate deeper into the domed prayer halls for Jami Masjid and Shah Bazaar masjid.			
Thicker walls help in absorbing and storing the heat from the sun.			

Simulation results

The simulation result of the Jami mosque shows the annual the shadow ranges of the building. The western and southern side remains shaded whereas the other two faces remain partially shaded during the rest part of the year. The software used to get this result is Ecotect. The purpose of simulation is to find out the shaded zones as well as daylight prone zones in the building. The shaded interior aisles which are much cooler but are darker inside. Very less amount of daylight entering the main prayer hall of the masjid.

The software used over here is climate consultant 6.0 which helps in identifying the sun shading achieved over the area. The psychrometric chart shows the various strategies applicable with respect to the climate.. The strategies used in this mosque are highlighted

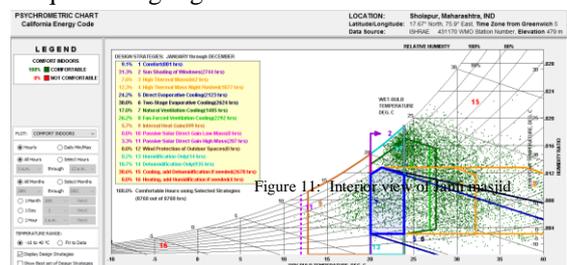


Figure 12: Psychrometric chart

Conclusion

With the growing number of Muslims and continuous demand for new mosque buildings, it is important to pay attention to the thermal characteristics of the mosque and to use sustainable technologies depending on the climate zone.

Gulbarga city has a specific architecture due to the climatic conditions it responds to. The traditional building of this city in terms of personality and cultural and religious problems is specific and corresponds to nature. Jami masjid, which is one of the oldest buildings in the city, has no pollution and produces a healthy and comfortable place for prayers and improves the environment quality. Although the construction principles which cannot be imitated as an exact model for present day, knowing these principles help us a lot for designing.

Acknowledgement

There have been a number of people who have truly helped me throughout my process of research. I would like to express my gratitude towards Prof. Priya Bangle ma'am who has been extremely encouraging and supportive as a guide all throughout. A special thanks to my family and friends.

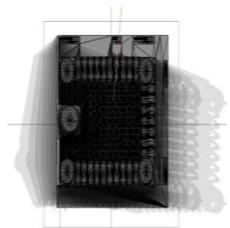


Figure 9: Jami masjid shadow range

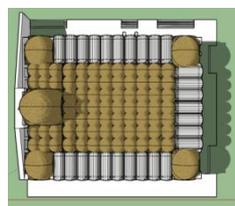


Figure 9: Jami masjid shadow range



References

- i. Abdullah, F. H., Majid, N. A., & Othman, R. (2016). Defining Issue of Thermal Comfort Control through Urban Mosque. *Procedia - Social and Behavioral Sciences* 234 (2016) 416 – 423, 416-423. [PAGEREF_Ref65879445 \h 5 PAGEREF_Ref65879452 \h 5 PAGEREF_Ref65879453 \h 5 PAGEREF_Ref65879486 \h 5 https://www.sciencedirect.com/science/article/pii/S1877705816X00136](https://www.sciencedirect.com/science/article/pii/S1877705816X00136)
- ii. Adi, S. M. (June, 2016). MOSQUE AS A MODEL OF LEARNING PRINCIPLES OF SUSTAINABLE. *JOURNAL OF ISLAMIC ARCHITECTURE*, 33-36. https://www.researchgate.net/publication/307670600_Mosque_as_a_Model_of_Learning_Principles_of_Sustainable_Architecture
- iii. Ahmad, T., Din, Z., & Thaheem, M. J. (2016). Implications of stereotype mosque architecture on sustainability. *Elsevier, Procedia Engineering*, 96-104. <https://pdf.sciencedirectassets.com/278653/1-s2.0-S1877705816X00136>
- iv. Alabdullatief, A., Siddig, O., Rami Zein, E., & Afraidi, S. (2016). GREEN ROOF AND LOUVERS SHADING FOR SUSTAINABLE MOSQUE BUILDINGS IN RIYADH, SAUDI ARABIA. *Proceedings - THE FIRST INTERNATIONAL CONFERENCE OF MOSQUE ARCHITECTURE* (pp. 129-154). Dammam: College of Architecture and Planning. University of Dammam.

- v. Dammam, Saudi Arabia. https://www.researchgate.net/publication/321180035_Green_roof_and_louvers_shading_for_sustainable_mosque_buildings_in_Riyadh_Saudi_Arabia
- vi. Burton-Page, J. (2008). *Handbook of Oriental studies - Indian Islamic Architecture-Vol 20*. Brill NV.
- vii. Hidayat, E. R. (June, 2018). ECO MASJID: THE FIRST MILESTONE OF SUSTAINABLE MOSQUE. *JOURNAL OF ISLAMIC ARCHITECTURE*, 20-26. https://www.researchgate.net/publication/326269655_EC_OMASJID_THE_FIRST_MILESTONE_OF_SUSTAINABLE_MOSQUE_IN_INDONESIA
- viii. Mushtaha, E., & Helmy, O. (2016). Impact of building forms on thermal performance and thermal comfort conditions in religious buildings in hot climates: a case study in Sharjah city. *International Journal of Sustainable Energy*, 925-944. https://www.researchgate.net/publication/289686837_Impact_of_building_forms_on_thermal_performance_and_the_thermal_comfort_conditions_in_religious_buildings_in_hot_climates_a_case_study_in_Sharjah_city
- ix. Sanusi, A. N., Fadzidah, A., Azmin, A. K., & Kassim, M. H. (2019). PASSIVE DESIGN STRATEGIES OF COLONIAL MOSQUES IN MALAYSIA. *Research gate*. https://link.springer.com/chapter/10.1007/978-3-030-30841-4_18
- x. Utaberta, N., Asif, N., & Z, H. (2016). EVALUATING POSSIBLE INNOVATIVE AND SUSTAINABLE APPROACH OF MOSQUE IN CONTEMPORARY WORLD. *Journal Design + Built - Volume 9*, 56-61. https://www.researchgate.net/publication/312017191_EVALUATING_POSSIBLE_INNOVATIVE_AND_SUSTAINABLE_APPROACH_OF_MOSQUE_IN_CONTEMPORARY_WORLD
- xi. Varzaneh, E. H., Amini, M., & Bemanian, M. R. (2013). Impact of Hot and Arid Climate on Architecture (Case Study: Varzaneh). *MRS Singapore - ICMAT Symposia Proceedings*, 25-32. https://www.researchgate.net/publication/275540865_Impact_of_Hot_and_Arid_Climate_on_Architecture_Case_Study_Varzaneh_Jame_Mosque

Figure 10: Top view of Jami masjid

Place Making: A Project Management Tool For Developing Inclusive Student Communities

Ar. Ketaki Deshpande

Prof. Zoher Siamwala (Guide)

Allana college of Architecture, 2019 – 2021

kddeshpande@gmail.com

Abstract: *The planning, design, and management of public spaces can be enhanced through the people-centric approach of place making. Varying levels of social interaction can increase familiarity and acceptance of cultural differences leading to the creation of communities with a greater sense of togetherness and a vibrancy of place. The paper identifies how outdoor spaces support student learning and socializing. An effort has been made to understand how project planning and maintenance of a campus can contribute to student success. The paper suggests measures to integrate place-making strategies in the design of educational campuses to foster inclusive student communities.*

Key words – Place making, inclusive communities, campus maintenance, architectural institutions, student learning, student socializing

INTRODUCTION

Campus environments have a variety of spaces and facilities that aim to accommodate student-learning activities. The physical environment of a campus provides the setting for learning and social interactions. These interactions lead to involved students, which help build community. Lively communities on college campuses contribute to student persistence and academic achievement. Community and community building are terms of importance in the college and university environment. Community building is considered as a desired outcome of the undergraduate experience at universities and particularly Colleges of Architecture. Building community is being treated as a fundamental element in college life and institution builders believe that more should be done to foster it. As a result, architecture education administrators consistently seek to involve students and build community through campus activities and planning initiatives. Institutions bear the responsibility for the design, creation and maintenance of campus environments arranged appropriately for meeting educational purposes and more.

Outdoor spaces on campuses are largely designed for break time and leisure while indoor spaces are planned for focus and learning. Break time is centralised around students chatting, relaxing, eating or catching up with friends. Spaces meant for such activities are fundamentally separated from the classroom. The indoors is treated as a space for learning and the outdoors is treated as a break from the learning. However new studies encourage the use of outdoor spaces as learning

environments which maybe more successful than indoor learning spaces.

LITERATURE REVIEW

Within the last decade, there has been increased research interest on teaching and learning spaces. Learning theories and pedagogical approaches are shifting from knowledge transmission to knowledge construction in higher education. Experiential learning is being integrated into existing curricula. College campuses are evolving and changing from being simple transition spaces to areas for conducting formal, interactive and collaborative activities. Activities are highly encouraged in these learning spaces allowing them to become more integrated in the educational process. These spaces, frequently called, ‘Learning Commons’, include technology, spaces for independent and group study, soft seating, coffee shops and more. The social and collaborative processes of learning are recognized and encouraged in this model. Taking the effort and time to concentrate towards planning, construction and maintenance for a college campus is essential to facilitate students’ success both socially and academically. Through the prudent use of design attributes suited for variety of student activities related to the curriculum of the architecture program, project planners and designers can manipulate spaces to influence student behaviour to contribute to both academic and social success.

Alternative learning spaces –

Using alternative learning environments such as corridors, lobbies, courtyards and other outdoor plazas and spaces help students to learn to adapt in their environment much like they would in any non-academic setting.

These spaces are beneficial not just to students but also serve to ease the financial and administrative strain on the University by being sustainable, enhancing campus aesthetic and increasing initial student attraction.

Students’ success in alternative learning spaces can be facilitated through design considerations, choice of materials and technology, taking into account the type of activities that a student engages in on any given day. Effective campus design can inspire students to work harder, to improve themselves and to focus on building their future.

Good learning environments promote:

1. Safety and inclusion

2. Student involvement and easy upkeep
3. Community and sense of belonging.

The overall perception of safety fosters a 'feel good' response and a sense of belonging among users. These are key criteria for multicultural placemaking. Safe and inclusive public spaces have the power to unite people of varied cultural backgrounds and encourage them to feel welcome within the space.

The social space in the public realm serves as a tie between the built and natural environment. Social environments on architecture college campuses are those that foster student engagement through the natural and built environment.

METHODOLOGY

An approach to placemaking projects in institutions of Architectural Education -

"A project is a set of events to undertake in a given time, with a mixture of human, physical and financial resources, with defined costs to produce a change in an institution, by completing certain well-known goals."

In summary, projects:

1. Must have a defined goal.
2. Must be planned to complete the goal.
3. Must have a determined budget

1. Set Expectations -

Define clearly what to accomplish with a college management project, identifying organizational issues and problems and think about solving them.

In the initial phase of a project, set goals that are:

1. Specific
2. Quantifiable
3. Possible
4. Realistic
5. Timely

2. Foster the Right Data to Benchmark the Performance –

Lack of good data records and historical data as the baseline to start a project for alternative learning, class management or academic planning are some of the most shared problems found in architecture institutions.

It is important to find the right data and prepare it for its addition in any enterprise planning software. This takes time, but it's crucial to begin on the right foot.

3. Follow a Cycle –

A project management approach is a schematic process with a series of deliverables over time. Finding the right provision

and resources for each step of the way is crucial. Institutions for architecture education must clearly fix what services are required for the placemaking project management, making sure they concentrate on the identified needs such as:

1. Creation of learning commons.
2. Right student behaviour.

4. A right mentoring program -

Re-examine effectiveness of plans regularly, celebrate accomplishments, provide motivation to continue, consider lessons learned and revise the future course of action.

5. Project assessment -

When starting to work on a project, it is essential to explore what are the assets, what issues is the project trying to address, and whether or not the proposed responses are the right way to fix them. This is particularly difficult in colleges of architecture because there is a need to visualise the scope of the project in totality rather than expecting it to be brought to the table.

Therefore, some questions to be asked could be:

Is the project:

1. Relevant?
2. Effective?
3. Efficient?
4. Feasible?
5. Sustainable?

6. Communicate the Project -

One of the most common ways of running total quality management is through improvement teams assigned for a particular project. However, these shouldn't work on their own. It is recommended that project managers in universities should listen to a broad range of voices from across campus before prioritizing, while also keeping an eye on quality.

Place making strategies for outdoor learning environments in colleges of architecture –

Features within the physical environment to be built to accommodate the student community, must first, encourage involvement and learning and second, promote the acquisition of skills that foster growth and development to nudge student towards active learning.

1. Create spaces that are visually appealing and inviting. Spaces must display a complete understanding of the needs of the body of students, the faculty and the staff. Permit spaces to be flexible enough so as to satisfy the evolving interest of its users. The space should efficiently change over time to suit the needs of the body using the facility. The use of diverse materials and colours can add

an aesthetic appeal that will quickly activate interest and use of a space.

2. Provide spaces that accommodate different types of study habits, ranging from needing ambient noise to needing solitude. Ensure there is enough space and furniture for everyone to find what they are looking for.
3. Provide both flexible and fixed elements that accommodate multiple use. Seating flexibility allows a space to transform into various uses. Easy to move seating can help transform a space from an old-fashioned study spot to a large group education seating in a matter of seconds. Easy to maintain, colourful, flexible furniture allows for rearranging of seats to promote creation of collaboration spaces.
4. Use landscaping to break up space and lighten an environment. Plan these locations to have a mix of sun and shade to provide an illusion of privacy and comfort. Encourage a strong relationship between nature and people for sharing a sense of space and familiarity as well as enhancing learning opportunities.
5. Use of lightweight tables and chairs can accommodate moving and shifting of group position when needed for discussion or comfort. Provide overhead and surrounding enclosures through use of various materials, construction techniques and landscaping to enhance sense of safety and comfort.
6. Provide hardscaped ground surfacing requiring minimum maintenance. Construction of a small amphitheatre space can allow for group presentations, class gatherings, or casual social interactions.

CONCLUSION

Visualizing beyond the boundaries of the subjects under the curriculum of architecture can help to develop the entire campus to support students' all-round growth and development. An understanding of how various stakeholders might be affected by an initiative or strategy is important to the success and implementation of the placemaking project.

ACKNOWLEDGEMENT

I would like to thank Prof. Zoher Siamwala for advising me and encouraging me at every step.

I would also like to thank my teachers at Allana College, particularly, Prof. Ghogale Sir, Ar. Prachi Iyer and my parents for their thoughtful inputs, support and encouragement at every stage of my work.

REFERENCES

- i. *Quick start guide to implementing place-based education getting smart in partnership with eduInnovation & Teton Science Schools.* <https://www.gettingsmart.com/wp-content/uploads/2017/02/Quick-Start-Guide-to-Implementing-Place-Based-Education.pdf>
- ii. *Lucinda Sue McDonald. The Impact of Campus Facilities on the Recruitment of Students in Higher Education.* Western Kentucky University *TopSCHOLAR* <https://digitalcommons.wku.edu/cgi/viewcontent.cgi?article=1169&context=diss>
- iii. *John Anderson, 10/07/19. Optimizing Campus Space to Create a Better Student Experience* <https://spaces4learning.com/articles/2019/10/07/optimizing-campus-space.aspx>
- iv. *Kim D. Harrington, Community on Campus: The Role of Physical Space* *Scholar Works @ Georgia State University*
- v. *Himasari Hanan, Open Space as Meaningful Place for Students in ITB Campus.* *Procedia - Social and Behavioural Sciences.* Volume 85, 20 September 2013. <https://pdf.sciencedirectassets.com/>
- vi. *Siu YuLau, Healthy campus by open space design: Approaches and guidelines.* *Frontiers of Architectural Research* Volume 3, Issue 4 <https://www.sciencedirect.com/>
- vii. *Investing in Public Spaces to Achieve Livable Cities for All.* <https://www.worldbank.org/en/news/press-release/2020/02/11/investing-in-public-spaces-to-achieve-livable-cities-for-all>
- viii. *Matthew Carmona, Principles for public space design, planning to do better.* *URBAN DESIGN International* volume 24 <https://link.springer.com/article/10.1057/s41289-018-0070-3>
- ix. *Surabhi Pancholi, Place making facilitators of knowledge and innovation spaces: insights from European best practices.* *International Journal of Knowledge-Based Development* Volume 6, Issue 3 <https://www.inderscienceonline.com/doi/abs/10.1504/IJKBD.2015.072823>
- x. *Student services and facilities.* *The Good Universities Guide* <https://www.gooduniversitiesguide.com.au/study-information/student-life/student-services-and-facilities>

Theoretical Review of a “Health-Wellbeing- Green” Approach In Design And Construction Practice for a Pandemic Resilient Office Interior Fit Out

Ar.Kamala Kulkarni¹, Ar.Romeiro Silveira²

¹M.Arch (Construction Management) 2019-2021, Allana College of Architecture, Pune.

²Associate Professor, M.Arch, Allana College of Architecture, Pune.

Email: kamalajoshi15@gmail.com , romeirosilveira@azamcampus.org

ABSTRACT: backdrop

The pandemic situation has changed the way we relate to, inhabit and construct a publicly occupied commercial space like an office interior, the topmost concern being “Impact on Occupant health and wellbeing.” Facilitating a safe return to the workplace brings up the need to build in resilience, foremost in the interior built environment, thereby effecting the same on its occupants. Against this backdrop the paper aims to establish the relevance of ‘HWG’ approach (“Health-Wellbeing-Green”) in office interior architecture, towards achieving pandemic resilience in the post pandemic workspace.

KEYWORDS: Resilience, Health, Wellbeing, Green, Workplace, Interior Architecture.

I. INTRODUCTION:

1. The Indian Workspace

The Indian Workspace has undergone a metamorphosis over the last decade, due to economic, demographic & technology changes. Factors such as global and younger workforce (large number of millennials), more women joining work , 3 generation of people working together, digitization of processes, quick response communication tools ,24x7 work shifts, to name a few have made the design of workspaces very complex ,challenging , and therefore innovative.

.In spatial design, this has manifested in the concept of “social office”,“open plan office space” and of “densification” leading to

- Integration of zones
- Evolution of barrier free spaces.
- Collaborative and mixed use spaces

This has also led to an increased use and complexity of MEP services like Air Conditioning, Lighting, Security Systems, Vertical transportation systems, Sophisticated Plumbing etc.



2. Occupational Health & Safety in Service sector

People spend between 80 % to 90% of their daily time indoors, up to 50% of which is spent at work, considering that an average working day spent in the interior of an office space can range between 8 hrs to 10 hrs, sometimes more.

This makes it very pertinent to have a workspace conducive to creating a positive impact on the health and well being of its occupants ,and closely examine its related concerns and aspects.

Although there are national and international standards on providing a safe and healthy workplace, literature suggests that these are largely focused on the tangible work related hazards in the industrial sector. There is a lack of focus in implementation of the standards in the service sector which is at equal risk and it could be due to the fact that the hazards are comparatively intangible.

However, the unexpected pandemic situation has raised with urgency and brought to the fore longstanding concerns around the Health and Wellbeing of employees in a publicly occupied interior space of an office.



3. The Concerns

(a) Lack of Indoor comfort

- Poor space planning
- Un-ergonomic furniture design
- Visual discomfort
- Thermal discomfort
- Acoustic discomfort
- Olfactory discomfort

(b) Disease transmission in an Unhealthy Indoor Environment

- Co-existence in densely occupied space
- Touch
- Surfaces retaining virus life.
- Poor Indoor Air Quality

(c) Improper Maintenance

-Lack of Hygiene and Sanitation measures
This calls for exploring an approach viable in the long term, for building resilience in the interior architecture of a workspace, which this paper attempts to address.

II. METHODOLOGY



III. MATERIAL

(i) Pandemic Guidelines for Health & Safety in the Workplace

1. ISO/PAS 45005:2020-General guidelines for safe working during the COVID-19 pandemic⁽ⁱ⁾

- Spatial planning to achieve Physical distancing,,Safe Sanitation & Hygiene Facilities, Healthy Ventilation Systems, reducing touch in building controls ,Disinfection ,Maintenance & Upkeep
- Accessibility and inclusion

2. WHO guidelines – Getting your Workplace ready for Covid-19⁽ⁱⁱ⁾

- Keep Workplaces clean, hygienic well ventilated.
- Keep people atleast 1 meter apart from each other.
- Isolation room for emergencies.

3. OSHA Fact Sheet (Occupational Safety and Health Administration regulatory agency of the United States Department of Labour) –protecting Workers during a pandemic⁽ⁱⁱⁱ⁾

- Modify the work environment for additional protection ,like physical barriers, drive-through service windows, telework, improve ventilation..

4. Rethinking the Office Space - Godrej Interio ^(iv) - Post covid workspace design needs rethinking to support people and the new realities with additional interventions:

Space Design & Ergonomics, Air Quality, Natural ventilation, Technology Hygiene and Sanitation

Use of Technologies

5. Accenture - COVID-19: Product and spatial design in a pandemic ^(v) - Integrate digital and spatial experiences,

normalizing touch free interactions, robotics to facilitate social distancing, reduce friction, and lower human density.

6. Engineered Systems Magazine-Building Automation Systems to the Rescue: Creating a Remote World ^(vi) -

BMS/BAS , in Building operations minimize the transmission of the COVID-19 virus , increasing energy efficiency, reducing long-term operational costs, making buildings much more resilient to future pandemic challenges.



source- <https://www.esmagazine.com/articles/100953-building-automation-systems-to-the-rescue-creating-a-remote-world>

(ii) Workplace Health & Wellbeing

1. ISO 45001:2018 ⁽ⁱ⁾ -International standard for Occupational Health and Safety management system : reduce risks, enhance health, safety and well-being at work contributing to UN Sustainable Development Goals.

2. IGBC Health & Wellbeing Rating for Occupants ^(vii) – Physical ,Intellectual ,Emotional and Social Wellbeing of occupants can be achieved by improving the influencing features of the built environment which are Comfort, Innovation in Design,Indoor Air Quality ,Water Quality, Hygiene and Sanitation, Connectivity to Nature, ,Employee Safety, Fitness Recreation & Culture Facilities .

While ,degradation of these factors has a direct/indirect impact on the chronic diseases in occupants ,such as Cardiovascular diseases (CVD), Cancer (CNR),Chronic Respiratory Diseases (CRD),Diabetics (DBS), Visual & Hearing Impairment (VHI) and Bone & Joint Disorders (BJD)

3. Centre for Active Design -Fitwel building certification ^(viii) Incorporating Wellness strategies in the Work Environment Design ,like Air quality, levels of physical activity, and social bonding improve physical and mental health, ,productivity, energy levels, mood, and reduce stress .

-Indoor air pollutants are generally 2 to 5 times greater than outdoor pollution levels,in some cases, 100 times greater.

-Poor ratings of light quality and views in offices are associated with a higher number of sick leave hours.

(iii) Green Interiors for Occupant Health & Wellbeing

1. IGBC Green Interiors Rating ^(vii) - Various sustainable aspects like Eco design Approach ,Green Interior Materials, Indoor Environment Quality and Innovation in Interior Design result in benefits that directly impact in Improved Health & Wellbeing of occupants.

- Enhanced Indoor Air Quality
- Non Toxic low VOC content materials
- Better Ergonomics, Visual, Thermal, Acoustics comfort

2. Green globes® for Sustainable Interiors (SI) Rating ^(ix) – Key performance indicators -Indoor Environment Quality , Material

choices and resource consumption ,Emissions and other impacts, create a healthy environment leading to greater comfort, satisfaction ,employee productivity and retention.

3. Case Study-(PBC) Paharpur Business Centre- Green Rated healthiest ready-to-move-in Office Building-New Delhi - India-by CPCB, MoEF, GOI and CNCI .USGBC LEED (EB) Platinum Certified ,BEE 5 Star , (ASHRAE) WHO,NABERS.

High Indoor Environment Quality achieved by attending to Indoor Air Quality & Ventilation , controlling all pollutants, lighting levels, noise and comfort parameters and enhancement of oxygen levels by the use of plants and mechanical practices.

Compared to other buildings in the city, incidences of eye irritation reduced by 52%, respiratory symptoms less by 34%, headaches by 24%, lung impairment by 12%, and asthma by 9% at Paharpur Business Centre.

An exceptionally high ‘occupant-satisfaction score’ shows that a truly sustainable building also maximises the wellbeing of the people who occupy it.



Testing Service for Indoor Air Quality (PBC)

4. Harvard T.H. Chan School of Public Health’s Center for Health and the Global Environment (CHGE), SUNY Upstate Medical University, and Syracuse University study conducted in March 2016 ^(x) -reveals :

Sustainable design implies -“green” buildings are energy efficient and are also designed to enhance indoor environmental quality.

People who work in “green” offices that are well-ventilated and have low levels of indoor pollutants and carbon dioxide have Cognitive function scores on average twice that of people working in more traditional office environments.

5. Shelterforce - Resilience in the Face of a Pandemic:

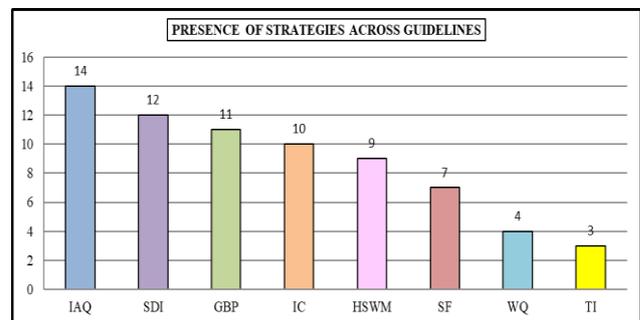
(i)Healthy and sustainable, green Building practices such as energy and water efficiency, good ventilation, and nontoxic materials provide defenses against respiratory illnesses,airborne vectors ,are better enabled to withstand the stresses of this pandemic , future health and climate threats, and help build resilience.

6. GRIHA- Building Fitness Indicator (BFI) Tool

Why should you get your building rated?- Among the benefits of a green design to a building user-

-Reduced air and water pollution offer direct health benefits ,Increased user productivity the end goal being is to ensure the health and well-being of employees.

VI. FINDINGS



VII. CONCLUSIONS

1.International Norms for achieving a safe and Pandemic Resilient workplace mention strategies also present in guidelines for Health Wellbeing and Green compliant Interior Architecture practice.

2.Resultant is an amalgamated "Health-Wellbeing - Green"(HWG) approach ,which is the relevant and right way forward, towards achieving Pandemic resilience in a publicly occupied Workspace.

VIII. RECOMMENDATIONS

To achieve a future resilient office interior Architecture ,the Design and Construction practice based on the HWG approach should incorporate these strategies :

- (i) Indoor Air Quality
- (ii) Spatial Design Interventions
- (iii) Green Building practices
- (iv)Indoor Comfort
- (v) Hygiene Sanitation & Waste Management
- (vi) Safety
- (vii)Water Quality
- (viii) Technology Interventions

A detailed practical guideline for the implementation of the HWG approach in design and construction practice for a

future resilient public workspace design , can be worked out, as a further extension to this research work.

IX. ACKNOWLEDGEMENT

I am thankful to D.Y. Patil School of Architecture for providing this platform and opportunity for carrying out the research work.

I am deeply grateful to my guide Ar. Romeiro Silveira ,for sharing his valuable insights ,knowledge and time towards guiding me for this research paper.

X. REFERENCES

- i. ISO/PAS 45005:2020-Occupational health and safety management — General guidelines for safe working during the COVID-19 pandemic
<https://www.iso.org/standard/64286.html>
- ii. Getting your workplace ready for COVID-19-WHO
<https://www.who.int/docs/default-source/coronaviruse/getting-workplace-ready-for-covid-19.pdf>
- iii. Protecting Workers during a Pandemic - OSHA
<https://www.osha.gov/sites/default/files/publications/OSHA-FS-3747.pdf>
- iv. Whitepaper: Re-Thinking The Office Space By Godrej Interio-Featured | Jul 24 2020
<https://www.designdekko.com>
- v. COVID-19: Product and spatial design in a pandemic
<https://www.accenture.com/in-en/insights/interactive/coronavirus-product-and-spatial-design>

- vi. <https://www.esmagazine.com/articles/100953-building-automation-systems-to-the-rescue-creating-a-remote-world>
- vii. <https://igbc.in/igbc/redirectHtml.htm?redVal=showratingSystem>
- viii. <https://www.quadreal.com/wp-content/uploads/2020/01/The-Office-Guide-to-Building-Health.pdf>
- ix. Green Globes® For Sustainable Interiors (Si)
- x. <https://thegbi.org/green-globes-certification/how-to-certify/sustainable-interiors/>
- xi. Can 'green' offices sharpen productivity?
<https://www.hsph.harvard.edu/news/hsph-in-the-news/green-offices-productivity/>

IV. RESULTS & TABLES

IAQ –Indoor Air Quality
TI-Technology Intervention
WQ- Water Quality
SF- Safety

IC-Indoor Comfort
GBP-Green Building Practices
SDI-Spatial Design Intervention
HSWM-Hygiene Sanitation & Waste Mgmt

STRATEGIES FOR A HEALTHY & SAFE WORKPLACE MENTIONED IN VARIOUS GUIDELINES										
GUIDELINES			STRATEGIES							
Type	Sr	Title	1	2	3	4	5	6	7	8
Health & Wellbeing	A	ISO 45001:2018	IAQ	WQ		SDI		SF	HSWM	GBP
	B	IGBC Health & Wellbeing	IAQ	WQ	IC	SDI		SF	HSWM	GBP
	C	Fitwel BC	IAQ		IC	SDI				GBP
Pandemic OH&S	A	ISO/PAS 45005:2020	IAQ		IC	SDI		SF	HSWM	GBP
	B	WHO	IAQ			SDI		SF	HSWM	
	C	OSHA	IAQ			SDI		SF	HSWM	
	D	Godrej Interio	IAQ		IC	SDI	TI	SF	HSWM	GBP
	E	Accenture				SDI	TI	SF		
	F	Engineered Systems	IAQ		IC	SDI	TI			
Green Interiors	A	IGBC Green Interiors	IAQ		IC	SDI			HSWM	GBP
	B	Green globes® Sustainable Interiors	IAQ		IC	SDI				GBP
	C	Paharpur B Centre	IAQ	WQ	IC	SDI			HSWM	GBP
	D	Study -Harvard ,SUNY,Syracuse	IAQ		IC					GBP
	E	Shelterforce	IAQ							GBP
	F	GRIHA	IAQ	WQ	IC				HSWM	

V . KEY (Explaining Strategies)

IAQ	Indoor Air Quality
Clean &Healthy HVAC system	
Fresh Air Ventilation	
Filtration for outdoor pollutants	
Control Excess Moisture & Dampness	
Minimise indoor pollutants like PM2.5,PM10,CO,03,TVOC,SO2,NO2	
Air Sealing for isolation	
Avoid Stagnant Air Zones	
CO2 monitoring	
Enhancement of Oxygen levels	
Tobacco Smoke Control	
Reduce indoor emissions & microbes	
Flush out indoor airborne contaminants before occupation	

WQ	Water Quality
Accesibility to drinking water	
Adequate Quantity of drinking water	
Quality of drinking water as per IS-10500 standard	
Quality of Recycled Water compliant to MOEF / CPCB / S P C /IS 10500 Norms	

SF	Safety
Hazard Identification	
Social distancing,barriers	
Provision of PPE Dispensers,Sanitiser stands	
Signages	
Anti microbial Surfaces	
CCTV,Public Address Systems	
Fitre Safety	
Electrical Safety	

SDI	Spatial Design Intervention
Design Innovation	
Spatial Planning,Zoning	
Lower Human Density	
Reduce Friction	
Circulation, Orientation	
Physical distancing,Barriers	
Workstation Planning	
Emergency Isolation Room	

GBP	Green Building Practices
Eco Design approach, Green certified Raw material	
Low VOC materials	
Green certified Furniture	
Paints and finishes that minimise dust ,non polluting materials	
Connectivity to Nature, Outdoors	
Biophilic Design	
Water and Energy efficiency to reduce operating costs	
Daylight, Natural Ventilation	

HSWM	Hygiene Sanitation Waste Mgmt
Adequate & Safe Sanitation Facilities	
Hand Hygiene facilities	
Regular Cleaning & Housekeeping	
Frequent Disinfection of Spaces	
Waste seggregation & safe disposal	
Contactless Plumbing Controls	
Proper Drainage	
Proper lighting in Hygeine facilities	
Easy to clean surfaces and spaces	

IC	Indoor Comfort
Visual Comfort	
Thermal Comfort	
Acoustic Comfort	
Olfactory Comfort	
Comfort for Differently Abled Occupants	
Ergonomics	
Outdoor Views	

TI	Technology Intervention
Integrate Digital and Spatial experiences ,Telework	
Touchfree, Contactless Controls	
Smarter Devices, App based Controls	
Remote Controlled Building operations	
Building Management Systems	
Building Automation Systems	
Biometrics	

Evaluation of Daylight Distribution in a Hospital room with Complex Fenestration System in Hot & Dry Climate

Urvashi Shroff, Sujata Karve, Prajakta Kulkarni, Namrata Dhamankar

Department of Environmental Architecture and Planning, Bhanuben Nanavati College of Architecture,
Pune

Email: urvashishroff3930@gmail.com

Abstract: *Hospital environments present special challenges continuously during the running time of hospitals, where patients are the primary focus. The speedy recovery of a patient greatly depends on their surrounding ambience. Daylight plays a major role in improving Indoor Environmental Quality of spaces. The incessant evolution of glazing system is guiding façade design towards a more complex and adaptive fenestration systems. The modelling and simulation of complex fenestration system (CFS) requires advanced modelling techniques like Climate based Daylight modelling (CBDM). The objective of this paper is to analyze daylight distribution in a hospital room and evaluate the daylight performance.*

Key words – Complex Fenestration system, Hospital room, Daylight simulation, Daylight metric, Climate based daylight modelling, hot and Dry

INTRODUCTION

Daylighting is an effective strategy that most designers focus to attain when designing a building. It has an optimistic effect on the occupants living in the space, especially hospitals where occupants require strong psychological improvement. Hospital environments present special challenges continuously during the running time of the hospitals. Several studies that are related to healthcare design showed dissatisfaction from hospital environment, such as comfort, lighting, IAQ (indoor air quality), temperature, humidity, and noise. Using daylight as primary light source has been widely recognized as an important strategy to reduce building energy demand and enhance indoor environment quality (Diab, 2017). In locations which have clear sky conditions, there is a risk of glare and overheating while administering daylight in buildings. It is, therefore, well-known that achieving an optimal indoor daylighting environment without compromising the visual and thermal comfort of the occupants represents a real challenge in such regions (Chantal Basurto, 2015).

Aurangabad is located at latitude 19.8762° N and presents hot and dry climate. With new developments in the city, the Architecture of city is moving towards glazed facades for aesthetics and visual purposes. Given Aurangabad's climate, these glazed facades produces overheating and glare which increases cooling energy demand and discomfort (Bustamante,

2015). Shading devices, such as louvers, venetian blinds and perforated screens control daylight and solar heat transmission through fenestration systems (bustamante, 2017).

Shading devices are known to offer protection from solar radiation. Simultaneously they should allow daylight access and visibility as much as possible. Shading systems have become a necessity, as they prove to be effective in energy and lighting performance of buildings and occupant comfort. These shading systems are formed by a non-specular layer (louver or blinds), which together with glass of the envelope form a "complex fenestration system" (CFS) (Bustamante, 2018).

The study aims at evaluating daylight distribution in a hospital room in presence of complex fenestration system placed on a window in hot and dry climate zone.

1. Complex Fenestration System

Complex fenestration systems (CFS) refer to any window technology that incorporates a switchable layer like Venetian and roller blinds. CFSs, due to their thermal and optical complexity can influence indoor visual and thermal conditions, daylight availability and energy consumption (Atzeri, 2017). They are usually characterized to redirect daylight from overexposed space to deeper areas inside the room, reducing visual discomfort and increasing daylight distribution (Kischkoweit-Lopin, 2002). Daylight distribution through some shading devices such as fins, awnings and overhangs can be analyzed using simple calculations. For complex fenestration systems, a more sophisticated evaluation process is needed due to their complex geometries and optical properties (Brembilla, 2019).

2. Climate Based Daylight Modelling

Climate-Based Daylight Modelling (CBDM) provides the framework for a year-round, evaluation of the building's day lit environment (Brembilla, 2019). CBDM metrics are used in various design guidelines and has been used by designers for simulations to demonstrate compliance. This paper evaluates daylight availability in a hospital room based on simulation outcomes of most commonly used metrics such as Daylight Factor (DF) and Daylight Autonomy (DA).

METHODOLOGY

To evaluate daylight distribution through complex fenestration system and to understand how it corresponds to daylight metrics, a case study room was modelled in SketchUp and Rhino with vertical louvres as shading system. This room is simulated in DIVA for Rhino, with two cases, one with shading and another without shading. The following sections describe characteristics of case study and the detailed procedure followed to run climate-based daylight simulation.

1. Description of Case Study

A hospital room with a large north facing window was chosen as a case study to study the effect of CFS in a direction receiving indirect sunlight. The hospital is an existing facility located in Aurangabad city which falls under hot and dry climate zone. The dimensions of space are 3.23m x 3.7m.

Table 1 shows standard reflectance and visible transmittances applied on model surfaces. Reflectance standard is a ratio value between total amount of light, reflected by a surface, and total amount of radiation incident on the surface while visible transmittance is the amount of light that passes through a glazing material.

As complex fenestration system, Vertical metal louvres were used as shading device on the window to block undesired sun and heat gain while allowing natural light into room. Figure 1 displays floor plan of hospital room showing position of window. This system was treated as fixed shading and applied on the room's north façade.

Table 1 Characteristics of Model Surfaces

Reflectance			
Hospital Room	Ceiling		0.7
	Interior walls		0.5
	Furniture		0.5
	Floor		0.2
Reflectance			
CFS	Vertical Louvre	Metal	0.8
	Visual Transmittance		
	Clear Window		0.8

The shading device is formed by Vertical louvres, placed on exterior side of glazing inside a metal frame outside the depth of sill. The slats were modelled as simple vertical surfaces, with zero thickness, 80 mm wide and spaced every 60 mm. The material assigned to slats was characterized by a 0.80 diffuse reflectance.

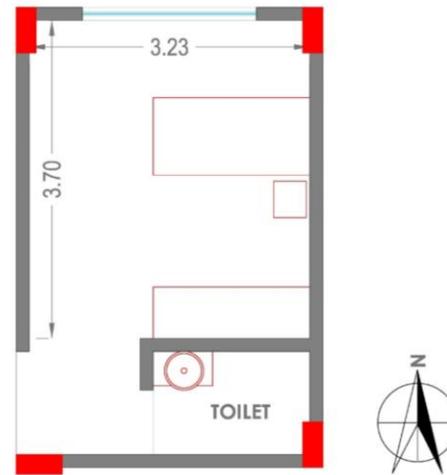


Figure 1 Floor plan of hospital room showing position of window

2. Daylight Simulation and Calibration of Model

The assessment of daylight conditions has been regulated by using dynamic simulations in DIVA (Costanzo, 2018). The weather file used for simulation was EnergyPlus epw file for Aurangabad. Figure 2 3D model of the room in SketchUp with north facing window 2 shows 3D model of room and calibration of model is done by keeping radiant parameters as default except ambient bounces –ab as 4. The occupancy schedule is kept as always occupied.

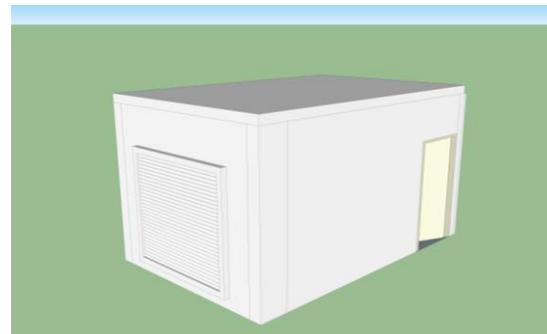


Figure 2 3D model of the room in SketchUp with north facing window

The grid of sensor points has been placed at bed height as 0.45m from the floor in the room. The sensor points were arranged in a grid of 0.45 x 0.45 m. The target illuminance is set at 150 lux which is ideal for hospital rooms. Two cases have been considered, case 1 with no shading system and case 2 with shading system. Dynamic shading parameter and fenestration system layer has been kept off for case 1 and turned on for case 2 respectively. The other parameters are kept default.

The metrics employed in this evaluation are listed below.

- Daylight Factor (DF) represents the ratio of the light level inside a structure to the light level outside the structure.

- Daylight Autonomy (DA) represents the percentage of occupied hours where the illuminance level is higher than a set threshold, 150 lux in this work.

RESULTS

The selected annual daylight metrics were used to compare the simulation results for each case. The results are presented in the two sections below and the comparison of both cases is drawn in the table below.

Table 2 Comparison of Case 1 and Case 2

Investigated Metric	Case 1: Without CFS	Case 2: With CFS
Mean Daylight Factor	16.9%	3%
Daylight Autonomy	46%	32%

1. Case 1: Without complex fenestration system

For first analysis, window without CFS, both the metrics mentioned in methodology were investigated. Table 2 shows the results of annual daylight metrics obtained in both the cases. According to simulation, the mean daylight factor and mean daylight autonomy is 16.9% and 46% respectively which means daytime electric lighting is rarely needed, but potential thermal problems due to overheating in summer can occur (Buckley, 2019).

2. Case 2: With Complex Fenestration System

For second analysis, window with CFS, the investigated metrics show that 70% of all illuminance sensors have a daylight factor of 2% and it does not qualify for LEED daylighting credit 8.1. The mean daylight factor and mean daylight autonomy is 3% and 32% respectively which means, room looks gloomy and electric lighting is needed for most of the day (Buckley, 2019).

CONCLUSION

This paper has presented and compared outcomes in respect to CFS and analyzed its effect on daylight distribution. Findings show that direction of openings and daylight oriented planning is important in daylight distribution in hospitals. Further studies could focus on effect of CFS in different directions and Indian climate zones.

ACKNOWLEDGEMENT

I would like to express my gratitude to my professors, Sujata Karve, Prajakta Kulkarni and Namrata Dhamankar, who guided me throughout this research. I would also like to thank my friends and seniors who supported me and offered deep insight into the study.

REFERENCES

- i. Atzeri, A. M. (2017). *On the Global Performance of Offices with Different Complex fenestration systems.*
- ii. Brembilla, E. (2019). *Evaluation of climate-based daylighting techniques for complex fenestration and shading systems. Energy and Buildings 203 (2019) 109454.*
- iii. Bustamante, W. (2015). *Thermal and lighting performance of 5 complex fenestration systems in a semiarid climate of chile. Energy procedia 78 (2015) 2494-2499.*
- iv. Bustamante, W. (2017). *Seasonal optimization of a fixed exterior complex fenestration system considering visual comfort and energy performance criteria. Energy procedia 132 (2017) 490-495.*
- v. Bustamante, W. (2018). *Solar and lighting transmission in complex fenestration systems with perforated solar protection systems. 7th International Building Physics Conference.*
- vi. Chantal Basurto, J. H.-L. (2015). *Annual Performance Assessment of Complex Fenestration Systems in Sunny Climates Using Advanced Computer Simulations. Journal of Daylighting 2 (2015) 32-43.*
- vii. Costanzo, V. (2018). *Application of Climate Based Daylight Modelling to the Refurbishment of a School Building in Sicily.*
- viii. Diab, Q. H. (2017). *Daylight Quality in Healthcare Design, Daylight. Journal of Energy and Power Engineering.*
- ix. Kischkoweit-Lopin 2002. *Kischkoweit-Lopin, Martin. An overview of daylighting systems. Solar Energy, Volume 73, Issue 2, August 2002, Pages 77-82*
- x. <https://www.iesve.com/discoveries/article/3813/ten-key-daylight-and-electric-metrics>

Study of Environmental Impact of Municipal Solid Waste Disposal on Moje Nagar, Lohegaon

Ar. Pankaj Kotalwar

Dr. D.Y. Patil School of architecture, Charoli Bk. Pune

Email: pankajkotalwar@yahoo.com

Abstract: Solid waste dumps are spoiling the environmental conditions in developing neighborhoods like Moje nagar, Lohegaon which is facing miserable solid waste management crises due to rapid industrialization, urbanization and insufficient funding. Improper solid waste dumps are spreading different diseases in the study area. It is investigated during the research that due to rapid growth in population, increments in solid waste generation rate, management deficiencies, lack of legislative implementation and funding, the solid waste management systems of Lohegaon are not working effectively. As per outcomes of survey, lack of solid waste management in the neighborhood is resulting into infectious diseases, land and waste pollution, obstruction of drains and loss of biodiversity.

Keywords: Solid waste management, environmental impacts, land pollution

1.1 BACKGROUND STUDY

Solid wastes are the organic and inorganic waste materials such as product packaging, grass clippings, furniture, clothing, bottles, kitchen refuse, paper, appliances, paint cans, batteries, etc. produced in a society, which do not generally carry any value to the first users. Solid wastes, thus, encompass both a heterogeneous mass of wastes from the urban community as well as a more homogeneous accumulation of agricultural, industrial and mineral wastes. Municipal Solid Waste is consisted of garbage, ashes and residues, combustible and non-combustible wastes, bulky wastes, street wastes, biodegradable and non-biodegradable wastes, dead animals, construction and demolition wastes.

2.1 SOLID WASTE MANAGEMENT

Solid waste management is associated with the control of waste generation, its storage, collection, transfer and transport, processing and disposal in a manner that in accordance with the best principles of public health, economics, engineering, conservations, aesthetics, public attitude and other environmental considerations.

3.1 INTRODUCTION OF STUDY AREA

Moje nagar is a developing neighborhood of Lohegaon which is situated at the outskirts of Pune city. Area of Moje nagar is 0.15 Sq.km. Population of Moje nagar is 540. Population density is 3933 persons/sq.km. This research includes study of 117no. of residential & commercial buildings.

2.1.1. Aim: To study the impact of solid waste management on environment of Moje Nagar, Lohegaon.

2.1.2. Objectives:

- 1) To assess the existing conditions of solid waste management at Moje Nagar, Lohegaon.
- 2) To collect & to analyse the data of solid waste in Moje Nagar neighborhood
- 3) To evaluate the impact of waste on air environment, water environment & land environment

4.1 EXISTING SCENARIO SOLID WASTE MANAGEMENT IN MOJE NAGAR, LOHEGAON:

Due to unplanned communities and developments in major areas, environmental and sanitary conditions are becoming very complex. Due to lack of awareness and low income sources, dwellers are forced to live with unhealthy & unhygienic conditions. An improper solid waste management system is contributing to a worsening environmental degradation of the community.



Waste getting collected by private contractors which are charging for taking municipal solid waste.

(Source-Self observation)



Existing road side dumpsite at Moje nagar, Lohegaon

(Source-Self observation)

5.1. PROBLEMS IN EXISTING SOLID WASTE MANAGEMENT SYSTEM

Open dumps of municipal solid waste are creating serious negative impacts on environment in Lohegaon. Following negative impacts are being observed in Lohegaon due to open dumping of solid waste. Dust and filthy dirt, odour, rats and other vermin, leachate are serious threat to human health & sanitation.

5.2. SERIOUS ENVIRONMENTAL ISSUES IN STUDY AREA DUE TO OPEN BURNING

It was observed during the field visit that solid waste collected at the dumping grounds in burnt. The local dwellers keep complaining that burning of dumped solid waste is common practice and creating drastic air pollution as shown in figure (iii)



Incineration of solid waste in Moje nagar, Lohegaon.

(Source – Self observation)

5.3. EFFECTS ON THE ENVIRONMENT OF MOJE NAGAR BECAUSE OF WASTE DISPOSAL

Indiscriminate disposal of wastes in Lohegaon is very common, giving rise to such problems as, Public health hazards, Pollution due to smoke & Pollution from waste leachate and gas formation.

5.4 SOURCE OF DATA COLLECTION

A survey of 135 households was conducted to gather primary data of solid waste management at Moje nagar, Lohegaon.

No. of dwellings	Volume of waste	Approximate weight per dwelling	Total waste generated per day
102	Half bucket	2 Kg	102 kg
27	Full bucket	4 kg	108 kg
5	2 Buckets	10 kg	60 kg
			270 kg

Waste generation calculation based on sample survey = 0.27 Metric ton per day

(Source – Primary Data collected from sample survey)

Waste generation calculation as per CPHEEO guidelines

Table 8.44: Waste Generation Per Capita per Day

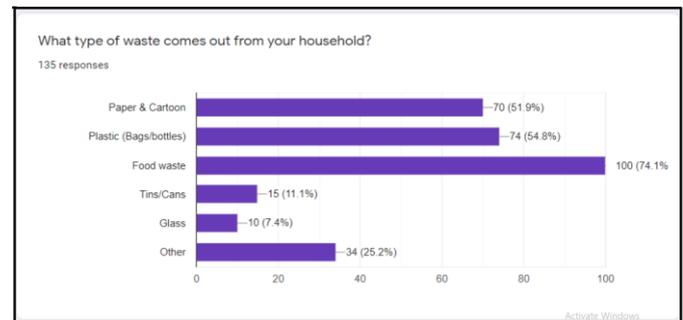
S.No.	Land use type	Estimated waste generation
1	Residential refuse	0.3 to 0.6 kg/cap/day
2	Commercial refuse	0.1 to 0.2 kg/cap/day
3	Street sweepings	0.05 to 0.2 kg/cap/day
4	Institutional refuse	0.05 to 0.2 kg/cap/day

Source: Manual on Solid Waste Management, CPHEEO – 2000

(Source: Manual on Solid Waste Management, CPHEEO – 2000)

5.4. ENVIRONMENTAL EFFECT

The pollution in Moje nagar, Lohegaon is associated with the solid waste practices through uncontrolled open dumping and partial combustion. The open dumping practices on the ground, which poses negative impacts on the human health and environment.



Many problems connected to this could threaten the ground water and surface water resources beside the spread of odour, insects, rats, smoke and gases resulting from the decomposition of waste.

Besides causing health disorders Lohegaon is facing adverse environmental effects due to inadequate & improper waste management.



(Source – Primary Data collected from sample survey)

5.4.1. Air quality impacts:

Burning of solid wastes in open dumps emit pollutants (gaseous and particulate matters) to the atmosphere. Environmental consequences of open burning are greater than incinerators, especially with respect to aldehydes and particulates.

Emissions from an uncontrolled incinerator system include particulate matter, sulphur oxides, nitrogen oxides, hydrogen chloride, carbon monoxide, lead and mercury.

5.4.2. Water and Land Pollution:

Lohegaon is facing a serious problem of very limited water resources. There are many possible sources for groundwater contamination, including open dumping grounds, septic tanks, domestic and industrial effluents.

Pollution of ground water can occur as a result of:

- the flow of groundwater through deposits of solid waste at dump sites;
- percolation of rainfall from waters solids wastes to the water table
- Diffusion and collection of gases generated by the decomposition of solid wastes.

5.4.3. Visual pollution:

The aesthetic sensibility is offended by unsightliness of piles of wastes on the roadside. The situation is made worse by the presence of scavengers rummaging in the waste. Waste carelessly irresponsibly discarded in public thoroughfares, along roads gives easy access to animals scavenging for food.

The solution to this social problem undoubtedly lays in the implementation of proper solid waste management & public education all levels.

5.4.5. Odour pollution:

Moje nagar faces nuisance from obnoxious odour due to the presence of decaying organic matter are characteristic of open dumps. They arise from anaerobic decomposition processes and their major constituents are particularly offensive.

5.4.6. Contribution to Climate change impacts:

Climate change is not only a major global environmental problem, but also an issue of great concern to developing country like India. Over the last 20 years, there is significant increase in temperature. The number of days with extreme high temperatures and days with extreme low temperatures are rising. More heat means more of our energy resources.

5.4.7. Effects on biodiversity:

Moje nagar is situated adjacent to a beautiful hillock called Khandoba Mal. Biodiversity is significantly reduced because of lack of management of solid waste at Moje nagar.

Poor waste management is harming biodiversity directly (e.g. contamination of soil) and indirectly (e.g. dumping grounds, which provide ideal conditions for bacteria that produce

methane – a potent greenhouse gas that contributes to climate change which leads to extension of species).

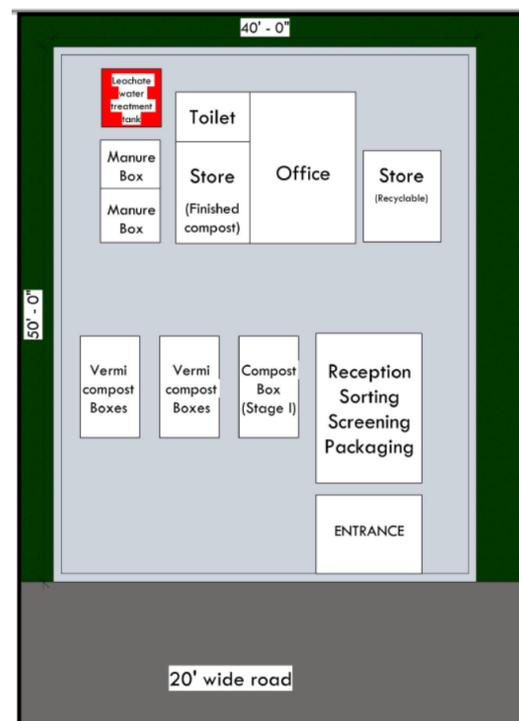
5.4.8. Effects on Public health of residents of Moje nagar, Lohegaon

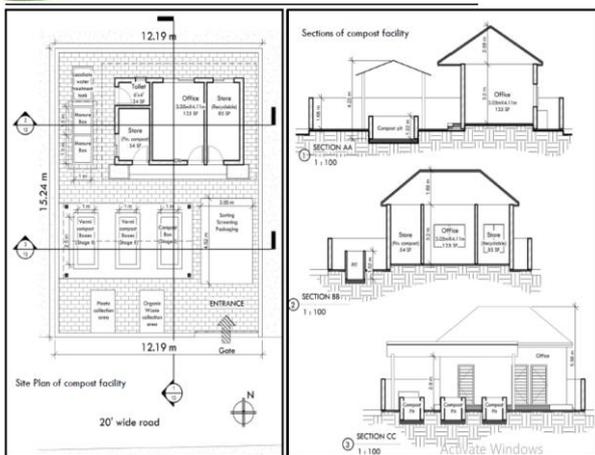
The waste in Moje nagar, is affecting rapidly as a result of increasing population and improving economic conditions in various localities. This increased volume of wastes is posing serious problems on health of occupants which is spreading diseases like Dengue, Malaria, Typhoid & other diseases which are disease caused by a family of viruses transmitted by infected mosquitoes.

5.1 RECOMMENDATIONS

Waste separation from the household level, proper storage, more efficient waste collection systems, and sustainable recovery and disposal practices are identified as needed processes in the study area. Efficient solid waste management plan consists of at source reduction and reuse, conversion of waste to energy transfer & decentralized Waste Management Systems

5.2 PROPOSAL





5.3 CONCLUSIONS

Over 50 Tons of kitchen & garden waste is produced per day at Moje nagar and other societies surrounding Lohegoan. This waste is accumulated in the form of dumping grounds on the roads. Some of the waste will be brought to a central waste treatment facility, at Porwal road, where it is incinerated.

The composting of the organic waste involves low effort and low cost. By treating the organic waste in a decentralised manner, the residual waste volume can be reduced. less waste has to be incinerated. This leads to reduction in emissions along the entire process. As the output of composting processes, compost can be used as input for the gardens.

6.1. References:

- i. George Tchobanoglous, Hilary Theisen, and Samuel A. Vigil, "Integrated Solid waste management" McGraw Hill edition.
https://books.google.co.in/books/about/Integrated_Solid_Waste_Management_Engine.html?id=5JSAAAAMAAJ&redir_esc=y
- ii. 2) Davis & Cornwell, "Introduction to environmental engineering" Second edition, McGraw Hill

<https://www.amazon.in/Introduction-Environmental-Engineering-Mcgraw-hill-Civil/dp/0073401145>
- iii. 3) Mohammad Aljaradin & Kenneth M. Persson "Environmental Impact of Municipal Solid Waste Landfills in Semi-Arid Climates – Case study – Jordan 2012

<https://benthamopen.com/ABSTRACT/TOWMJ-5-28>
- iv. 4) Municipal solid waste management in India: a review and some new Article in International Journal of Civil Engineering and Technology · February 2014

https://www.researchgate.net/publication/260230170_MUNICIPAL_SOLID_WASTE_MANAGEMENT_IN_INDIA_A_REVIEW_AND_SOME_NEW_RESULTS
- v. 5) The Concept of Waste and Waste Management Ebikapade Amasumol & Jim BairdI School of Engineering and Built Environment, Glasgow Caledonian University, Glasgow, UK

https://researchonline.gcu.ac.uk/ws/portalfiles/portal/26876389/64728_232860_1_SM_1_1_.pdf

Post Disaster Site Management

Ar. Neha Thosar

Allana College of Architecture Pune India

Email: (thosar.neha3350@gmail.com)

Abstract: India covers 58.6 % of land mass which is prone to earthquakes of moderate to very high intensity. The very first step that is needed in any such situation is providing the immediate response to the victims. The National Disaster Management Authority was founded in 2005 with the strategies for site management unrefined. This Research paper aims at studying the Government guidelines put forth by National Disaster Management Authority (NDMA) and proposing the refinement needed in designing the protocols when it comes to the site management needed for the Immediate Response of the situation and for the victims. Gujrat, being an exceptional state having some site management strategies as per their State Management Plan, a case study of 2001 Kutch Earthquake is studied and analysed. The research will be analytical and theoretical and will conclude with the refinement done in the guidelines which will be helpful in earthquake disaster for site management.

Key words – Post Disaster, Guidelines, Earthquake, Immediate Response, Site Management, Analysis

INTRODUCTION

Disaster management is the management of resources and responsibilities for dealing with all humanitarian aspects of emergencies in particular preparedness, response and recovery in order to lessen the impact of disasters. The post disaster situation is the recovery and rehabilitation of all the victims and the living system as before. This post disaster situation is divided into two sections: 1. Immediate Response to the victims, site and providing all the help they need. 2. Rehabilitation which is a long term and time consuming process to rebuild all the living system that has been destroyed.

Among the entire disasters earthquake occurs up-to 43% compared to other natural disasters that happen in India as per the National Seismic Data base. Other disasters are: Floods-27%, Drought-6% and Cyclones-24 %. [xi].

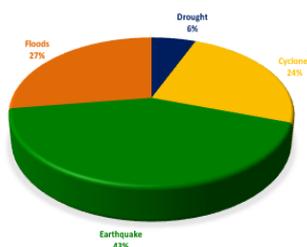


Figure -1 Natural Disaster Occurrence

Site Management is one integral part of the entire immediate response handling in post disaster situation as a first step towards recovery. Site Management includes many aspects such as providing food supplies, shelter, medical facilities, Clothing, emergency medical care units, disposing debris, setting tents, camps or temporary roof for all, providing toilet and kitchen facilities in them and so on. This involves the entire managing of supplies and also a co-relation between governing and other non-governing bodies.

Whenever a disaster happens a certain policy, guidelines are put-forth by the National Disaster Management Authority that are followed. Some liberty is given by them to the individual state which makes a different set of guidelines for the State itself.

These policies and strategies helps one understand the situation on how it should be handled, what are the recovery points. These guidelines state the rehabilitation process for rebuilding the structures. These policies need a refinement for having another set of guidelines or policies which are strictly for the immediate response to the situation. This will help to reduce the delays that occur on the site.

For any post disaster situation many Agencies, Government Bodies, NGOs, Doctors, Nurses, Local people (who are able to and are willing to help in recovery process) come together to make it all stand again. This situation creates a kiosk and miss-communication between them which states the need of having a certain strategy that is completely focused on immediate response to the site as a part of site management. [iv].

The aim of this paper is to put forth points as strategies regarding site management in immediate response context after studying the past incidences with the help of interviews and the guidelines. This will add a refinement to the existing system and hence will help in reducing the time factor on site.

For this, site management for Kutch, Gujrat is studied from many research papers. Surveys and interviews of the people who have experienced earthquakes and have worked on sites are conducted. A comparative analysis is done for Kutch and other sites and with respect to time factor. These studies will

prove the need of site management policies for immediate response.

The study is focused on the earthquakes among all other natural disasters and is limited on immediate response to the situation. Long term rehabilitation is not considered as National Disaster Management Authority already have a set of SOPs.

LITERATURE REVIEW

Uncountable research is already done and is being done on disaster management although recovery is a complex part of the study that comes into picture. Many research are still being conducted on different stages of recovery one of which is immediate response.

A paper by Dr. Malcolm E. Baird – The Recovery Phase of Emergency Management [1], refers to the emergency management and short as well as long term recovery phases. The paper questions whether the recovery phases are neglected or not. It concludes with more focus on planning which eventually reduces the need of recovery phase.[iii].

Another paper by Pramod Patil – Disaster Management in India [2]; This paper highlights the disaster profile of India and the management for it. It also talks about the approach government have taken for the recovery process.[vii].

Gujarat Earthquake Management Plan, Gujarat State [3], a book for earthquake management plan that explains the recovery phases, emergency response centers and other factors regarding earthquakes. The report also states the SOPs followed by the Gujrat State, relocation and management done on site in the first stage of post disaster situation.[x].

NDMA, National Disaster Management Authority – National Disaster Management Guidelines for Earthquakes, 2007 [4], refers to the guidelines for earthquake management, mitigation programs, and earthquake resistant reconstruction framework. It describes the retrofitting and building codes, safety codes related to the earthquakes and reconstruction.[ii].

Amy Javernick-Will and Bernard P Amadei – Post Disaster reconstruction: Lessons from Nagapattinam district, India [5], talks about the infrastructure, housing quality and problems faced by the district after the disaster. It also states about the kiosk on the site and lack of immediate response management.[i].

METHODOLOGY

To understand the site management for post disaster situations in India, Interviews of the people who have been victims of earthquakes and also of the people who have worked on such sites in different roles. A random survey is conducted to understand the time frame and response from people. Many online interviews are conducted of people who

are working at different disaster management cells. This helped in understanding the need of the proposals in depth as well as many aspects which gets neglected on the site and in management. Analysis of all these surveys and interviews are done with the help of charts, graphs etc.

HISTORY OF SITE MANAGEMENT TILL DATE

India covers almost entire area that comes under the earthquake prone zone as per the updated zoning data by the seismic department of India. The National Disaster Management Cell was founded in 2005, from which the management concept came to rise. The situation of sites after any earthquake disasters was in a devastated condition till then. The doctors on site had to put open air OTs as no availability of tents was there. The history of mismanagement for post disaster situation is been in continuation till date. Few interviews were conducted of people who have worked on post earthquake sites of different sectors at different times. After the major earthquake incidences like Latur, Maharashtra and Kutch, Gujarat the Disaster Management Committee came into existence in 2005. Since then no such major earthquake incident have occurred. This management becomes a part of the ‘Preparedness’ which makes and keep the system polished for immediate recovery if any such incidences happens in future.

As per the four interviews conducted from doctors and volunteer workers on Latur and Kutch site, a few common points has been noted, some of which have been taken in the management guidelines and some of which will lead to the betterment of the site conditions. [xii].

Description	Rating
Communication	
Shelter Facilities	
Coordination between Teams	
Financial Help	
Site Clearance	
Basic Facilities (Toilet, Kitchen)	
Waste Management	

Table- 1 Rate Chart

The above table clearly states the site conditions on Kutch and Latur site for the immediate response. The points mentioned above were of major concern as found from the interviews.

NATIONAL DISASTER MANAGEMENT GUIDELINES

The National Disaster Management Guidelines are designed by studying the frequency, type, zones of a particular disaster. Each disaster and its strategies with respect to the four steps of disaster management, i.e. Preparedness, Response, Recovery and Mitigation.

The guidelines in NDMA categorize the levels of disasters into L0, L1, L2 and L3 based on the ability of various authorities to deal with them.

L0 – normal times utilized for closed monitoring, documentation, prevention and preparatory activities.

L1 – Disasters that can be managed at district level.

L2 – Which requires assistance and participation of state.

L3 – Large scale disasters where state and district requires assistance from central, stakeholders for rescue, recovery and response measures.[ii].

STATE DISASTER MANAGEMENT GUIDELINES

Every state in India have set up a SDMP, i.e. State Disaster Management Plan on the basis of previous disasters, infrastructure, and priorities. The vision behind these plans is to build a safe and disaster resilient state with the use of technology, prevention measures and actions for timely, dynamic and integrated response as well as a speedy recovery regime. The plan describes the roles and responsibilities of state, district and local authorities.

This involves a good operation procedure for pre, during and for post disaster phases in a smooth and integrated manner within an acceptable timeframe.

An efficient resource management has been setup for any upcoming manjor earthquake incidences every happened in future. One more objective of SDMP is to have a well structured command, control and communication between all the stakeholders and the government bodies.

The response measures are well taken care of in the plan to make the emergency management more effective. Changes are done as per every year's record of disasters which upgrades the plan every time.

The SDMP have assigned supervisors and group-in-charge, who assigns resources, report the progress of operations and status of resources, resolve problems within the division, record the activities performed on site. Single resource leader is appointed to take charge of necessary equipment and supplies, take any orders given by the supervisor.

A strike team/task force is appointed to ensure communication and maintain records, perform any other duties.[xi].

SITE MANAGEMENT

Site Management is a part of immediate response to the incident. This involves site clearing, debris removal, clearance of site for camps, setting up medical facilities, temporary residences, rescue, managing deceased after the occurrence, supply of food, clothes, providing temporary kitchen and toilet facilities, making access for rescue teams, doctors, volunteers, temporary residences for all, handling the destructed situation of sanitation, water supply, rebuilding these MEP facilities for temporary living, evacuation routes etc.

Figure- 2 Seismic Zones of India



The contribution towards these tasks is of 20 % by the government bodies and 80 % of others (NGO Volunteers, Army, Doctors, Supervisors and other helping hands).

As noted from the interviews of people worked on previous incidences the tents installation and basic living facilities are provided by the army. 70 % Medical Assistance, doctors, Nurses are appointed by the NGOs and 30 % by the government bodies. It takes 2-3 hours for any local governing bodies to reach on site after the confirmation of major earthquake is given by: IMD (Indian Meteorological Department), ISR (Institute of Seismological Research), NGRI (National Geophysical Research Institute), DEOC (District Emergency Operation Center).

All the state crisis committees, and task forces are to be activated by the confirmation and reach the site that has been allocated as per the zones made in state.

Making access to the site, removal of dead bodies, clearance of debris and setting up tents and medical facilities is the first step in site management which runs parallel to each other.

The tents setup by army is for the medical facilities for the injured and for the victims as well as for workers to live in.

Equipment and machineries are provided by the LMR (Collector of the certain district). NGO volunteers contribute their work to the removal of dead bodies, consolation and taking care of victims, setting up more camps if needed, providing food, clothing and supplies to the people on site.

A part of land is cleared for the cremation and death rituals by the families which are taken care of by the NGO volunteers and the army.

Financial resources are provided by the state to the LMR which at the time of incidence is supplied as required. As per

the plans supervisors and group-in-charge are assigned with the tasks by LMR and are expected to report every activity on site that is being carried out.

Post Disaster site management further needs clearance of a large area of land to erect the semi-permanent structures. The counting of people and death count is taken by the army as well as by the governing bodies on which basis the semi-permanent structures are built and hence the resources are managed. [iv].

FACTORS FOR EFFICIENT WORKING

The site management is a crucial part for any post disaster situation. A proper hierarchy in the teams and coordination in between governing and non-governing bodies plays a vital role.

For Communication: Extracting information from the table and interviews, there could be a coordinator, in between the supervisors of government bodies and Heads of the NGO volunteers. This will help in the improvement of communication on the site. These coordinators will be having communication equipment, contact list for all the experts required on field such as doctors, nurses, volunteer heads, government supervisors, army volunteers, machine handlers, suppliers etc.

These coordinators can be appointed at different locations on site as per the given data by GIS. The area of incident can be divided into different groups, a team of governing bodies, NGO volunteers, army, doctors etc.

For Shelters: New technology can be adapted for the shelter facilities as per the climate zones of the country which have been used at many different temporary sheltered places.

This will reduce the time taken for the installation of tents on site as compared to the temporary methods. New technology will also help to keep the tents intact for any after-shocks, after earthquake rains, drought etc. This technology can also provide good toilet and kitchen facilities which can be put-up in no time. Different colour tents can be made available for different purposes such as medical, living, kitchen and toilets as shown:

Description	Colour code
Medical Facilities	
Residential	
Emergency Medical Facilities	
Toilets	
Kitchen	

Table -2 Colour coding

New Equipment: Walkie-Talkies can be given to the coordinators for quick communication in between themselves.

For Toilets and Kitchens: For every group of 10-20 people, two toilets and one kitchen tents can be installed which will provide basic facilities and food until the semi-permanent structures are built.

Kitchen tents can be of different design which is safe from fire and have some amount of storage for cooking. The group of people, their living shelters and the toilets and kitchen provided for those group can be put up in an organized manner separate from other such groups which will help in improving communication, reporting of each every single person as well as of the injured. The same group system can be applied to the injured and the medical tents.

Few of the toilet and kitchen tents with cooks can be put up for the doctors and the volunteers. Improving this systematical way can help women volunteers to feel safer on site in such post disaster situations.

For Waste: Many times the disposal facilities are used for solid waste. However, these systems are not big enough for people and that too for days. In this case, traditional methods of pit toilets can be helpful. This will need a team and secluded area with pits especially for the toilets little far from the living shelters. These pit system can be also helpful in food or kitchen waste which reduces the amount of waste on the surface. This system being degradable is definitely environment friendly.

CONCLUSION

The points covered in the interviews of experts, doctors and volunteers are noted and analyzed by discussions with them which concludes the following factors as an addition to the plan. This will help the site management to run quick, smooth and communication efficient. The site will have a fast running team, with people from various places and positions which adds to the value of team management. A certain hierarchy is required for taking all the volunteers together. With such minor additions the site management will be completely efficient anywhere in the country.

ACKNOWLEDGEMENT

I would like to express my deep sense of gratitude from the bottom of my heart to my guide Ar. Prachi Aiyer for her valuable guidance, inspiration and encouragement. Her keen and indefatigable indulgence in this work helped me to reach an irreproachable destination.

REFERENCES

- i. Amadei, A. J.-W. (n.d.). *Post Disaster Reconstruction :Lessons from Nagapattinam District, India.*
- ii. Authority, N. D. (2007). *National Disaster Management Guidelines for Earthquakes.*

- iii. Baird, M. E. (2010). *The Recovery Phase of Emergency Management*.
- iv. Col. Supnekar Sir, Y. (2021, February 27 th). *Site Management*. (A. N. Thosar, Interviewer)
- v. *India today*. (n.d.). Retrieved from Magazine Cover Story: <https://www.indiatoday.in/magazine/cover-story/story/20010212-gujarat-earthquake-tragedy-strikes-gujarat-as-india-celebrates-52nd-republic-day-775757-2001-02-12>
- vi. Organization, W. H. (n.d.). *Gujarat Earthquake Relief Mission*.
- vii. Patil, P. (n.d.). *Disaster Management in India*.
- viii. Prevention, C. f. (n.d.). *Disaster Site Management*. Retrieved from National Institute for Occupational Safety and Health: <https://www.cdc.gov/niosh/topics/emres/sitemgt.html>
- ix. *Seismic Data of India*. (n.d.). Retrieved from Seismic Maps of India: <https://www.mapsofindia.com/maps/india/seismiczone.htm>
- x. State, G. (n.d.). *Gujrat Earthquake Management Plan*.
- xi. State, M. (n.d.). *Maharashtra State Disaster Management Plan*.
- xii. Thosar, D. (2021, February 24). *Tent Facilities* . (A. N. Thosar, Interviewer)

Study of Environmental Awareness And Environmental Attitudes Among Students

Minal Lonare, Prof. Archana Gaikwad

College of Architecture, Bharati Vidyapeeth (Deemed to be University), Pune

Email: minallonare@gmail.com

Abstract : It is quite evident that the environment has undergone serious degradation in the past few decades. The degraded environment quality affects the humans directly or indirectly in the form of loss of lives, resources, property, spread of diseases and so on. Thus, the conservation of Environment is necessary which can be achieved with the knowledge of the importance of Environment and its protection. Thus, the intent of this study was to analyse the level of environmental awareness and attitudes among the students. A questionnaire was prepared and total 107 responses were administered. Environmental awareness questions were analysed through the points scored by the students and the Environmental attitude questions were analysed through the five-point Likert scale. Along with this, the student's participation in activities was also analysed. The results for awareness were found to be moderate to high but in spite of such knowledge the participation level was low. The attitudes were found to be on the positive side of the scale among the majority of the students.

Keywords: Environmental awareness, Knowledge, Environmental Attitudes, Participation, Environment Protection, Education

I. Introduction

All the living and non-living objects are included in the Environment. Man is an important part and parcel of the environment. We use the environmental resources like air, water and land to meet our daily requirements and needs. The near total dependence of man on the natural environment for food, shelter and security gave rise to feelings of respect towards the environment. The 19th century industrialization brought about an unprecedented alienation of man from nature. The development in technology has a considerable effect on the depletion of Environmental quality and resources. Some of the problems caused by our own actions include air pollution, water pollution, land degradation, wildlife extinction, deforestation, loss of biodiversity, etc. Whilst fulfilling our ever-growing requirements, we put tremendous pressure on the environment and when the pressure exceeds the carrying capacity of the environment to repair or replace itself, it creates a serious problem of environmental degradation.

Human interventions have degraded the environment quality at an alarming rate. Hence Environment Sustainability has become the need of the hour which can be achieved by Environmental education, Knowledge and awareness. Thus, this dissertation aims "to analyse the level of environmental awareness and environmental attitudes among the students."

India is a country with a population approximately 1.21 billion people (Source: Office of the Registrar General & Census Commissioner, India, Ministry of Home Affairs, and

Government of India Census Info 2011). The Youth constitutes nearly 40% of the total population of India. Youths are full of ideas, energy and passion and have potential to bring about meaningful change in social behaviour and attitudes. If educated properly, the youths can embrace good practices. Thus, the youth population who have completed their class twelve education and currently pursuing further education are selected as the sample for the study.

(Source: Ministry of Youth Affairs and Sports, GOI)

II. Material and Methodology

The literature review was conducted to study the various concepts related to Environment and to derive the parameters for the survey questionnaire.

Environmental Awareness

Environmental awareness can be understood as being aware of the natural environment and making choices that do not harm or degrade the natural environment. If we use any natural resource beyond its limit of regeneration, we will lose the resource forever. This is where Environmental awareness comes into picture. Environmental awareness implies not only being knowledgeable about the environment, but also being acquainted with sets of values, attitudes and skills for addressing environment related problems (Abbas & Ripudaman Singh, 2014). Environmental awareness can be spread by Environmental education as well as induced public participation in Environment protection.

Environmental Attitudes

Whereas Attitude is the way in which a person feels about something or someone. "Environmental attitude has been defined as a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour". Attitudes are a latent construct and as such cannot be observed directly. Thus, rather than being measured directly, attitudes have to be inferred from overt responses; in (Milfont & John Duckitt, 2010) by (Himmelfarb, 1993).

Environmental Issues

Several issues are being faced but only a few were considered for the study, keeping in mind the profile of the respondents. Since the respondents were students belonging to varied geographical locations in the country, no city or region-specific issues were identified. Only those issues with major

environmental concern ‘globally’ were considered for this study. The environmental awareness and knowledge section consisted of questions related to the below mentioned issues only. These issues include:

- Global warming and Climate Change
- Air pollution
- Water pollution
- Land pollution

The methodology followed preparation of a survey questionnaire based on secondary data through Literature review. With the help of the data collected on, certain parameters were shortlisted for the preparation of survey questionnaire which included-

- Personal information Section
 - Name, Age, Gender, Academic disciplines, educational qualification, etc.
- Environment awareness and Knowledge section
 - Global warming, Climate change and Air, Water & Land pollution
- Environmental attitude section
 - Based on daily routine habits of individual
- Voluntary participation/ involvement in Environment protection activities

The questionnaire consisted of knowledge-based questions to measure awareness, 5-point Likert scale questions to measure attitudes and questions on the involvement of students in environment protection and conservation activities. After the questionnaire was designed, it was circulated ‘online’ among the students fulfilling the criteria of pursuing education and the age limit of 18 to 29 years. The questionnaire was circulated through social media platforms only. The portal of online survey questionnaires was kept open for responses for two weeks, from 26th October 2020 to 8th November 2020. After the Online survey was completed, the data was analysed through the graphs and charts generated manually and online in google forms.

III. Results and Tables

Profile of the Respondents

Total 107 Sample were involved in the study.

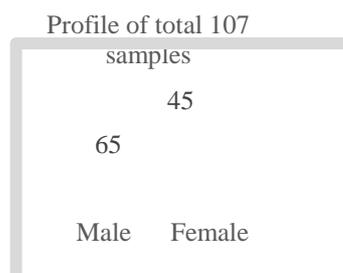


Figure 1: Gender profile of respondents

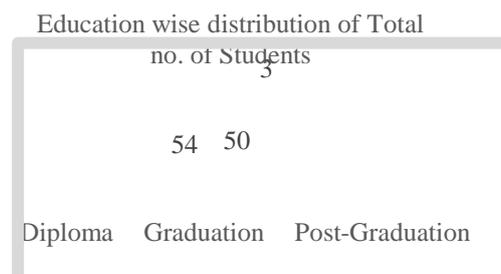


Figure 2: Education profile of respondents

To simplify the analysis process, the entire questionnaire data is divided following sections-

- Awareness (General Environmental knowledge)
- Awareness (Sign language knowledge)
- Attitudes
- Participation

Awareness (General Environmental knowledge)

The General Knowledge questions consisted of questions on topics like global warming, air pollution, water pollution and land pollution.

Maximum 26 points were to be scored by answering 16 questions. The points were allotted as per the difficulty level of each question.

Table 1: Analysis of Awareness (General Environmental knowledge)

	Total score	Score out of 26	Interpretation
Diploma	42.5 / 78	14.16	Moderate
Graduation	1021 / 1300	20.42	High
Post-Graduation	1084.5 / 1404	20.08	High
Index			
Interpretation	Low	Moderate	High
Score ranges	0 – 8.6	8.7 – 17.2	17.3 - 26

It is observed that Post graduation students have scored highest points followed by Graduation students. Diploma students have scored comparatively lesser points than the others.

Table 2: Analysis of Awareness (Sign language knowledge)

Awareness (Sign language knowledge)

Parameter	Diploma	Graduation	Post-Graduation
Sign Knowledge	8/15 (53.33 % correct answers)	162/250 (64.80 % correct answers)	190/270 (70.37 % correct answers)

Score out of 5	2.6	3.2	3.5
	Moderate	Moderate	High
Index			
Interpretation	Low	Moderate	High
Score ranges	0 – 1.7	1.8 – 3.4	3.5 - 5

It is interpreted that the sign knowledge is lesser among the Diploma students, moderate among Graduation students and highest among the post-graduation students.

Participation

- For the voluntary involvement, less percentage students selected ‘very active’ and ‘active’ while majority of the respondents selected ‘rarely active’ and ‘inactive’.
- For the willingness to learn about and engage in green behaviours and practices, majority of the respondents selected ‘willing’.
- For shopping items, majority of the respondents selected ‘Expensive- environmentally friendly items’ over ‘Cheaper- less environmentally friendly items.’

Attitudes

The attitude questions are based on the 5-point Likert scale where the sense of responsibility towards the environment is tabulated and shown at various degree from; *Always, Usually, Sometimes, rarely and Never*. In all of the questions mentioned below, ‘Always’ represents a very high sense of responsibility, ‘Usually’ represents high sense of responsibility, ‘Sometimes’ represents moderate sense of responsibility, ‘Rarely’ represents low sense of responsibility and ‘Never’ represents very less or no sense of responsibility at all.

After analysing all the environmental attitude questions, it was observed that majority of the students show positive environmental attitudes. Diploma student’s shows higher sense of responsibility towards environment followed by Graduation students and Post-graduation students respectively.

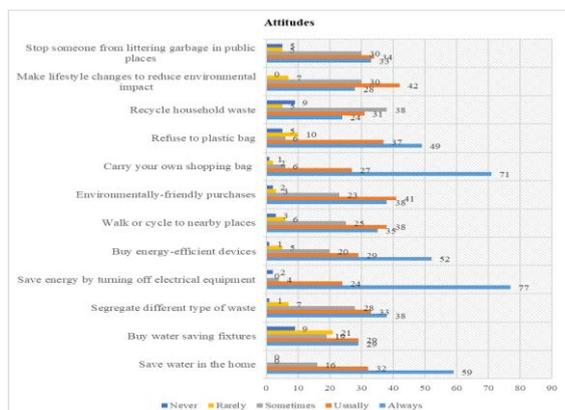


Figure 3: Chart showing Attitudes of the respondents

IV. Conclusions

The results of this study revealed moderate to high knowledge levels but in spite of such knowledge the participation level was low. The attitudes were found to be on the positive side of the scale among the majority of the students. A gap is observed between being aware and actually working towards it and this gap needs to be addressed. \

Acknowledgement

Special thanks to the institute’s faculty members for their valuable guidance and suggestions. I also owe my gratitude to my friends and colleagues for their constant support and encouragement which motivated me to complete my work.

References

- Abbas, M. Y., & Ripudaman Singh. (2014). A Survey of Environmental Awareness, Attitude, and Participation amongst University Students: A case study. *International Journal of Science and Research (IJSR)*.
URL- [HYPERLINK "https://www.ijer.net/archive/v3i5/MDIwMTMyMTg3.pdf"](https://www.ijer.net/archive/v3i5/MDIwMTMyMTg3.pdf) A Survey of Environmental Awareness, Attitude, and Participation amongst University Students: A Case Study
- Aminrad, Z., Sharifah Zarina binti Zakaria, & Abdul Samad Hadi. (2011). Influence of age and level of education on Environmental Awareness and Attitude: Case study on Iranian Students in Malaysian Universities. *The Social Sciences* 6 (1): 15-19.
URL- [HYPERLINK "https://pdfs.semanticscholar.org/ee4e/c9f5f3ffd9055e560272a832050c46ef10bb.pdf"](https://pdfs.semanticscholar.org/ee4e/c9f5f3ffd9055e560272a832050c46ef10bb.pdf) Influence of age and level of education on Environmental Awareness and Attitude: Case study on Iranian students in Malaysian Universities
- Aminrad, Z., Zakariya, S. Z., Hadi, A. S., & Sakari, M. (2013). Relationship Between Awareness, Knowledge and Attitudes Towards Environmental Education Among Secondary School Students in Malaysia. *World Applied Sciences Journal* 22 (9): 1326-1333.
URL- [HYPERLINK "https://www.idosi.org/wasj/wasj22\(9\)13/15.pdf"](https://www.idosi.org/wasj/wasj22(9)13/15.pdf) Relationship Between Awareness, Knowledge and Attitudes Towards Environmental Education Among Secondary School Students in Malaysia
- Anand, S. V. (2013). *Global Environmental Issues*. *Global Environmental Issues*. 2: 632 doi:10.4172/scientificreports.632.
URL- [HYPERLINK "https://www.omicsonline.org/scientific-reports/2157-7617-SR-632.pdf"](https://www.omicsonline.org/scientific-reports/2157-7617-SR-632.pdf) Global Environmental Issues
- Gifford, R., & Reuven Sussman. (2012). *Environmental Attitudes*. *The Oxford Handbook of Environmental and Conservation Psychology*.
URL- [HYPERLINK "https://web.uvic.ca/~esplab/sites/default/files/Gifford%20%26%20Sussman%202012%20.pdf"](https://web.uvic.ca/~esplab/sites/default/files/Gifford%20%26%20Sussman%202012%20.pdf) Environmental Attitudes

- vi. Guieysse, B., Cecile Hort, Vincent Platel, Raul Munoz, Michel Ondarts, & Sergio Revah. (2008). *Biological treatment of indoor air for VOC removal: Potential and challenges*. Guieysse et al. / *Biotechnology Advances* 26 (2008) 398–410.

URL- **HYPERLINK**

"<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.412.3577&rep=rep1&type=pdf>" *Biological treatment of indoor air for VOC removal: Potential and challenges*

- vii. Hasan, Z., & Sabiha Akhter. (2011). *Determinants of public awareness and attitudes on climate change in urban Bangladesh: Dhaka as a case*. *European Journal of Social Sciences*, 21, 154-162.

URL- **HYPERLINK**

"https://www.researchgate.net/publication/259104986_Determinants_of_public_awareness_and_attitudes_on_climate_change_in_urban_Bangladesh_Dhaka_as_a_case" *Determinants of public awareness and attitudes on climate change in urban Bangladesh: Dhaka as a case*

- viii. Milfont, T. L., & John Duckitt. (2010). *The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes*. *Journal of Environmental Psychology*.

URL- **HYPERLINK**

"https://www.academia.edu/22198365/The_environmental_attitudes_inventory_A_valid_and_reliable_measure_to_assess_the_structure_of_environmental_attitudes" *The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes*

Facilities Management of Interior Spaces in It Companies (Locker management system)

Ar. Swapnil Kanitkar

Ar. Zoher Siamwala

Email: swapnilkanitkar@gmail.com

Abstract: Facility management covers two main areas: 'Space and Infrastructure' (which includes planning, designing, lease, occupancy and maintenance of civil and interior infrastructure) and 'People and Organisation' (which includes catering, housekeeping and hospitality) which are commonly referred to as "hard FM" and "soft FM". A major role of a facilities manager is to ensure the usability, reliability, and safety of the asset being managed. The most frequent maintenance activities come under the carpentry section. This paper is about the cost and time analysis for retrofitting existing wooden pedestals/lockers to achieve more durable and user friendly pedestals. This paper also discusses the issues raised by the users of these pedestals. The cost and time analysis indicates that the pedestals can have a longer maintenance cycle with minimal cost input and also improve efficiency of the executive handling such issues by freeing up his time to focus on other issues.

Keywords: Facility management, carpentry, pedestals, user friendly, maintenance cycle, improve efficiency.

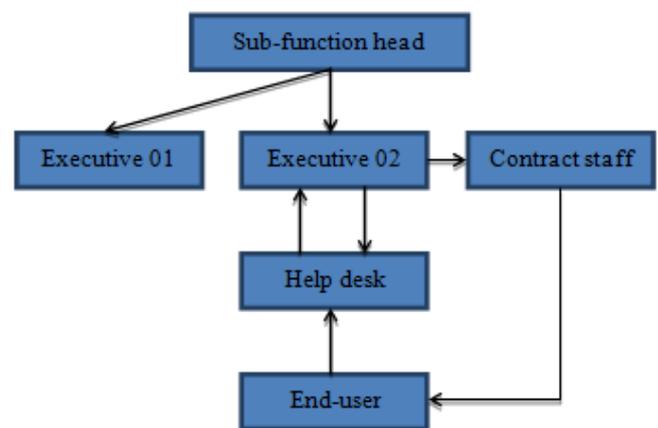
INTRODUCTION

Operations and maintenance (O&M) of a facility encompasses a broad spectrum of services and processes to assure that the built environment performs the functions for which it was designed and constructed. Factors like design, materials used/proposed, workmanship and function decide the time and type of maintenance needed during the lifetime of the facility. A facility manager's major time and effort is spent on monitoring and resolving complaints related to regular day-to-day operations while very little time is spent on strategy and planning of activities. Hence, if materials/products are selected such that they require minimum maintenance or have a longer maintenance cycle then the facility managers can use their spare time to focus on other activities.

1. Facility management team - The help desk, facilities team and contract staff are the main components of any facility management team. The facilities management team is entrusted with the responsibility of resolving various issues raised by any end-user and maintain a healthy work environment. All the complaints received by the helpdesk are routed to the concerned department executives for action initiation. The executive prepares a list of consumables as per the requirement of the job and prepares a job card. The concerned technician (carpenter/plumber/electrician/AC technician) is handed over the list of consumables and job card to complete the job. The technician along with the executive goes to the store and issues the consumables to the

technician. The balance stock of consumables is logged on daily basis and a detailed report is submitted to the sub-function head for monthly procurement. Upon successful closure of complaint the end-user signs on the job card OR the technician mentions any other requirements that need to be done to close the complaint along with a tentative date of closure on the job card and submits it to the executive for further processing. In case of an open complaint the executive ensures that all arrangements are done to close the complaint within the date stipulated by the technician. The executive updates the helpdesk with a report on weekly basis.

2. Components of a typical workstation - A typical workstation comprises of a work desk (working surface), soft board panels (to pin-up documents) and a pedestal (file/document storage unit) which are placed below the work desk in either corner. These pedestals come in a combination of 3 or 4 drawers with a lock on the top right corner. All the drawers can be locked together using a single unique key.



Flow chart explaining 'complaint closure process'

LITERATURE REVIEW

Security represents protection of life and assets. Ensuring safety of people and their valuables is very important for illegal handling. Many authors have presented their studies on various types of locks such as digital door locks, password based locks etc. which are being implemented to secure assets at homes, offices etc. The innovations are easily absorbed by furniture manufacturing companies while designing new pedestals/lockers but there is less focus on retrofitting traditional lockers with the new system.

One such study carried out by Salma Mohammed and Abdul Hakim Alkeelani – Locker security system using

keypad and RFID 2019 talks about a system which is a password and RFID based access control system which permits only an authentic person to unlock. The aim of this study was to put a formidable locker system free of errors.

Another study done by Arvasu Chikara, Pallavi Choudekar, Ruchira, DivyaAsija – Smart bank locker using fingerprint scanning and image processing 2020 keeps track of date, time and number of access that a user has made to the locker. The smart lock programme compares the user’s image and fingerprint with the data stored in the user base and after checking the authenticity of the user allows the user to access the locker.

An article by Louis W. Bender ‘No locks on lockers? It works!’ talks about getting rid of locks and provide a true experience for children to be trustworthy, responsible citizens of school. The objective was to permit the students to assume a personal as well as a group responsibility for the property of and eliminate the hours of professional and non-professional staff time that was dedicated towards assisting the students in the use, operation and maintenance of the lockers.

Another paper written by ShwetaChanda, Deepak Rasaily, PurnaKhulal – Design and implementation of a digital code lock using Arduino 2016 explains the use of Arduino (an open-source prototyping platform based on easy-to-use hardware and software). It allows the user to unlock if the password matches the one stored in the internal memory. The lock can be used for ATMs, main door of houses, lockers, offices etc.

A paper ‘Authenticated secure bio-metric based access to bank safety lockers’ by Srivatsan Sridharan focuses on providing a secure, authentic and user-friendly mechanism for both the user and the bank’s manager in all the operations pertaining to the safety of lockers. The main feature is a two-level authentication required to access the locker (the system operates using the concept of dual keys as per the current market practice).

Locker security systems can be classified based on the technology used such as (a) Password based, (b) Biometric based, (c) Smart card based, (d) RFID based.

a. Password based system – It is a programmable electronic device which operates only with the correct entry of predefined digits.

b. Biometric based system – It is based on fingerprint recognition and operates on the image of the fingerprint of the user stored by the system

c. Smart card based system – This type of system permits the authorized user to access the asset without a key by using a smart RFID. Total control of the activity is performed by the micro controller.

d. RFID based system – In this system the user has to place the tag in contact with the RFID detector which provides access to the user if the data matches with the registered data stored in the central server. It is usually used to track attendance of employees in an office.

METHODOLOGY

The traditional locking mechanism has two components i.e. the lock and the key. Each lock can be opened using the key that has been assigned to the particular lock. Thus the number of keys is directly proportional to the number of locks installed at a particular location. A table indicating the costs

involved in replacing the keys/faulty locks with new keys/locks along with the savings in time and efforts has been prepared based on actual data available with a facility management team of a reputed company in Pune.



Existing pedestal lock



Locking mechanism of existing wooden pedestal

1. Analysis

- The existing pedestal locks are operated using a single unique key which is handed over to the user post his induction.
- When the user resigns it is his responsibility to handover the key back to the help desk. If the user fails to submit the key then a new one has to be made for the next user.
- Many a times it so happens that the user tends to lose the key due which it has to be replaced.
- In case the pedestal is in unlocked condition then it is easier for the carpentry team to remove the lock and hand it over to the executive for making a duplicate key (case 01).
- If the pedestal is in a locked condition then the carpentry team has to make a lot of effort to first unlock the pedestal, remove the lock and then hand it over to the executive to make duplicate key (case 02). This also damages the pedestal. The following table shows the cost incurred to make duplicate keys in both cases.

Costs break-up (1 lot) – Case 01

Sr. no.	Description of work	Cost in INR
1	Labour cost for removing and reinstalling lock. CTC of carpenter Rs. 18,000/- per month considering 24 working days i.e. Rs. 750 per day for 8 working hours.	156
2	Cost for making duplicate key (1 lot of 5 keys)	150
3	Cost of fuel	100
4	Cost of Executive. CTC of store keeper Rs. 40,000/- per month for 24 working days i.e. Rs	312

	1,665/- per day for 8 working hours.	
	TOTAL	718

Cost break-up (1 lot) – Case 02

Sr. no.	Description of work	Cost in INR
1	Labour cost for removing and reinstalling lock. CTC of carpenter Rs. 18,000/- per month considering 24 working days i.e. Rs. 750 per day for 8 working hours.	235
2	Cost for making duplicate key (1 lot of 5 keys)	150
3	Cost of fuel	100
4	Cost of Executive. CTC of store keeper Rs. 40,000/- per month for 24 working days i.e. Rs 1,665/- per day for 8 working hours.	312
	TOTAL	797

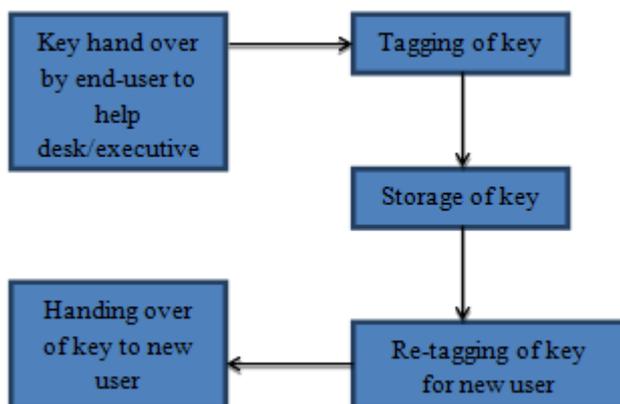
* 1 lot = 5 keys

*On an average the company has 75 nos. of keys that need to be made every month.

* Cost considered is for Pune location only.

In addition to the above costs there are some costs which cannot be calculated such as:

1. Time spent in cleaning, tagging, sorting keys handed over by the end user, storing them at a safe location and re-issuing them to the new user.
2. Duration for which the pedestal is left unsecured with the valuables of the user (such as chargers, power banks, ear phones etc.) as well as important documents.
3. On few occasions it so happens that the user hands over the key to the help desk/executive, but due to some urgent works in-hand the executive delays the tagging process or on some accounts the key may also get misplaced by the executive due to mishandling.
4. The keys are stored at a common location which is accessible to other contract staff also and they misplace/damage the keys while cleaning the store area or while handling/shifting other materials.
5. Also while unlocking locked pedestals there are chances of the lock getting damaged during the process and needs to be replaced.



Flow chart explaining ‘process of key hand over and re-issue’

2. Solution

An exercise was carried out which involved preparing a comparative statement for combination lock, access card lock and digital lock to understand the functional and commercial viability of each type of lock for carrying out the retrofitting process. Out of the three it was found that the combination lock was the most economical solution and involved minimal recurring costs post installation. Also the existing pedestals required minimal modifications to be done for installing the combination lock. Another advantage was that the lock can be unlocked using a single master key for a set of 30 locks. Also as these are mechanically operated locks they do not need electricity or batteries to operate, they also do not require the user to handle/manage keys as they can be locked/unlocked using a numeric combination.



Image of a combination lock

The following table shows the cost incurred to retrofit the existing locks with new combination locks.

Size of pedestal 300mm (W) X 600mm (H) X 450mm (D)

Sr. no.	Description of work	Cost in INR
1	Cost of combination lock (Ebco make or equivalent). (Bulk order of 500 locks)	290
2	19mm thick plywood for making shutter and shelf.	175
3	1mm thick external laminate for shutter.	100
4	Auto hinges for shutter (1 pair soft closing of Hettich make or equivalent).	300
5	Polishing of internal surfaces for shutter and shelf and polishing of shutter edges	165
6	Labour cost. CTC of carpenter Rs. 18,000/- per month considering 24 working days i.e. Rs. 750 per day for 8 working hours.	94
7	Deduction Scrap value of dismantled drawers (4 drawers in 1	-59

	pedestal)	
	TOTAL	1065

Cost of access card locks is Rs. 2085/-* per lock and cost of digital locks is Rs. 3595/-* per lock.

* Market research

Cost of modification to the existing pedestals i.e. item no. 2 to 7 remain the same.

This puts the overall cost for retrofitting existing pedestal locks with access card locks at Rs. 2332/- per pedestal and for digital locks at Rs. 3842/- per pedestal.

Over and above the costs mentioned above for access card locks and digital locks, they require batteries or electricity for operation.

CONCLUSION

The traditional pedestal/locker locks have been functionally and economically compared with the new combination locks. The combination locks have an edge over the traditional locks in terms of operation and maintenance. After doing the analysis and understanding the advantages it is found that retrofitting the existing pedestal locks with combination locks outweighs the current challenges being faced for maintaining the pedestals with traditional locks. This type of retrofitting can be adopted by other industries and institutions to reduce their operations and maintenance costs on existing locker systems.

ACKNOWLEDGEMENT

I would like to express my gratitude to my guide Prof. Ar. Zoher Siamwala for his valuable guidance, inspiration and encouragement. His keen indulgence in this work helped me reach an irreproachable destination. I would also like to thank all the team members of the reputed company in Pune who shared their data and valuable inputs at every step for carrying out my study.

REFERENCES

- i. Salma Mohammed, Abdul Hakim Alkeelani - *Locker security system using keypad and RFID*, 2019.
- ii. ArvasuChikara, PallaviChoudekar, Ruchira, DivyaAsija - *Smart bank locker using fingerprint scanning and image processing*, 2020.
- iii. Louis W. Bender - *'No locks on lockers? It works!'*, 2015.
- iv. ShwetaChanda, Deepak Rasaily, PrernaKhulal - *Design and implementation of a digital code lock using Arduino*, 2016.
- v. SrivatsanSridharan - *Authenticated secure bio-metric based access to bank safety lockers*, 2014.
- vi. Ebco website - www.ebco.in.
- vii. Vendors for market research.

Effective Communication in Construction Industry

Ar. Sameer Chouhan, Ar.Romeiro Silveira

M.Arch (Construction Management), Allana college of Architecture, Pune (2019-2020)

Associate Professor (M.Arch) Allana college of Architecture, Pune

Email: chauhansameer19@gmail.com, RomeiroSilveira@azamcampus.org, romeirosilveira@gmail.com

Abstract - The impact of effective communication in any construction organization cannot be over-emphasized as it determines project success. The study assessed: communication tools used in the construction industry, contribution of construction team to communication at various stages of construction work and the effectiveness of communication tools on construction project performance. The study also showed that client,

Architect, financial body and quantity surveyor communicate mostly at the brief stage while project

Managers, construction managers, engineers, contractors and builders communicate mostly at the technical stage. The study recommended that the framework developed should be used to determine communication pattern among construction team at various stages of construction for effective project delivery.

Aim: The main purpose of the study was to determine the lapses in communication and which leads to loss of time.

Scope: The study will focus mainly on where lapses in communication at planning stage.

Limitation: Research will not cover execution and on site operation.

INTRODUCTION

The construction industry is a dynamic and complex business. Accordingly, it is characterized with many challenges arising throughout the project lifecycle. The construction industry consists of many types of shareholders with different objectives, cultures and skills. They work together on multiple levels in order to achieve project objectives. Communication is a vital tool that is used to transfer information from one stakeholder to another. Effective communication only occurs when the process is completed successfully. The importance of effective communication is clear due to its impacts within the project as it can result in a negative or positive outcome

The Importance of Communication: Effective communication is vital to the successful completion of any construction project. Good communication can improve teamwork and lead to better project collaboration. Poor communication can result in misunderstandings, delays, and issues down the road.

Communication is simply the exchange of information in order to convey a message and good communication involves being able to

transmit your message so it is received and understood by the intended recipients.

Different medium of Communication

Communication medium is divided into two different categories:

1. Physical media
2. Mechanical media

Physical media - With physical media we mean channels where the person who is talking can be seen and heard by the audience. The whole point here is to be able to not only hear the messages but also to see the body language and feel the climate in the room.

Examples

- Large meetings, town hall meetings
- Department meetings (weekly meetings)
- Up close and personal (exclusive meetings)
- Video conferences
- Viral communication or word of mouth

Mechanical media - mechanical media we mean written or electronic channels. These channels can be used as archives for messages or for giving the big picture and a deeper knowledge. But they can also be very fast.

Methods of communication

Written Communication

- It refers to printed or recorded materials such as plans, contracts, memos, minutes of the meeting, requirement analysis document, design documents risk registers and other related written materials.
- It is used to provide well-thought and well-planned details, thus easily to be reviewed than verbal communication because everything that has been written cannot be altered right away. More so, it can be used for future reference.

1. Oral / verbal Communication

- It involves the exchange of message or information by using words verbally through face to face or telephone conversations.
- It is the most common type of conversation as it paves way to get feedback right after receiving the message.
- It is known to be spontaneous as well. In verbal communication, the ability to listen and think carefully before speaking is critical.

2. Non – Verbal Communication

- Non-verbal communication is sending information without the use of words. It is mostly through one's body language, gestures, eye-contacts, appearance, pitch and tone of one's voice etc. one can communicate huge amount of feelings and emotions.
- They say, "It is important to understand what has not been said explicitly".
- Non-verbal communication includes body-language, paralanguage (pitch and tone of voice), appearance etc

3. Visual communication

- "A picture is worth a thousand words". Visual aids such as animation, colour, illustration, graphs & charts, drawing, signs and logos immensely enhance written communication.
- Visual communication is also used in the right balance for making information sharing more effective and efficient.

Upward and downward communication

Upward communication is the process by which lower-level company employees can directly communicate with upper management to provide feedback, complaints or suggestions regarding the day-to-day operations of the company.

Advantages of upward communication

- Increases mutual trust
- Improves workplace procedures
- Helps managers identify areas for self-improvement
- Makes employees feel valued
- Creates an inclusive environment within an organization

In **Downward communication**- formal messages are conveyed to the employees via a chain of command.

Downward communication is basically the opposite of upward communication. It is the process of sending a message from the top level management to the employees.

Communication tools in the construction industry

i.Drawings

- Drawing of various types (architectural, structural, mechanical, electrical, services etc.) are main means of communication between construction team. Drawings are instrumental in communicating intention and requirement of client to project team.
- Drawings for construction project are generally classified as scheme drawings and detailed drawings.

ii.Programme of Work

- The programme of work and construction of a building project is a common reference for predicting and qualifying communication performance.
- It involves the coordination of many complex human and material resources to ensure economy and efficiency.

iii.Site Photographs

- Photographs are used to send pictorial messages in the construction industry especially where difficulties have occurred.
- Colored photographs are preferred to black and white. The cleaner the details, the more information it would contain or reveal Photograph records very useful information, if any alterations or extension are carried out in the future and they also be of considerable value as evidence in legal action.

iv.Letters

- This is the most commonly used means of communication of information between the client and the consultants, between the consultants and the contractors.
- In writing a letter, the writer must make sure the receiver will understand the content and context, be concise and directed to the target audience or person.

v.Team Briefing

- This involves communicating to small teams of employees and giving them the opportunity to receive, discuss and feedback on issues that are relevant to the organization Such systems may be particularly appropriate for project-based organizations for overcoming the inherent difficulties created by the distributed nature of construction sites.

Barriers in communication

The following are the barriers to communication in the construction industry.

Lack of detailed drawings

- Inexperience of the site agents or Clerk of Works will lead to misinterpretation which can cause a lot of damages and change to the original design.
- Poor and horrible writing or lettering can mislead the Clerk of Works or other operatives.

Geographical location

- Poor recording of Bills of Quantity and omission of items or rates.
- Fear of the authority especially the senior staff can cause one of the junior staff to make mistakes during face-to-face communication.
- Inferiority complex of artisans and operatives can also lead to misinterpretation of information.
- A wrongly received telephone message is also a barrier.
- Nervousness is also a barrier because mistakes can also occur if the one delivering the message is not composed.
- Complexity of the job can also be a barrier if the job is not fully understood.
- Availability and level of technology can as well be a barrier if the job needs a sort of specialist to carry it out

Lapses in Communication

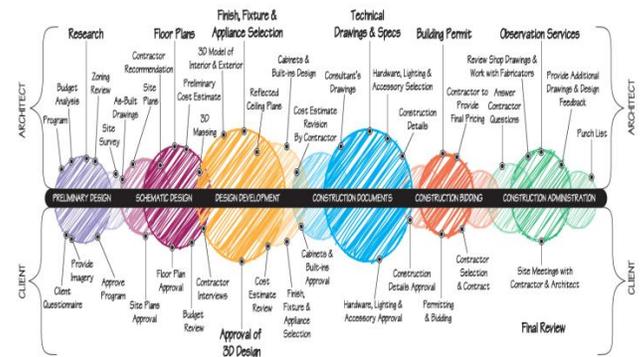
Poor pictorial representation: Many a times, jobs are described by sketchy, incomplete inaccurate and not well correlated drawings and charts, thus, they are much more difficult to be priced and constructed.

Poorly written materials: Badly written reports, letters, specifications, schedules and bills of quantity most times make it difficult for such projects to be completed on time and without disputes.

Semantic problem: The same word or sentence may mean different things to other people. For example, if a foreman tells one of his gang men to get something done “as soon as possible”, the gang man may not get it done until say after two days and then he will give the excuse of doing it “as soon as it is possible for him to get it done”.

Incompatibility: Individuals have diverse cultures, small groups, large groups through which they assimilate and interpret differently.

Office organization structure of design phase



CONCLUSION

Communication is important towards actualization of construction project to time, cost and quality. All construction participants have tool with which communication is disseminated to client, construction professionals and other stakeholder. Drawings and other communication tools play significant role in delivery of construction projects.

Its completeness or comprehensiveness would help in achieving quality required by client and other stakeholders. Communication also enhances team building and effective collaboration among construction professionals.

REFERENCES

- i. Akinra Dewo, O. F., Akinola, J. A. & Ojo, L. D (2017). A Regression Equation for Determining Completion Period of Construction Projects in Ondo State, Nigeria. *Journal of the Nigerian Institute of Quantity Surveyors*, 63, 13-23.
- ii. Aladeloba, A.E., Onukwube, H.N & Raheem A. (2010). *The effect of communication practice of construction companies on project performance*.
- iii. Calvert, R.E., Bailey, G & Coles, D. (2003). *Introduction to Building Management*. Butterworth - Heinemann. Oxford: Great Britain.
- iv. Cameron, D. (2000). *Good to talk?: Living and working in a communication culture*. Sage.
- v. Craig, R. T. (2001). *Communication*. In T. O. Sloane (Ed.), *Encyclopaedia of New York:Oxford University Press*.
- vi. *American Institute of Architects, 2008, The Architect's Handbook of Professional Practice, 4th Edition*
- vii. Dainty, A. Moore D. and Murray, M. (2006) *Communication in Construction: Theory and Practice*, Taylor and Francis.
- viii. Emmitt, S.; Otter, A. *Exploring effectiveness of team communication*. *Eng. Constr. Archit. Manag.* 2007, 14,408–419.

Risk Analysis and Risk Management in Residential Construction Projects

Ar. Gauri Patel¹

Allana College of Architecture, Pune, 2nd year M. Arch (Construction Management)

Email- gaurirasikpatel@gmail.com

Ar. Naziya Mistry²

Associate Prof. at Allana College of Architecture, Pune, M. Arch. (Construction Management)

Email- NaziyaMistry@gmail.com

Abstract: Risk management is a concept which is very popular in a variety of fields. Various firms often establish a risk management plan in their practice for upgrading the efficiency and increasing the gains. The undertakings in the construction division are very dynamic in nature, having a substantial budget, and thus eliminating and controlling risks associated needs to be a prime concern for every project manager. This paper presents an application of risk management in various stages of the project life cycle of a construction project. The aim is to study the awareness and practical use of risk analysis and management in order to find out how project information is being used in this process. Additionally, based on the interviews, the research depicts how risks impacts Time, Cost and Quality in the project.

Key words: Risk; Risk analysis and Risk management; Time; Cost; Quality

Introduction:

According to Project Management Institute (PMI), Risk management, is considered a crucial element and essential for project success. Construction projects are extremely complex in character, in which uncertainty arises from multiple origins. Risk management has hence become a core component of the management of construction projects, aiming to efficiently deal with unexpected events. The procedure facilitates risk neutral decision making, which in turn will result in superior performance. Systematic methods for obtaining more information about uncertainty on the project is needed to achieve that objective (Winch, 2010).

Aim:

To review risk management, from the point of view of the impact that risks have on Time, Cost & Quality construction industry, for Residential Projects.

Objectives:

- To identify the types of risk.
- To review the perception of RM within the construction industry.
- To review the impacts of risks on triple constraints- Time, Cost and Quality.

Need for study:

To achieve a systematic approach over control and eliminate accidents at work through risk management in residential projects. It is an important fundamental ingredient of any workplace safety system and comprises risks recognition, determination of control methods to terminate the risks time, cost, & quality related risks or diminish them to a minimum.

Research Design Structure:

a) Secondary Data

The nature of the topic dictates that the focus would be majorly on Secondary data that is collected.

Literature Review:

The conceptual skeleton in this study initially covers the basics of risk management in residential construction, the varying risk attitudes and impact on time, cost and quality.

b) Primary Data:

Carefully constructed questionnaires and interviews with design department, senior engineers, contractors, marketing dept, assistant engineers, accounts, quality department, quantity dept, project in charges.

•Part 1: Attitude towards Risk and the Risk Management

- i. Perception of risk
- ii. Most important phase of RM implementation
- iii. Most important Risks

• Part 2: Knowledge in Relation to Risk Management

- i. Impact of risks on time, cost and Quality
- ii. Provision of training
- iii. Lessons from previous ventures

c) Analysis:

- Statistical analysis for types of risks and impact on time, cost & quality.

Literature Review:

What is Risk?

Risk always exists when taking decisions based on presumption, expectations, and approximation of the time ahead. It characterizes situations where the actual outcome for a specific event or activity is likely to deviate from the estimated value (Raftery, 1994). Risk is manifold and can be analyzed in terms of deaths and injuries, sample of a people, in terms of probability and reliability or in terms of the possible effects on a project.

Uncertainty and Risks

The difference and interrelation between uncertainty and risk can be narrated as risk being quantifiable uncertainty whereas uncertainty is indeterminate risk. Uncertainty can be viewed as the possible occurrence of some circumstance where the chance distribution truly is undetermined, that is, uncertainty relates to the chance of a circumstance about which little is known other than the fact that it may happen.

Project Risk Classification

Risks may be segregated into various types or classes or categories, the critical aspects of these are:

Known risks: These risk events are frequently occurring in all construction projects and are inevitable, thus including minor fluctuations in material costs and productivity (Smith et al., 2006).

Unknown risks: It is the event of uncertainty in which someone may have information about the risk origin and probabilities but keeps the information to himself.

What is Risk Management?

The RM process includes the systemic application of management policies, processes, and procedures for the tasks of establishing the context, recognizing, evaluating, analyzing, treating, controlling, and communicating risks.

Purpose of Risk Management

- The gains from RM are not only exclusively for the project, but also for the people. The main motivation is clear recognition and awareness of possible risks in the project.
- Another benefit of application of risk management is increased level of power over the entire project and more effective analytic processes which can be based on a more authentic basis.
- It comprises of the basic phases: **recognition, assessment and analysis, and response**. All steps in RMP should be considered when handling risks, to efficiently implement the process in the project.



Image 1 Risk management process.

Source: <https://i0.wp.com/pmcenter.bellevue.edu/wp-content/uploads/2016/06/risk-management.png?fit=438%2C438&ssl=1>

Risk recognition

The recognition of risk is known as the most fundamental step within risk management cycle. The goal is not to get perfect forecast of events to come, but it is the recognition of prospective risk origins with great effect on a particular project, should they happen.

Risk Assessment

The next phase is to decide the importance of risks quantitatively, prior to response management. The goal in risk assessment and analysis is to narrate the risk situations as entirely as possible and to make them a priority. There are two fundamental categories segregated in the literature on risk assessment, qualitative and quantitative analysis.

Methods for Conducting Risk Assessment and Analysis

Bahar et al (1991) describes the first step in risk analysis and evaluation process as the collection of relevant data to the risk exposure, which might be historical data collected through past project experience by the contractor.

The utilization of a risk matrix is usually done when working with static risk, i.e., risks that only have negative effects. A choice of handling risk is made hinged on where the risk lies in the matrix. Each project specifies what type of risk is tolerable or intolerable and the colours are chosen with the project in mind.

• Qualitative Methods

Probability & assessment could be used to estimate the probability of a certain risk to occur. The risk to project goals is evaluated in terms of chances and beneficial impacts as well as threats and negative impacts. It is necessary to evolve and define the likelihood according to the specific project.

Quantitative Methods

Sensitivity analysis: The goal is to look at the sensitivity of most elements of the risk model on project output, by varying the values of one factor at a time and then representing them on the project.

Probabilistic analysis: It evaluates the effect of risks on project timeline and budget and it utilizes three-point evaluation such as worst-case scenario, most likely scenario, and finally best-case scenario for every task.

Risk Response

The third step in the process of risk management signifies what actions should be taken towards the various risks and threats previously recognized.

• Avoidance

Avoidance can be justified if the risk is evaluated to have extreme consequences that may need a re-examination of the entire project. One can use avoidance to cope with risk by changing project plans in a way that makes the risk irrelevant.

• Transfer

This response approach involves transferring the risks and consequences to third parties who are willing to accept responsibility for its management and the liability of the risk. It involves the utilization of insurance and contracts to transfer the liability to another party, for example by contractor to subcontractor and often involves payment of risk premium to the party that is taking on the risk and responsibility of the consequences (PMI, 2000).

• Acceptance

It is unworkable in truth to benefit from all opportunities and remove all threats to the project, but it is feasible to be aware of the threats and opportunities through the documentation and recognition of them. The utilization of this method is justified when it is impossible to deal with the risk by other strategies, or when the quantum of the risk makes

other responses defeated.

• Risk Monitoring

Continuous monitoring and review of prospective risks is an important regarding the implementation of the risk management process. It guarantees new risks are detected and managed. The project manager should monitor a list of the major risks that have been recognized for risk treatment action.



Image 2 Risk Response.

Source: <https://images.slideplayer.com/27/9043168/slides/slide>

Risks in Residential construction projects

Because of the character of the construction industry, RM is a very fundamental process. It is commonly used in residential projects that have higher levels of uncertainty. These types of risk investments are characterized by more formal planning, monitor and control processes in residential projects. The quickest way to spot risk is to evaluate and extract an inference from projects which tanked in the past. To make sure that the project objectives are met, the portfolio of risks associated with all actors across the project life cycle (PLC) should be considered. In later stages, RM applied systemically, helps to control those critical elements which can negatively project performance. In other words, to keep track of previously recognized threats, will result in early warnings to the project manager if any of the objectives, time, cost, or quality are not being met.

Finishing a project is not deemed as a victory for the project head. The success of a project relies on various factors; primarily completing the project within the budget and schedule with quality work and no safety issues.

The problem of cost overruns is widely encountered in the construction of the residential projects. When projects prolong, the contractor increases the speed of construction, resulting in a rise in cutting corners, leading to poor quality work.

Many residential projects are plagued by time overruns. These overruns differ from some months to 1.5 or more years putting the project feasibility in danger. Interviewees identified the bottlenecks, as below,

(i) Pre-execution phase

(ii) Execution phase

Hold ups in land acquiring, and handover is the main cause for time overruns in pre-execution. Various authority permissions from all agencies results in delay of Construction. Poor management results in ineffectual co-ordination and schedule hold ups. Unsuccessful management of Project scope change is commonly seen, accessibility of resources, specs, etc., are not received by the contractor on time. Rework is be carried for issues like extreme climate conditions, natural calamities, etc. Various kinds of cost overrun are seen in construction industry. Understanding the reason, lets us to classify course of action to navigate cost overrun. The reasons of cost overrun were initially inspected on the base of feedback from interviews. The reasons are listed on the base of probability, effect and significance.

—Slow-mowing decision making was the top cause with the highest chances of repeating and having a bad effect, making it the prime reason of cost overrun.

—Poor design came next in significance.

—Poor scheduling stood next

These ultimately impacted the quality of work of the project.

Risk perception

Risk catalog has been described as a combination of threat and vulnerability which occurs when the two conditions overlap. A threat is that which has an extreme repercussion on the tasks of a company. A weakness is distinguished by a system that, while not being dependent of any threat, lets a threat to be utilized.

Analysis

Application of the probability and matrix method

An online questionnaire was circulated as a follow up to the interviews. The main goal was to focus on the previously recognized risks, to put in a probability and matrix and show an example of an RMP method. The respondents were asked to evaluate the probability of the risk occurrence as well as the on time, cost and quality.

Based on the type of likelihood, a rating between 1 and 10 is allotted to the risk and the impact is rated between 1 and 5. This number is multiplied together with the rate of impact in order to get a result. This matrix is easy to understand and determine which action needs to be taken against an analyzed risk. All risks are ranked from least to most critical ones.

Finally, the results were combined in a table based on a matrix. Risks marked with red color, are those with the biggest negative on the project performance.

Results

No	Impact	Colour Code
1	Low	
2	Medium	
3	High	

Table 1 Legend

No.	Identified Risk	Factor	Probability	Impact	Matrix
1	Misunderstand the client	Time	4	3.5	14
		Cost	4	4	16
		Quality	4	3.5	14
2	Lack of cooperation between actors in the project	Time	7	4	28
		Cost	7	3.5	24.5
		Quality	7	3.5	24.5
3	Not finding the right contractor	Time	4	3.5	14
		Cost	4	4	16
		Quality	4	4	16
4	Contractor does not have enough knowledge or experience	Time	3	4	12
		Cost	3	4	12
		Quality	3	4.5	13.5
5	Material Miscalculation	Time	4	3	12
		Cost	4	5	20
		Quality	4	4	16
6	Shortage of Material	Time	5	4	20
		Cost	5	5	25
		Quality	5	5	25
7	Insufficient Buffers in scheduling	Time	7	5	35
		Cost	7	5	35
		Quality	7	3	21

No.	Identified Risk	Factor	Probability	Impact	Matrix
8	Scheduling Miscalculations	Time	4	3.5	14
		Cost	4	4	16
		Quality	4	3.5	14
9	Cutting corners (leading to rework)	Time	7	4	28
		Cost	7	4	28
		Quality	7	3.5	24.5
10	Lack of knowledge	Time	4	3.5	14
		Cost	4	4	16
		Quality	4	4	16
11	Inefficient Design	Time	6	4	24
		Cost	6	4	24
		Quality	6	4.5	27
12	Missing supporting details	Time	4	3	12
		Cost	4	5	20
		Quality	4	4	20
13	Inefficient Supervisor	Time	5	4	20
		Cost	5	5	25
		Quality	5	5	25
14	Extreme Weather (force majeure)	Time	7	5	16
		Cost	7	5	18
		Quality	7	3	8

No.	Identified Risk	Factor	Probability	Impact	Matrix
15	Changes by Client	Time	8	5	40
		Cost	8	5	40
		Quality	8	2.5	20
16	Delayed Approval	Time	7	5	35
		Cost	7	4	28
		Quality	7	2	14
17	Delayed Payment	Time	6	3.5	21
		Cost	6	3.5	21
		Quality	6	3.2	19.2
18	Labour Related Issues (accidents, lack of training, low productivity, etc.)	Time	4	2.5	10
		Cost	4	3.5	14
		Quality	4	4.5	18
19	Machinery Related Issues	Time	5	3.2	16
		Cost	5	4.8	24
		Quality	5	3	15

Table 2 Matrix of Results

Conclusion

The study depicts that risk management within the residential construction industry depends on 2 processes, experience and personal knowledge of individual project members and the explicit process described within the management system and in the internal documentation.

Risk management is, mainly used for budgeting the cost of uncertainties inherent to all residential projects, as cost overrun has a critical impact on residential projects. While this is not explicitly stated, it is evident in the actual use of risk management. Another purpose of risk management w.r.t to residential construction is to prepare backup plans to diminish risk sources, hence reducing the cost.

Risk is viewed as a negative term, despite the fact that in theory it can have two dimensions.

Risks are managed daily in the industry, but not as methodically as the literature states. Also other researchers have confirmed, the knowledge of RM and RMP is very to minimal, even if the idea of risk management is getting popular in the residential sector.

Respondents are willing to start using RM, but only if it brings in profits. By using the simplest of methods, it is possible to recognize apparent risks.

Additionally, it creates a possibility of detecting cost related risks, as they have the deepest impact on residential projects. Those risks should be terminated or dealt with, by taking an correct action.

The study shows that the most widely used response was risk

mitigation. It is realized that the results from probability and impact method vary in different projects because of the fact that every project, its quantum and its scope are unique.

Acknowledgment

I would like to express my sincere gratitude to my adviser Prof. Naziya Mistry for the continuous support of my study and related research, for her patience, motivation, and immense knowledge. Her guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better adviser and mentor for my research paper.

References

- i. PMI (Project Management Institute), 2004. *A guide to the project management body of knowledge: PMBOK*. 3rd edition. <http://www.physics.rutgers.edu/~ransome/muse/project/reference/PMBOK3rdEnglish.pdf>
- ii. Webb, A., 2003. *The project manager's guide to handling risk*. Aldershot. \
- iii. https://www.researchgate.net/publication/248345235_Alan_Webb_The_Project_Manager%27s_guide_to_Handling_Risk_Gower_Aldershot_2003_Hardbound_179_pp_5500_ISBN_0_566-08571-2
- iv. Winch, G., 2002. *Managing construction projects, an information processing approach*.
- v. <https://books.google.co.in/books?hl=en&lr=&id=z8bwas7GGEkC&oi=fnd&pg=PR13&dq=Winch,+G,+2002.+Managing+construction+projects,+an+information+processing+approach.&ots>
- vi. Raz T., Shenhar A.J. and Dvir D., 2002. *Risk management, project success and technological uncertainty*, R&D Management Blackwell Publishers. Vol. 32, No. 2, pp. 101-109
- vii. Raftery, J. (1994) *Risk Analysis in Project Management*, E & FN Spon (an imprint of Chapman & Hall), London and New York
- viii. <https://epdf.pub/risk-analysis-in-project-management.html>
- ix. Shri. B.S. Patil, D. P. (2011). *Factors Affecting The Cost And Quality Of Construction*. International Referred Research Journal , II (20), 1-3.
- x. Hillson, D. (2009) *Managing Risk in Project*, Gower Publishing Limited.
- xi. <https://www.pmi.org/learning/library/overall-project-risk-assessment-models-1386>
- xii. Kavuma, A., Ock, J., & Jang, H. (2019). *Factors influencing Time and Cost Overruns on Construction Projects*. KSCE Journal of Civil Engineering.
- xiii. https://www.researchgate.net/publication/331355520_Factors_influencing_Time_and_Cost_Overruns_on_Freeform_Construction_Projects
- xiv. Ahbab, C. (2012). *An Investigation on Time and Cost Overrun in Construction Projects*
- xv. https://www.researchgate.net/publication/338084319_An_Invstigation_on_Delay_Cost_Overrun_Quality_and_Health_and_Safety_Problems_in_Construction_Projects
- xvi. A.R.Vishweswar, S.Janani, M.C.Akilarasu (2020). *Study and Analysis of Time and Cost Overrun in Construction Sector*
- xvii. <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiAw9nbv5rvAhUGwzgGHUAhDDEQFjABegQIBhAD&url=http%3A%2F%2Fsersc.org%2Fjournals%2Findex.php%2FIJAST%2Farticle%2Fdownload%2F7258%2F4298%2F&usg=AOvVaw2eFXPHPM9ADNSVxyMQcAh>

Noise Pollution Due to Construction Activities

Ar. Mamta Wani

Guide: - Ar. Prachi Aiyer (mamta.phirke@gmail.com)

Abstract - Construction activity accounts for 23% of Noise pollution found in urban parts of the world. Any noise beyond 85 decibels (dB) is harmful whereas noise levels on construction sites often can exceed 90 dB and act as irritants to the neighbors. Neighborhood residents suffer with daily routine due to such noise pollution especially in the densely packed areas.

This research paper aims at studying the Noise pollution created due to various construction activities by a survey taken in Pune area. Study can be further extended to analyze strategies that can be followed to minimize impact of construction activity on noise pollution.

Key words: Construction Activities, Construction machineries, Noise, Noise Pollution, Public Response, Neighborhood impact

I.INTRODUCTION

Environmental Pollution is the biggest threat today not only for the mankind, but for the entire world as its causing grave and irreparable damage to the natural world and human society with about 40% of deaths worldwide being caused by water, air, and soil pollution. Researchers have studied these pollutions and have published papers. The area, which does not have its due focus, is Noise Pollution, which have many contributing factors. Out of all those, Construction Activity accounts for 23% and can be found in urban parts of the world.

Construction industry plays an important role in nation's economic development. The construction sector employs workers, creates new job, and increases revenue by trades in construction materials and services. Thus, construction industry has a significant contribution in Gross Domestic Product (GDP) growth rate. As one of the results of the rapid development of construction industry, noise has become one of the problems and affects the people involved and people surrounding such work sites.

As per Oxford Definition, noise is a sound, especially one that is loud or unpleasant or that causes disturbance. Noise is generally considered as undesirable sound and sound can be considered undesirable due to amplitude or volume of loudness, category of noise, occurrence time of the day and resonance created. Noise is regarded as a pollutant under the

Prevention and Control of Pollution Act, 1981 of

India (MoEF 1981Act).

Construction site generates noise with activities like demolition, excavation, building works, machinery involved, material unloading etc. The noise generated from such activities is found loud and irritant at times. Such activities generate noise exceeding the Occupational Safety and Health Administration's (OSHA) limit given of 90dB.[2] Continuous exposure to such loud noise can cause various physical, psychological, and mental illnesses. This hassle can affect the workers, as well as the residences, commercial complexes or school colleges surrounding the ongoing construction sites.

Therefore, this paper identifies the sources of noise pollution in building construction and the impact and effect of noise on the neighbourhood. The paper also suggests some noise control techniques that can effectively minimise noise on the construction sites, reducing the impact of building activities on the environment and Humans.

Aim & Objective: - The Aim of this research is to find out the Neighbourhood Impact of Noise Pollution caused due to construction activities. This Paper will help to create awareness among neighbouring people to construction sites. **Scope & Limitation:** - The Study and research is restricted to Pune City and places around.

II.MATERIAL AND METHODOLOGY

Questionnaire Survey: -

The construction noise pollution survey was done using the Questionnaire Survey Method for the age group of 10 to 70+ years.

The Google Form was created and circulated in Pune City. 163 people filled up the questionnaire from various areas in Pune Region. All the respondents have come across construction activity in last 3 years. The Questions were based on the People's experience to the Construction activities related noise. Questionnaire helped to understand the impact and effects of Construction noise on people's daily routine, on their health and well-being.

54.3% people were agreed that the construction process is Noisy and is disturbing for them to carry out their daily routine while as 24.1% people were strongly agreed to this.

Literature Review: -

Part of the data was collected by the doctrinal research. Various journals, Research papers and Articles were studied to understand the Construction Noise related issues.

Construction Related Noise Generators: -

1. Various Machineries / Equipments are involved at various stages of construction. Right from the Excavation until Finishes, various machineries are involved which help to carry out the work with lesser labours and at a faster speed by also achieving the required quality.
2. Labours Talks / yelling: - Some of the activities like Plastering, curtain wall installation, fixing trusses at sites involve laborers working at different heights. In such cases, the talk happens by yelling, shouting for the instructions.

Construction Activities

Noise Pollution due to Construction Machineries is a major hazard observed on Modern Construction sites where extensive machineries are used for the Speed and Quality. Noise generated from the heavy machineries and the power tools varies between 80dB to 120dB. OSHA states permissible noise exposure limit is 90 dBA (29 CFR 1926.52), whereas the American Conference of Industrial Hygienists has a noise threshold limit value of 85 dBA.

Below are the 10 loudest tools and 10 loudest tasks identified in surveys conducted on worksites.

(Source: Department of Environmental and Occupational Health Sciences, School of Public Health and Community Medicine, University of Washington) [3]

Table 1: Showing Loudest Tools

Tools	Average Noise Level (dBA)	Maximum Noise Level (dBA)
Welding/Cutting Tools	94.9	122.8
Other Hand Power Tool	95.4	118.3
Hand Power Saw	97.2	114.0
Screw Gun, Drill Motor	97.7	123.7
Roto hammer	97.8	113.5
Chop Saw	98.4	117.7
Rattle Gun	98.4	131.1
Stationary Power Tool	101.8	119.8
Powder Actuated Tool	103.0	112.8
Chipping Gun	103.0	119.2

Table 2: Showing Loudest Tasks

Tasks (Trade)	Av. Noise Level (dBA)	Max. Noise Level (dBA)
Installing Trench Conduit (Electricians)	95.8	118.6
Operating Work Vehicle (Bricklayers)	98.0	116.7
Operating Man lift (Operating Engineers)	98.1	117.6
Welding, Burning (Ironworkers)	98.4	119.7
Operating Scraper (Operating Engineers)	99.1	108.6
Demolition (Labourers)	99.3	112.1
Laying Metal Deck (Ironworkers)	99.6	119.9
Grinding (Masonry Trades)	99.7	118.6
Operating Bulldozer (Operating Engineers)	100.2	112.5
Chipping Concrete (Labourers)	102.9	120.3

Effects of Noise Pollution: -

The construction work is not a process, which finishes in a day or two. Construction activities go on for a longer span. The longer the exposure to the Noise, more are the health issues found.

According to the World Health Organization (WHO), excessive noise seriously harms human health and interferes with people’s daily activities at school, at work, at home and during leisure time. It can disturb sleep, cause cardiovascular and psychophysiological effects, cause heart attacks, reduce performance and provoke annoyance responses and changes in social behaviour. The overlooked threat of noise pollution can cause a number of short and long-term health problems, such as sleep disturbance, cardiovascular effects, poorer work and school performance, hearing impairment and more.

According to OSHA, Exposure to loud noise kills the nerve endings in our inner ear. More exposure will result in more dead nerve endings. The result is permanent hearing loss

that cannot be corrected through surgery or with medicine. Noise-induced hearing loss limits your ability to hear high frequency sounds and understand speech, which seriously impairs your

ability to communicate. Hearing aids may help, but they do not restore your hearing to normal.

III .Results and Tables

The Questionnaire survey was taken to understand the daily routine disturbances, health problems caused due to construction noise and the mitigation or noise control strategies that can be suggested.

54.3% people were agreed that the construction process is Noisy and is disturbing for them to carry out their daily routine while as 24.1% people were strongly agreed to this. 44.5% of people said that the construction noise is troublesome.

163 people identified the noisy construction machineries. JCB excavator machine (107), Concrete Mixer (81) Stone / Tile / Paving Wok (74), Pile / Foundation work (58), Metal Sheet work (54), Fittings Work (49) these are the activities that people found noisy. 117 people said that the Machineries used in construction are noisier than the Labours shouting, while as 45 people found Machineries and Labour talks both noisy.

96 people said they could not concentrate for Office work or any mental work with the construction noise.

55 people said they could not do the reading.

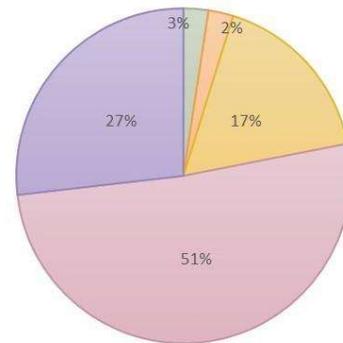
5 people said that they can concentrate for the daily chores.

Table 3: the responses received on questions based on mental and physical well-being.

	Completely disagree	Disagree	Neutral	Agree	Strongly Agree
Disturbs while studying / reading	2.4%	2.4%	17.1%	51.2%	26.8%
Affects Sleep / Sleep Pattern	1.2%	11%	19%	45.4%	23.3%
Faces Physical,	2.5%	13.6%	30.2%	41.4%	12.3%

Mental Issues					
Affects Kid's sleep & peace	5.5%	7.4%	28.2	40.5%	18.4%
Harms Psychological Health	1.2%	7.5%	19.3%	57.8%	14.3%
Causes long term Health issues	2.5%	12.4%	18.6%	52.8%	13.7%

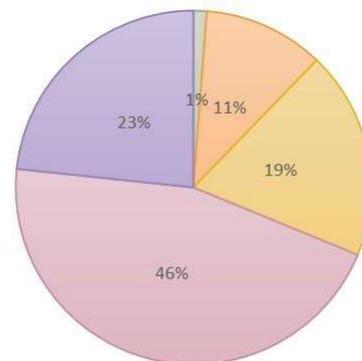
Pie Chart 1: Disturbance to Study / Read



■ Completely Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

From the Above Pie Chart 1, we can make out that about 77.9% people agreed that they feel disturbed while studying or reading due to construction noise.

Pie Chart 2: Sleep Disturbance



■ Completely Disagree ■ Disagree ■ Neutral ■ Agree ■ Strongly Agree

Pie Chart 2 reflects the percentage of people suffering with sleep disorders, Sleep Pattern changes, Insomnia.

58.8% people said that they feel that they should complain about this noise issues.

The Problem is that they do not know whom to go, to whom

they should approach if they get irritated with construction noise. 71.4% people said that they never complained about such noise, but simply tolerated it. People do not know if such system exists where they can file a complaint. 35.7% people agreed that noise due to construction could be a serious offence while as 39.4%, people remained neutral and 25% disagreed that such noise can be an offence. This shows the lack of awareness in our legal system about noise due to construction; hence, there is no authority control either. 41.5% people rated our Pune city administration as one (lowest on the scale of 1-5).

People are not aware either if any city administration has tackled such noise pollution issues effectively. Only 34.8% people felt that the Environmental noise pollution laws could protect us from such noise. There is no portal where people can lodge a complaint. Out of 162, 142 people said that they simply close the doors and windows to reduce the impact of noise. 42 people said that they could not do anything about such noise pollution, so they simply bear it.

Suggestions were requested from people about mitigating this noise. Construction activities are necessary for the growth and development of the nation. Noise from construction activities is inevitable, but most of the people suggested that having fixed timing for such activities would help them to plan / alter their day-to-day schedule if they are made aware about the construction activities and the timing for such activities. 51.2% people felt that using some noise barriers would also be helpful.

Based on all above survey that we got from various people, we can see that Noise create major issues for people in the surrounding area where the construction activities are performed. People are unable to focus on the tasks, causing mental disturbances, restlessness, and depressions. The most prominent symptom is degradation of hearing, following with heart symptoms (Atrial fibrillation).

Currently we do not have any solutions rather than natural order of adopting to the situation. We need to identify the issue of noise as one of the environmental degradation factor. Though there are no specific laws about construction noise, we need some enactments to control the noise generated by construction activities and that can be done by adopting some noise abatement measures. This research paper concludes by proposing few recommendations for construction industry to follow in practice, which will be discussed in the following section.

IV .Conclusion

People exposed to construction noise are disturbed to perform their daily routine, faces physical and psychological health problems some of which are long term adverse effects. The questionnaire survey helped to understand the problems due to construction noise, lack of construction management and lack of authoritative control in our Pune city. The research work concludes with the following recommendations.

V .Recommendations

- Neighbouring residential and office complexes should be made aware of the upcoming construction work.
- Use quiet power tools and equipment to manage noise pollution. Apply silencer and muffler to reduce the noise produced by heavy machineries. Wherever possible, use modern construction equipment that has been designed specifically to produce less noise.
- Schedule work during sociable hours rather than when residents are likely to be sleeping. For Example, between 8 to 6pm on weekdays, except between 1 to 4pm. You could also notify local residents of the excessive working hours and keep them updated on the project.
- Put acoustic (movable noise) barriers in place to manage the levels of noise pollution.
- Ensure plant and equipment is properly maintained and operated.
- Switch off plant when it is not in use.

VI .Acknowledgement

I sincerely thank and acknowledge my research guide Ar. Prachi Aiyer, without whom this paper and the required research would not be possible. Her knowledge and valuable and constructive suggestions helped me to formulate this research.

I would also like to thank all my friends and colleagues who have helped me to circulate the questionnaire form. Finally, I wish thanks to my family for their support.

References

- i. *Santa Sabina College, Clean up school's day*
<https://www.ssc.nsw.edu.au/2018/04/clean-up-schools-day-2/>
- ii. *Standard Number 1926.52 – Occupational Noise Exposure*
- iii. <https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.52>

- iv. *Noise in Construction by Jeff Birkner*
<https://www.ehstoday.com/ppe/article/21910176/noise-in-construction>
- v. *Evaluation and Analysis of Environmental Noise Pollution in Seven Major Cities of India by Naveen Garg,*
<https://www.readcube.com/articles/10.1515/aoa-2017-0020>
- vi. *Occupational Noise Exposure by OSHA*
<https://www.osha.gov/noise#:~:text=Exposure%20to%20loud%20noise%20kills,through%20surgery%20or%20with%20medicine.>
- vii. *%20medicine.*
- viii. *Noise Pollution - Everything Connects*
<https://www.everythingconnects.org/noise-pollution.html>
- ix. *Noise - Control Measures : OSH Answers*
https://www.ccohs.ca/oshanswers/phys_agents/noise_control.html
- x. *Engineering noise control*
https://www.who.int/occupational_health/publications/noise10.pdf
- xi. *Analysis of Construction Site Noise: The Causes, Impact on People and the Environment By O. Godwin Ebikabowei & O. Reginald*
- xii. *Environmental Noise in India: a Review By Shreerup Goswami & Bijay K. Swain*
- xiii. *An evaluation of environmental impacts of construction Projects*
- xiv. *By Adnan Enshassi¹*, Bernd Kochendoerfer^{**}, Ehsan Rizq^{*}*

Wind Speed Change with Height in Built Environment

Ar. Prachi Aiyer & Dr. Sachin Pore

Student & Guide, PhD-Architecture, DBATU, Lonere, Maharashtra
prachiaiyer@gmail.com & smpore@dbatu.ac.in

Abstract : *Natural geographical wind in a region gets affected by the land form and land cover. The dense built environment in the city with tall buildings interferes with the natural wind affecting its natural flow, direction and velocity, which plays a significant role in natural ventilation and configuration of buildings. This research aims at discussing the change in wind speed at different heights of buildings with the help of pre-existing theory and expression. Terrain and height corrections are essential to perceive increasing wind speed with increasing height of buildings, to further adapt it to natural ventilation strategies of buildings.*

Keywords: Wind, High-rise Buildings, Wind Speed, Height Effect, Wind Speed Profile, Natural Ventilation

I. INTRODUCTION

Air is the basic element of life, wind is the basic element while designing spaces for living. Wind speed and its direction play a significant role in natural ventilation and configuration of layout of buildings. Wind speeds are measured at a height of 10m in open flat land or in locations with good exposure for the anemometer by meteorological departments. Wind velocity varies with the location, region, terrain and the height apart from the fact that its direction also depends upon the landform and other natural, man-made barriers in rural or urban areas.

Owing to the development in urban areas and built environment, terrain and height corrections are essential to estimate wind speed at different levels of structures. Wind speed available at different heights of buildings with the help of pre-existing theory and equation regarding wind speed variation with height can help to find out its efficiency in ventilation. Observed wind speed increases with increasing height of buildings. This phenomenon puts forth a challenge to design buildings with natural ventilation with increasing height. If wind velocity and wind direction of a location are known, buildings can be planned for naturally ventilated spaces with an expected wind speed (with certain limitations), to curtail artificial ventilation, especially in case of high-rise buildings.

Aim: to describe how wind speed experienced at the surface of the building is influenced due to the height, form and orientation of buildings, especially in urban built environment.

Objective: to perceive increasing wind speed with increasing height of buildings and to recommend on how the design of openings and outdoor spaces further can be adapted to it.

Scope and limitation: The study describes the wind pattern observed in the urban built environment with respect to wind speed or velocity only. Effect of other parameters of air flow viz. temperature, humidity, pressure, density, purity, direction is not discussed or specified. The results from the method can

be further used to understand and estimate ventilation of indoor spaces.

Research Methodology: The literature reviewed is the secondary data about air movement and wind from books, research and other digital sources. Publications and existing theories are considered to demonstrate using an example of wind data of Pune city and conclude further.

II. PHYSICS OF AIR AND WIND

Atmosphere surrounds all life and objects on earth within few hundred meters above the ground i.e. the surface layer, the height through which wind is affected by topography. Wind is caused by air movement in a direction from higher pressure (dense air) to lower pressure, lower temperature (cool air) to higher temperature, lower humidity (dry air) to higher humidity. Higher the differential, higher is the velocity of wind. When humidity and/or temperature increase, density and pressure decrease. Wind has characteristics viz. direction, speed or velocity, temperature, humidity, purity.

Air is considered as a fluid that flows or changes its shape by application of pressure while moving around things (science of Aerodynamics). Computational Fluid Dynamics (CFD) applications are used to simulate wind flow around buildings.

WIND AND LAND

Wind is unaffected by water surface (viz. lake, sea, ocean) as it is smooth compared to land. Natural geographical wind in a region is greatly affected by different types of terrain viz. landform and land-mass, natural land-cover (terrain, water and vegetation) and man-made land-use (buildings, roads, infrastructure, open spaces, green areas) over it. There is noticeable 40-50% reduction in wind flow over urban area or rough terrain with obstacles or wind-breaks offering surface friction or aerodynamic drag to the wind flow, slowing it and changing its direction.

WIND SPEED OR HEIGHT EFFECT

It is observed that wind gets stronger with increasing altitude above ground. This is called the Speed or Height effect. Flow near the ground surface encounters surface roughness that interferes with the flow to reduce wind speed and introduce different wind patterns with random vertical and horizontal velocity components at right angles to the main direction of flow. A decelerating or retarding effect occurs in layers of air near the ground, which reduces gradually with increasing height until it gets negligible. Also, there are no obstacles at higher altitudes. Hence, wind speed increases with increasing height above ground.

Pressure Gradient

Other reasons for this tendency are that the pressure and density gradients. Warm air is less dense, lighter and occupies more volume. Pressure difference between warm air and cold

air increases with increasing height of air volume around tall structures. A greater pressure difference creates stronger wind with greater heights. Furthermore, air has weight. Warm air is lighter & tends to rise. Dry air is lighter & tends to rise. Air density and weight is highest at ground level. More force is required to move denser air than less dense air at greater heights. Hence, as density decreases with height, higher wind speed is experienced.

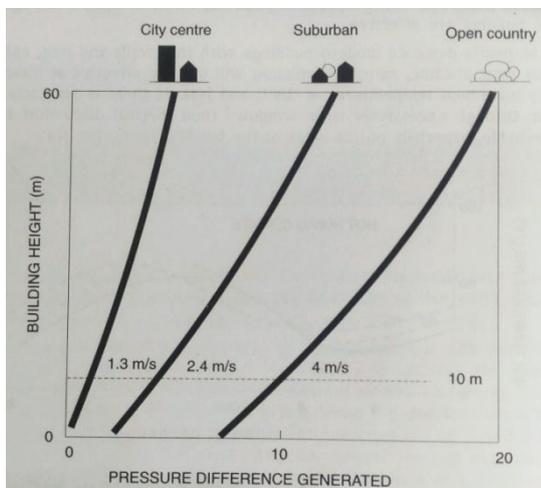


Fig-1: Pressure Gradient and Terrain(Source: i)

Wind Shear

Wind shear is the difference or change in wind speed or direction experienced over a relatively short distance in atmosphere. Vertical shear occurs along different heights or in a vertical direction, whereas horizontal shear occurs over a horizontal distance laterally at a height, usually influencing wind direction.

WIND GRADIENT

Wind speed at 20-24 meter height can be almost double of that at ground. Wind velocity gradient is the vertical gradient of horizontal wind speed stating the rate of wind speed increase with unit height, measured as wind speed in meters per second per kilometer height (m/s/km). Height at which wind speed does not change is called the gradient height with the corresponding gradient velocity. Gradient height is dependent on terrain roughness. It is 1200 feet (i.e.366m) or more above ground for developed urban environment, depending on density and height of buildings.

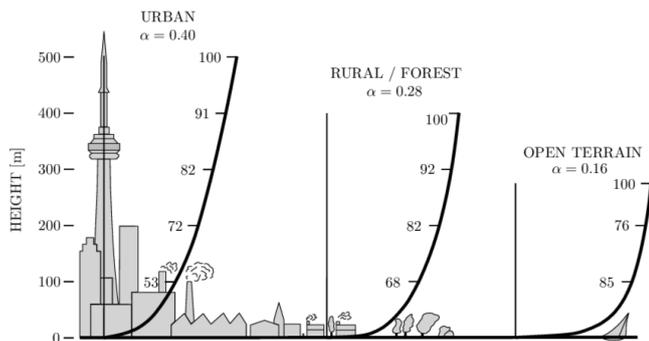


Fig-2: Terrain Roughness and Wind Velocity
(Source: fig1_320480813, www.researchgate.net)

BEAUFORT SCALE

Beaufort wind force scale by Irish hydrographer Francis Beaufort, 1805 is an empirical measure that relates wind speed to observed conditions at sea or on land, where unit of every stage of perception is given as wind force.

The wind speed mentioned is that measured meteorological departments at 10 m above ground in open country, not at the ground surface. At 2 m height above ground, wind speed may be only 50-70% of that measured at 10 m.

Wind Force	Description	km/h	mph	knots	Specifications
0	Calm	<1	<1	<1	Smoke rises vertically
1	Light Air	1-5	1-3	1-3	Direction shown by smoke drift but not by wind vanes
2	Light Breeze	6-11	4-7	4-6	Wind felt on face; leaves rustle; wind vane moved by wind
3	Gentle Breeze	12-19	8-12	7-10	Leaves and small twigs in constant motion; light flags extended
4	Moderate Breeze	20-28	13-18	11-16	Raises dust and loose paper; small branches moved
5	Fresh Breeze	29-38	19-24	17-21	Small trees in leaf begin to sway; crested wavelets form on inland waters
6	Strong Breeze	38-49	25-31	22-27	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty
7	Near Gale	50-61	32-38	28-33	Whole trees in motion; inconvenience felt when walking against the wind
8	Gale	62-74	39-46	34-40	Twigs break off trees; generally impedes progress
9	Strong Gale	75-88	47-54	41-47	Slight structural damage (chimney pots and slates removed)
10	Storm	89-102	55-63	48-55	Seldom experienced inland; trees uprooted; considerable structural damage
11	Violent Storm	103-117	64-72	56-63	Very rarely experienced; accompanied by widespread damage
12	Hurricane	118 plus	73 plus	64 plus	Devastation

Fig-3: Beaufort Scale for Land

(Source: <https://www.rmets.org/resource/beaufort-scale>)
Force-1: Light Air: 1-5 km/h i.e. 0.28-1.39 m/s is minimum air movement required
Force-2: Light Breeze: 6-11 km/h i.e. 1.67-3.06 m/s is the desirable comfort air movement

III.

EXTRAPOLATION OF WIND SPEED AT HEIGHT

There are various theoretical equations followed for determining wind speed profile of a place for increasing height. The common method of Power law equation introduced by Hellman in 1916 is used to find wind speed at a height with reference to wind speed at 10 m height to extrapolate data from 10 meters up to 100-150 meters.

Power law or Hellman Exponential law equation is based on determination of Power Law Index or Hellman exponent or friction coefficient α , which relates to terrain roughness. The coefficient varies with height, time of the day and year, land features, wind speeds and temperature. Average annual wind speeds available from meteorological stations are used for basic estimation.

$$v_2 = v_1 \cdot \left(\frac{Z_2}{Z_1} \right)^\alpha$$

Hellman Exponential Law Equation:

where V_2 = desired velocity to be found at desired height Z_2 , Z_2 = desired upper height, V_1 = reference velocity at height Z_1 at 10 m from meteorological station Z_1 = reference lower height at 10 m, α = friction coefficient or Hellman exponent.

Landscape type	Friction coefficient α
Lakes, ocean and smooth hard ground	0.10
Grasslands (ground level)	0.15
Tall crops, hedges and shrubs	0.20
Heavily forested land	0.25
Small town with some trees and shrubs	0.30
City areas with high rise buildings	0.40

Fig-4: Friction coefficient α for different terrain(Source:ix)

WIND SPEED FOR NATURAL VENTILATION

With reference to the Beaufort scale and standards of ventilation, indoor wind speed required for comfort conditions is 1.5 m/s (i.e. 5.4 km/h) to 2.5 m/s (i.e. 9 km/h). Air velocities should rarely be less than 0.5 m/s (i.e. 1.8 km/h) and frequently above 2 m/s (i.e. 7.2 km/h). This requirement may slightly differ based on location, climate, weather, individual physiological requirements.

INTERNAL WIND SPEED WITH OPENINGS

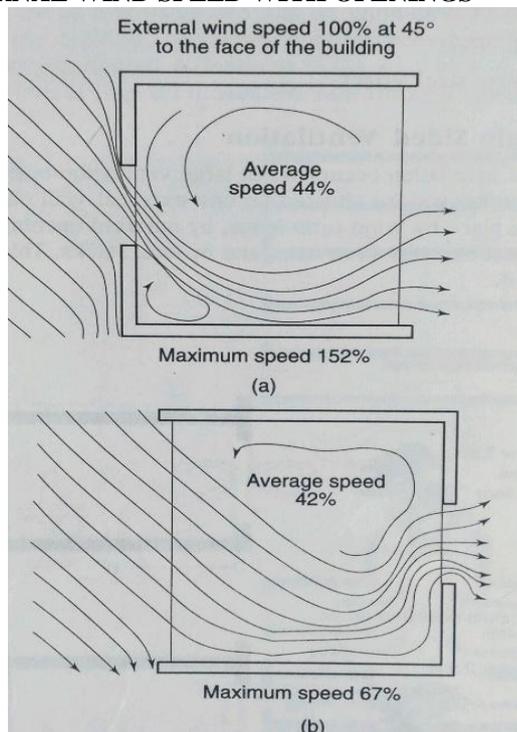


Fig-5: Indoor Ventilation and Wind Speed(Source: i)

Considering natural ventilation factors viz. opening size, opening orientation, opening level, single-sided ventilation or cross ventilation, the average indoor wind speed available is approximately 42-44% of outdoor wind velocity. While expecting indoor wind speed to be 45% of that outdoors, corresponding outdoor wind speed requirements are:

- 1) indoor wind speed 0.5 m/s: 1.11 m/s outdoor (minimum)
- 2) indoor wind speed 1.5 m/s: 3.33 m/s outdoor (comfort)
- 3) indoor wind speed 2.0 m/s: 4.44 m/s outdoor (comfort)
- 4) indoor wind speed 2.5 m/s: 5.55 m/s outdoor (desirable)

PUNE AVERAGE WIND SPEED IN PAST 5 YEARS

Pune (559m)

Diagram | Travel Planner | Climate Robot

Analysis(Month) | Analysis(Year)

Start: January 2016 | End: January 2021 | go

Wind-force per Day (January 2016 - January 2021)

Jan	Feb	Mar	Apr	May	Jun	[km/h]					
1.3	1.9	2.4	3.1	5.5	5.3	Data availability[%]					
99	97	94	100	100	100	Data availability[%]					

Jul	Aug	Sep	Oct	Nov	Dec	[km/h]					
4.7	4.9	2.7	1.3	1.2	1.2	Data availability[%]					
100	100	100	100	100	100	Data availability[%]					

Averaged Value (January 2016 - January 2021) : 3.0 km/h

Temperature	Daily Hours of Sunshine
Max. Temperature	Total Hours of Sunshine
Min. Temperature	Wind speed

Table-1: Wind Speed Data for Pune City(Source:viii)

WIND SPEED PROFILE OF PUNE CITY

Wind Speed Extrapolation for Pune city using Power law equation
considering α = friction coefficient or Hellman exponent
= 0.40 for city area with high-rise buildings

Appraisal of natural wind speed for indoor ventilation requirements													
No. of Floors	Height (m)	Average Wind Speed (m/s)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	(km/h)	1.3	1.9	2.4	3.1	5.5	5.3	4.7	4.9	2.7	1.3	1.2	1.2
G+2	10	0.36	0.53	0.67	0.86	1.53	1.47	1.31	1.36	0.75	0.36	0.33	0.33
G+4	15	0.42	0.62	0.78	1.01	1.80	1.73	1.54	1.60	0.88	0.42	0.39	0.39
G+7	24	0.51	0.75	0.95	1.22	2.17	2.09	1.85	1.93	1.06	0.51	0.47	0.47
G+11	36	0.60	0.88	1.11	1.44	2.55	2.46	2.18	2.27	1.25	0.60	0.56	0.56
G+15	48	0.68	0.99	1.25	1.61	2.86	2.76	2.45	2.55	1.40	0.68	0.62	0.62
G+19	60	0.74	1.08	1.37	1.76	3.13	3.01	2.67	2.79	1.54	0.74	0.68	0.68
G+24	75	0.81	1.18	1.49	1.93	3.42	3.30	2.92	3.05	1.68	0.81	0.75	0.75
G+29	90	0.87	1.27	1.61	2.07	3.68	3.55	3.14	3.28	1.81	0.87	0.80	0.80

Appraisal of natural wind speed for extended outdoor spaces													
No. of Floors	Height (m)	Average Wind Speed (m/s)											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	(km/h)	1.3	1.9	2.4	3.1	5.5	5.3	4.7	4.9	2.7	1.3	1.2	1.2
G+2	10	0.36	0.53	0.67	0.86	1.53	1.47	1.31	1.36	0.75	0.36	0.33	0.33
G+4	15	0.42	0.62	0.78	1.01	1.80	1.73	1.54	1.60	0.88	0.42	0.39	0.39
G+7	24	0.51	0.75	0.95	1.22	2.17	2.09	1.85	1.93	1.06	0.51	0.47	0.47
G+11	36	0.60	0.88	1.11	1.44	2.55	2.46	2.18	2.27	1.25	0.60	0.56	0.56
G+15	48	0.68	0.99	1.25	1.61	2.86	2.76	2.45	2.55	1.40	0.68	0.62	0.62
G+19	60	0.74	1.08	1.37	1.76	3.13	3.01	2.67	2.79	1.54	0.74	0.68	0.68
G+24	75	0.81	1.18	1.49	1.93	3.42	3.30	2.92	3.05	1.68	0.81	0.75	0.75
G+29	90	0.87	1.27	1.61	2.07	3.68	3.55	3.14	3.28	1.81	0.87	0.80	0.80

Table-2: Analysis of Natural Wind Speed for Ventilation

Pune city is used as an example for understanding the Height effect. Average wind speed data for past 5 years is considered with respect to the urban development observed lately. May to August are the good months for wind, with rains cooling the atmosphere from June. March, April & September are moderate, except that March onward the temperatures rise beyond bearable levels. December, January, February are winter months, hence wind speed may not be much desired. October & November appear to be the difficult weather conditions when temperature rises after monsoon and wind is also not strong for comfort ventilation.

Implementing natural ventilation strategies will help even in case of high-rise buildings. Ground floor with building

entrances, parking spaces, adjoining landscapes mostly gets the advantage of surface breeze. First two floors of most of the buildings are considerably affected due to negligible wind speed, which increases gradually for higher floors.

The average wind speed data used is different during different times of day and days of month. The experienced wind is suitable only when it is at speed equal to or more than the average, used in the example.

Outdoor spaces as extension to interiors are most desirable at all heights in buildings, as they give the experience of actual natural wind speed outside and prove to be the relieving pleasant areas for frequent visits from well-ventilated interiors, and during cooler and windier times on hot days.

IV. CONCLUSION

Speed or height effect i.e. wind speed increase with increasing height above ground is observed in cities. If wind speed is high at heights, natural ventilation can be aimed at by using opening design strategies and desirable open spaces like attached terraces and high-level patios to experience the free wind.

ACKNOWLEDGEMENT

I express my humble gratitude to Dr. Sachin Pore to guide me orient my research in proper direction, Prof. R. T. Ghogale to encourage me to teach 'Building Science & Services' in my academic career, Prof. Lina Debnath, my friends and family to motivate me to start my research journey.

REFERENCES

- i. Arvind Krishnan, Simos Yannas, Nick Baker, S. V. Szokolay, "Climate Responsive Architecture", McGraw Hill Education (India) Private Limited, New Delhi, 2001.
- ii. G. Z. Brown, Mark DeKay, "Sun, Wind & Light: Architectural Design Strategies", John Wiley & Sons Inc., New York, 2001.
- iii. O. H. Koenigsberger, T. G. Ingersoll, Alan Mayhew, S.V. Szokolay, "Manual of Tropical Housing and Building", Orient Longman Ltd, Chennai, 1975.
- iv. "IS 3362 (1977): Code of practice for natural ventilation of residential buildings", Bureau of Indian Standards, New Delhi, 1978,
v. <https://law.resource.org/pub/in/bis/S03/is.3362.1977.pdf>
- vi. D. A. Spera & T. R. Richards "Modified Power Law Equations for Vertical Wind Profiles", U.S. Dept. of Energy, Washington D.C., 1979,
vii. <https://ntrs.nasa.gov/api/citations/19800005367/downloads/19800005367.pdf?attachment=true>
- viii. TeamCivil, "Variation of Wind Velocity with Height", Civil Engineering Forum, 2017,
ix. <https://www.civilengineeringforum.me/variation-wind-velocity-height/>
- x. Aliashim Albani & Mohd Zamri Ibrahim, "Wind Energy Potential and Power Law Indexes Assessment for Selected Near-Coastal Sites in Malaysia", *Energies*, 2017, 10, 307; doi:10.3390/en10030307,
- xi. www.mdpi.com/journal/energies
- xii. WeatherOnline, 1999-2021,
- xiii. <https://www.weatheronline.in/weather/maps/city?FMM=1&FYY=2016&LMM=1&LYY=2021&WMO=43063&CONT=ini>

- xiv. *n®ION=0024&LAND=IMH&ART=WST&R=0&NOREGION=0&LEVEL=162&LANG=in&MOD=tab*
ix) Francisco Bañuelos-Ruedas, César Angeles-Camacho and Sebastián Rios-Marcuello, "Methodologies Used in the Extrapolation of Wind Speed Data at Different Heights and Its Impact in the Wind Energy Resource Assessment in a Region", *IntechOpen*, 2011, DOI: 10.5772/20669,
xv. <https://www.intechopen.com/books/wind-farm-technical-regulations-potential-estimation-and-siting-assessment/methodologies-used-in-the-extrapolation-of-wind-speed-data-at-different-heights-and-its-impact-in-th>
- xvi. x) "Wind Speed Extrapolation", *Katabatic Power*,
- xvii. <https://websites.pmc.ucsc.edu/~jnoble/wind/extrap/>

We are proud to announce
THE 4TH EDITION

Gear up to realise your ideas.

APRIL 2022

**INTERNATIONAL STUDENTS CONFERENCE
RESEARCH IN ARCHITECTURE**

IT AIMS TO INCULCATE RESEARCH CULTURE IN ARCHITECTURE, AND ENCOURAGE STUDENTS
TO UNDERSTAND THE VALUES OF INTER-RELATIONSHIPS OF VARIOUS DISCIPLINES
B.ARCH, M.ARCH & PH.D. STUDENTS

ORGANIZED BY
D Y PATIL SCHOOL OF ARCHITECTURE, LOHEGAON
IN ASSOCIATION WITH
MAHARASHTRA ASSOCIATION OF SCHOOLS OF ARCHITECTURE [MASA]

FOR REGISTRATION PLEASE VISIT OUR WEBSITE

ADVISORY BOARD

Dr. Sushant Patil (ADVISOR, ADVPLU)
Dr. Vasudha Colhale (MEMBER BOS, SPPLU)
Dr. Prajakta Baste (MEMBER BOS, SPPLU)
Dr. Kartik Vora (DESIGN CHAIR, DVPSOA)
Prof. Veena Shenvi (DESIGN CHAIR, DVPSOA)
Prof. Aparna Mhetras (HOD M.ARCH, DVPSOA)

FACULTY COORDINATORS

Prof. Amit Kaur (PH.D, ASSOCIATE PROFESSOR, DVPSOA)
Prof. Neha Bagade (ASSISTANT PROFESSOR, DVPSOA)
Prof. Adhreja Dey (ASSISTANT PROFESSOR, DVPSOA)

CONVENER

Prof. Nilesh Pore
(ASSOCIATE PROFESSOR, DVPSOA)

CHIEF PATRON

Dr. Ajeenkya D Y Patil
(CHANCELLOR, ADVPLU)

PRINCIPAL

Prof. Shubhada Chapekar

MASA PRESIDENT (Interim)

Dr. Poorva Keskar

STUDENT COORDINATORS

Anoushka Sengupta +91-9975041070
Anubhab Ghosh +91-8972058472

Follow us for more details

<https://www.facebook.com/dyparch>

https://www.instagram.com/dypsoa_lohegaon

www.dypatilarch.com
www.adypu.edu.in

[D Y Patil School of Architecture, Ajeenkya D Y Patil Knowledge City, Charholi \(Bk\), Via Lohegaon, Pune 412105](#)
[\(020\)67077902, +919511955962](tel:(020)67077902,+919511955962)

conference.dypsoa@dypatilarch.com



MASA



AJEENKYA THE INNOVATION
UNIVERSITY

Published & Printed By :



Innovative Research Publications
Bhopal MP India
www.irpublications.org

Copyrights @ Prof. Shashwati Sinhal.