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THE 6th EDITION

INTERNATIONAL STUDENTS CONFERENCE

RESEARCH IN ARCHITECTURE

Organized by

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Dean
Prof. R.T. Golgire

Editor
Prof. Nilesh Pore

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6th International Students Conference
on
Research in Architecture

6th International Students Conference on Research in Architecture

EDITOR

Prof. Nilesh Pore

Hosted by

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Message from Key Note Speaker

It has been an immense pleasure for me to be part of the 6th International Students Conference- "Research in Architecture" held on the 14th March 2024 at D Y Patil School of Architecture.

During the conference, I am grateful to be able to witness so many enthusiastic and bright candidates of Architecture sharing their research findings passionately.

It has definitely brought a lot of positive energy and dynamism to the lecture hall when these papers were presented.

I would like to take this opportunity to congratulate all candidates who have presented as well as participated in the conference.

I strongly believe that knowledge sharing is a significant part in advancing education, which is the need of the day. I hope that this effort will continue, building a research culture that can be shared within the region.

Dr. Sudhir Chavan
Principal
Smt. Kashibai Navale College of Architecture,
Ambegaon Budruk, Pune

Message from Advisor

Prof. Aparna Mhetras

It gives me immense pleasure and pride to pen down the note as advisory board member for International Students conference " Research In Architecture" 6th Edition hosted by DYPSOA. This conference serves as a pivotal platform for the exchange of ideas and research findings that shape the future of built environment. It is an opportunity for students of architecture, architects, urban planners to come together and engage in meaningful dialogue about the challenges and opportunities we face in our field. I would like to extend my gratitude to the convenor and organizers of the conference for their hard work and dedication in bringing us all together. Your efforts provide an invaluable platform for us to learn from one another, I am sure all of the hard work put by all of us will help in progress in field of architecture.

Best Wishes!

Prof. Aparna Mhetras
Dean IC - School of Design,
Professor & Academic Coordinator,
School of Architecture,
Environmental Architect
IGBC Accredited Faculty

Message from Advisor

Prof. Aprajita Kaushik

A great effort from the team I congratulate the Principal, Convener, coordinators, organizers, students volunteers and all the members for their immense contribution for organizing the conference. I wish them a grand success and urge all the Architecture student participants to contribute to the Research realm. I also wish the speakers, presenters, participant's best wishes for their continued interest in Research. I as an Advisory Board member I have great appreciation for the institute and its management to help the Architectural Research fraternity by organizing such events.

Prof. Aprajita Kaushik
Associate Professor,
DY Patil school of Architecture, ADYPU, Pune

Message from Advisory Board

It gives me great pleasure to greet you all to the 6th International Students Conference on Research in Architecture, which is being held at DY Patil School of Architecture in Lohegaon, Pune. Being a part of this conference since its inception has been an honor, and I'm happy to see its exponential expansion and now reaching a global audience. The unique conference is a significant step towards the school's objective of being the hub for Architectural research and innovation. As with the previous five editions, this conference, which was hosted on a hybrid platform, had a huge success.

This year physical Conference is a great success.

My warmest regards to everyone involved in the student conference.

Dr. Sushant Patil

Advisor/Trustee,
Ajeenkya DY Patil Group, Pune

Principal's Message

It is with great satisfaction that I pen down my thoughts on successful completion of 6th International Students conference at DY Patil School of Architecture. Our 5th International Research in Architecture student's conference was a successful endeavor with International collaboration which encouraged us to set our foot forward to the 6th International Research in Architecture student's conference. Relentless work by our college and its members gives the students of Architecture the opportunity to strengthen their knowledge and explore avenues in research.

At DY Patil School of Architecture, we think providing such a platform is the first step towards developing inclination and propensity for research for the students present this work and get peer -reviews, interact with costudents from other institutes and participate in an open-ended channels for intellectual discussions. It lays the groundwork for being a successful professional by assisting with decision-making and encouraging the growth of an inquisitive attitude. Research has enormous relevance in the subject of Architecture. The work completed at such a young age and the themes chosen are quite encouraging. I'm happy to see that the students have seized the chance to use a live platform to present a wide range of research to a jury. Additionally, it demonstrates the students' curiosity and desire to pursue interests outside of Architecture, which is undoubtedly positive for the field.

I am grateful to Dr. Kamaljeet Kaur Siddhu, Director, Technical Campus, Ajeenkya D Y Patil Knowledge City, Lohegaon, Pune, Keynote Speaker Dr. Sudhir Chavan, Principal, Kashibai Navale College of Architecture, Pune for their support and encouragement. I thank all our knowledge partners for supporting us. I also value the assistance that the Heads of the institutions have given their students in attending the conference, particularly the guides who have helped the students to succeed.

I congratulate the convener Prof. Nilesh Pore, Prof. Seema Paulzagade & Mr. Mayuresh Lanjekar, Advisors Prof. Aparna Mhetras and Prof. Aprajita Kaushik along with the 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 nonteaching 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. A special mention to the eminent jury panel and paper reviewer for their time and valuable contributions.

I appreciate the continuous support I received from our Chairman Dr. Ajeenkya DY Patil, Vice Chancellor Prof Hrridaysh Deshpande Ajeenkya DY Patil University, Mr. Raymond Paul, Registrar, our Advisory Board, Dr. Sushant Patil, Chief Guest Dr. Eknath Khedkar, Guest of Honour Prof. Jayshree Deshpande and our Guests Dr. Manju Rughwani & Dr. Ashwini Sovani Deshpande for helping us to successfully hosting the conference.

Wishing the best to all the participating students and organisers !

Prof. R.T. Golgire,
Principal
D Y Patil School of Architecture
ADYPU, Pune

Message from Convener

It gives me immense pleasure and honour to be the Convener for the International Conference on Research in Architecture 6th Edition hosted by the team at D Y Patil School of Architecture, Lohegaon, Pune. We hosted our first research in architecture, students conference in the year 2019, the first of its kind, which provides a platform for student researchers, academicians, professionals to come together. It is an honour for me to present convener's report today on 14th March 2024. This year also, we received huge response from the fraternity, schools of Architecture, students and the faculty. The first flier of the conference was sent during 2nd week of November 2023.

The first detailed poster was sent to various colleges in December 2023. And we started receiving the abstracts as per the given date of 31st December which was extended to 31st January on request of many colleges. Full papers received were 21 for B Arch and 07 for M Arch. Out of which 16 were selected for B Arch & 06 for M Arch.

A paper reviewing committee was appointed to review the full papers. The committee consisted of eminent experts in the field of Architectural research from practice as well as academics.

This Year our Advisory Board comprised Prof. Aparna Mhetras and Prof. Aprajita Kaushik. Advisory committee members gave their valuable guidance from time to time, which helped in smooth conduct of the whole process.

I sincerely thank our Principal Prof. R.T. Golgire for his encouragement and guidance throughout the process of the conference. The Dedicated Core faculty Prof. Seema Paulzagade, Prof. Mrudula Darade and Mr. Mayuresh Lanjekar have enormously worked hard since the announcement of the conference. Student Volunteers Ajay Dalvi and Trupti Wadhai have tirelessly communicated with the students.

All my colleagues who were part of different committees and all the dear students who helped to conduct the conference smoothly. All the members of Advisory committee, paper reviewing committee, panel members for all the sessions, we are very grateful to all our knowledge partners. Last but not the least all the authors for taking out their time to write the research papers, all paper presenters, participants and faculty of all the colleges for gracing the occasion by their presence.

Prof. Nilesh Pore
Associate Professor
DYPSOA, Lohegaon, Pune

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List of Winners

Sr. No.	*Category*	*Name of Winner*	*Name of Institution*	*Title of the Research Paper*	*Position Secured*
1.	B.Arch	Tejas Satish Gaikwad	Ajeenkya D.Y. Patil School of Architecture, Lohegaon, Pune	Architects as Entrepreneurs: Bridging the gap between design and business.	Best Paper
2.	B.Arch	Vaishnavi Mohan Mahamuni	Anantrao Pawar College of Architecture, Pune	Rejuvenation of Mutha Nadi Bank Canal in Pune: Janta Vasahat	First Runner Up
3.	B.Arch	Harshita Rajendra Mayekar	CTES College of Architecture, Chembur, Mumbai	Preserving the tangible and intangible cultural heritage through architectural lens: A case of Ratnagiri, Maharashtra	Second Runner Up
4.	M.Arch	Simran Vinod Solanki	CTES College of Architecture, Chembur, Mumbai	Analysis of existing walling material with respect to Embodied carbon footprint	Best Paper
5.	M.Arch	Sindhu Namwad	CTES College of Architecture, Chembur, Mumbai	Experimenting the use of recycled plastic in mosaic tiles	First Runner Up

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Designing Approach for Primary School Involved in Active Experiential Learning

Sweety Shekhar[1] and Ar. Shubhashree Upasani

[1]4th year, BVDUCOA, Pune

Bharati Vidyapeeth (Deemed to be University) College of Architecture, Pune, India

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ABSTRACT: This paper explores a comprehensive design approach to enhance primary school education through active experiential learning. Acknowledging the pivotal role of early education in shaping a child's cognitive and socio-emotional development, this research advocates for a pedagogical shift from traditional, passive learning models to dynamic, hands-on methodologies.

The proposed approach combines insights from educational psychology, **pedagogy**, and architecture to inform the creation of dynamic and flexible learning spaces. Special attention is given to the diverse needs of primary school students, considering their cognitive, emotional, and physical development. The design principles prioritize **adaptability**, collaboration, and **multisensory experiences** to cater to various learning styles and preferences. The design approach includes flexible furniture arrangements, **versatile learning zones**, and interactive technology integration. Outdoor spaces are also important in promoting connections with nature and physical activity. The design emphasizes teachers as facilitators, requiring spaces that support collaborative teaching methods and teamwork. The research analyzes case studies of successfully implemented active experiential learning environments in existing schools. The study aims to create a framework that architects, educators, and school administrators can use to inform the design and renovation of primary school facilities. Ultimately, this research contributes to the ongoing discourse on the intersection of architecture and education. It proposes a holistic approach to designing primary school spaces that foster active experiential learning and contribute Investing in the overall well-being and development of young learners is crucial.

1. INTRODUCTION

Education is an important part of every child's life and the experiences and lessons we learn often serve us well in life. The lessons we learn are designed to prepare us for life outside the safe walls of the classroom. However, with changing paradigms and developments in technology and the global economy, a working adult may feel that the skills and knowledge taught in school are insufficient. While education is required, this thesis advocates for learning as a choice. Architectural Interventions are required to push the gradually evolving system beyond the incubation period to integrate active learning into today's curriculum effectively. This study envisions a school design guided by curation rather than the requirements of a multipurpose classroom. The creation of integrated learning experiences. This allows students to take charge of their learning by allowing for more flexible and autonomous exploration. It presents a new approach to architectural design that aims to facilitate active experiential learning in primary schools. Recognizing the significant impact of the physical environment on educational experiences, this study investigates how active learning principles can be integrated into the designof primary school spaces.

Aim: To formulate strategies for the primary school involved in active experiential learning. Objective: To ensure that students develop fundamental skills in reading, writing, and mathematics. This forms the foundation for all their future learning & and introduces students to a range of subjects including science, history, geography, and the arts. The aim is to provide a broad base of knowledge.

Scope: To holistically connect them through the principle of the scientific method: through discovery and exploration, testing of ideas, evaluation of outcomes, and community analysis andfeedback.

2. LITERATURE REVIEW

The Role of Architecture in School Improvement with Flexibility Approach published in January 2016 A building's design and elements can make it adaptable to changing operational requirements, whereas inflexible buildings may become obsolete. With a flexible design, users have the freedom to experiment over time and create something truly unique.

ISBN: 978-93-89934-54-0

Pre-Design for Primary School Active Learning Module (A Triadic Reciprocal Needs Analysis Framework) published in January 2021 explains how needs analysis can highlight the potential of full-scale active learning. An investigation into active learning to determine learners' needs by examining the relationship between internal and external factors.

Architecture and its Impacts on Children's Happiness and Satisfaction in the Sports Spaces January 2017 The spaces where children grow to become creative individuals in the future are usually designed without considering their requirements, as are the sports spaces.

Experiential Learning in Design Education: Teaching Construction and Technology through Active Experimentation in Interior and Architectural Design published in January 2022 explains that concrete experience, reflective observation, abstract conceptualization, and active experimentation form a four-stage process (or cycle) transformed into effective learning. Kolb's learning theory can benefit students, educators, and employers.

Analysis and Design of Primary School Building published in January 2021, the document provides a comprehensive overview of designing primary school infrastructure. It covers architectural design, spatial planning, and safety measures for an effective learning environment.

3. MATERIAL AND METHODOLOGY (Data Collection Through CASE STUDIES)

To collect data on the topic of experiential learning, I have chosen to conduct case studies on schools that have already implemented this approach successfully. These schools have used various design approaches to provide experiential learning opportunities. Here are a few examples of such schools:

1. Hong Ling Experimental Primary School, China.
2. Experimental primary school of Suzhou science andtechnology town Suzhou, China.

Hong Ling Experiential Primary School China: The Hong Ling Experimental Primary School (HEPS) and its surrounding cities were built on a hill called Antuoshan in the northwest part of Futian District the hill almost disappears, except for a small lonelypart standing to the west of the school site. (Figure 1)

Planning Aspect: The design of the drum-shaped floor plan offers more flexibility and freedom compared to traditional rectangular classrooms. It also allows for a wider range of teaching and learning methods. The folding curve outline of the learning units and the curved edge of the courtyard create a dynamic semi-outdoor space that provides a linear activity area for the children. Overall, this design provides a more conducive environment for a variety of learning and teaching patterns.

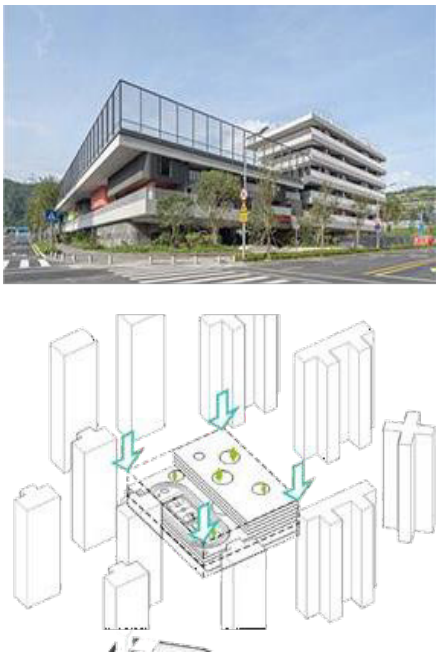

Figure 1

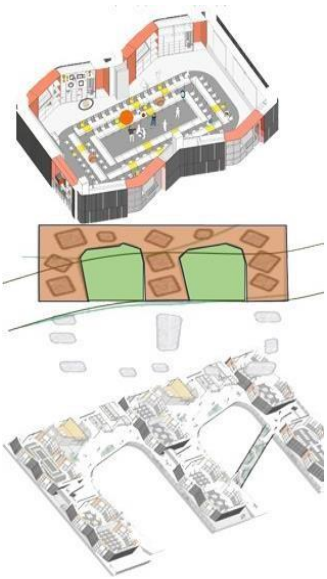

Figure 2

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Types of Learning Spaces: The classroom has a drum-shaped design that is aimed at promoting interaction among students. The architect took advantage of the varying heights between the north and south of the site to establish one-meter slopes, which connect the three rows of learning units on each floor. This design creates a unique landform experience on the E-shaped floor plate. (Figure 2)

Open and Built Spaces: On the third floor of the Eastern Half, there is a 200-meter circular runway and sports ground. It is conveniently linked to the second level of the main teaching building on the west side. This provides easy access for students on the second, third, and fourth floors to reach the sports area.

Circulation: The architect strives to control building height within 24 meters to encourage horizontal interactions and respond tothe physical and psychological characteristics of children in architectural and landscape design.

2. **Experimental Primary School of Suzhou Science and Technology Town Suzhou, China:** The Suzhou Experimental Primary School has done a remarkable job of blending traditional cultural values with modern educational ideals. The academy is not just a centre for knowledge, but also a symbol of our evolution through history and the transmission of culture. The design of the school is a perfect example of how traditional culture can be preserved while still adapting to modern times.

Design Inspiration: I completely understand what you mean. It is important to consider the students as an integral part of the campus and not just as users. Having various depths and proportions of spaces can help provide privacy while still maintaining a sense of unity. It is crucial to find the right balance that works with the existing site and to recognize the contrast between the urban and natural environment. Additionally, there should be efforts to address the current resistance towards exam-oriented learning methods. (Figure 3)

Types of Learning Spaces: Each classroom is arranged ina grid system on the western side of the site, close to an urban areato cater to basic teaching needs. We have organized teaching offices administrative management, a lecture hall, a library, and class-merging rooms for optional courses, a gymnasium, a canteen, and other facilities with varying requirements for size, form, and volume using grouping, concession, and descent mode plate methods. OPEN AND BUILT SPACES: The outdoor playground and theatre's openness and flexibility play a crucial role in stimulating students' creativity and imagination, both spatially and programmatically. The library offers spaces for both solitude and gathering, allowing students to enjoy a moment of silence to read and think. As different thoughts and ideas collide, children become immersed in an organic arrangement of garden settings, fostering a unique environment for learning and growth. (Figure 4)

Figure 3

Figure 4

Circulation: The building's social component is strengthened by a circulation space that wraps around it, providing access to all units and encouraging various activities to take place in these common areas. The design incorporates a significant amount of social space, which not only meets the educational needs but also creates a lively atmosphere within the campus. Additionally, the design establishes a connection between the East and West spaces through a communal spine. This spine connects the entire school in a north-south direction and acts as a buffer zone, balancing the standardized classrooms and interactive spaces.

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4. RESULT AND DISCUSSION

Table 1

Parameter	*Hong Ling Experimental Primary School, China*	*Experimental Primary School of Suzhou Science and Technology Town Suzhou, China*
Design Inspiration	Creating classrooms that merge, as well as using curved lines rather than straight walls, to maintain students' interest.	Creating space for children to evolve by learning from their own experiences and expanding interactive spaces for children to evolve with one another
Types of Learning Spaces	Curvilinear walls and combining two classrooms into one space, as well as creating more common areas, will increase interaction among students	The array grid system is required to connect with a natural view on one side.
Planning Aspect	To encourage horizontal interactions and to respond to the physical and psychological characteristics of children in architectural/landscape spatial design. The school's low-rise strategy in the presence of high-rise structures.	An amalgamation of Suzhou academies' traditional culture and contemporary educational ideals, with one side experiencing greenery and the other side experiencing high-density artificial buildings.
Circulation	Keeping building heights under 24 meters and increasing horizontal circulation by constructing a staircase between each two blocks to connect two building blocks and increase horizontal circulation	The design also connects the spaces between East and West via a spine of communal spaces. This communal spine not only connects the entire school along the north-south axis, but it also serves as a buffer zone between standardized classrooms and interactive spaces.
Open and Built Spaces	The 200-meter circular runway and sports ground are located on the third floor of the Eastern Half, connected to the second level of the main teaching building on the west side, making it convenient for students on the second, third, and fourth floors to run to the sports area.	The openness and flexibility of the outdoor playground and theatre in the middle gap of E-formed planning serve as students' creativity and imagination both spatially and programmatically. Children immerse themselves in an organic arrangement of garden settings.

Table 2

Parameter	*Suggested Strategies*
Types of Learning Spaces	• Involve students in the design process, allowing them to contribute ideas and preferences for their learning spaces. • Design classrooms that reflect the diverse interests and personalities of the students, creating a sense of ownership and pride in their environment.
Circulation	• Design flexible, multipurpose spaces that can be easily adapted for various activities. • Consider movable furniture and modular arrangements to support different teaching methods. • Create designated areas for group work, individual study, and hands-on projects. • Design classrooms that support project-based learning, allowing students to work on extended, hands-on projects.
Planning Aspect	• Ensure easy connectivity between different learning zones to facilitate smooth transitions. • Minimize long corridors and consider open pathways or atriums to connect different areas. • Ensure that all facilities are accessible to students with diverse abilities. • Consider ramps, elevators, and other features that promote inclusivity.
Open and Built-Up Spaces	• Integrate natural elements into the design, such as indoor plants, nature- inspired color schemes, and large windows that provide views of the outdoors. • Create outdoor classrooms or learning gardens to promote a connection with nature and enhance overall well-being.

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5. CONCLUSIONS

Adopting an architecture design approach physical layout and aesthetics of the school play a crucial role in shaping the overall learning experience. Spaces designed for active learning should be flexible, and adaptable, and promote movement, encouraging students to explore and interact with their surroundings. Incorporating outdoor learning areas, interactive installations, and versatile classrooms can enhance the students' cognitive and social development. The design should consider sustainability and eco-friendliness, instilling a sense of responsibility towards the environment in young minds. Natural lighting, energy-efficient systems, and green spaces contribute to creating a healthy and inspiring atmosphere for both students and educators.

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Reconstructing Cultural Narratives: A Restorative Approach to Kashmiri Pandit Heritage through Architectural Intervention

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ABSTRACT: The study, "Reconstructing Cultural Narratives: A Restorative Approach to Kashmiri Pandit Heritage through Architectural Intervention" seeks to reestablish a broken cultural bond by looking into the emotional, empathic, and psychological effects of man-made damage. The initiative, which focuses on Kashmir and the displaced Kashmiri Pandits, proposes the rebuilding of a Mohalla as a restorative retreat, defying tourism-driven ideas of normalcy. The effort attempts to recreate pre-1990s Mohalla authentically, emphasizing cultural subtleties and building a sense of belonging.

The findings highlight cultural decline, the importance of intangible characteristics, Rainawari problems, documentation inadequacies, and cultural liveliness during festivals. The initiative, which aligns with the GHAR KA PATA and INTACH research, validates a restorative strategy based on observed emotional consequences and cultural intricacies.

Unexpected discoveries, such as a significant aversion to returning, highlight the need for complex solutions. The findings help to shape future study directions, such as different areas, deeper architectural intricacies, and long-term heritage preservation. The concept goes beyond constructed buildings by offering a framework for restoration that restores culture and fosters a built environment that resonates with the sense of home.

Keywords: *Kashmiri Pandits, Cultural Heritage, Architectural Intervention, Restorative Retreat, Mohalla Recreation, Emotional Impact.*

1. INTRODUCTION

Reconstructing Cultural Narratives: A Restorative Approach to Kashmiri Pandit Heritage through Architectural Intervention is a conscious effort to return architectural viewpoints to India's vernacular origins. The initiative, which focuses on Kashmir and Kashmiri Pandits, strives to resuscitate a cultural bond broken by man-made damage, moving beyond physical areas to explore emotions, empathy, and psychological effects. It emphasizes architects' obligation to create spaces that reflect people's stories, feelings, and histories. The initiative, which is urgent owing to the unsolved condition of Kashmiri Pandits after 33 years of forced exile,[1] demands a better knowledge of rehabilitation issues as well as a change away from labelled migrant housing and towards restoring cultural narratives. The project's purposeful focus on Kashmiri Pandits intends to highlight cultural loss caused by man-made damage, emphasizing the significance of architecture in recreating cultural narratives, and restoring a feeling of belonging. The planned restoration of a Mohalla as a retreat tackles the subtle nuances of the Kashmiri terrain, questioning the erroneous image of normalcy fostered by tourism initiatives. It emphasizes the need to revive the cultural fabric and bridge the gap between history and the present. The project goes into the deteriorating status of Pandit-inhabited places, highlighting the lack of emotional connection with the land to answer the issue of why reconstruct a Mohalla and why in the form of a retreat rather than residences. It explores whether architects are erecting structures on vacant lots or helping build societies and revitalize cultural identities. The concept aspires to fill the hole by offering a place that is more than simply a structure but also a cultural effort that connects the past with the future. The project recognizes the difficulties of returning to Pandit's experience by launching a small-scale endeavour to bridge the gap between traditional legacy and current advancements. It proposes the restoration of a Mohalla as a therapeutic retreat, functioning as a beacon of hope for preserving intangible heritage. The narrative unfolds beyond the physicality of buildings, symbolizing the restoration of a cultural identity and a bridge connecting the essence of the past with the aspirations of the future. In essence, the project beckons architects and stakeholders to explore, understand, and contribute to reconstructing not just buildings but the fabric of Kashmiri culture.

[1] Know more about the seven exodus that led to 33 years of exile, refer to (BHAN, 023).

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It calls for fostering a renewed sense of belongingness and cultural continuity, emphasizing the transformative potential of architecture in preserving and revitalizing cultural narratives. Beyond the materiality of structures, the story emerges, symbolizing the restoration of a cultural identity and a bridge linking the essence of the past with the ambitions of the future. In spirit, the initiative invites architects and stakeholders to investigate, comprehend, and contribute to the rehabilitation of not just buildings but also the fundamental fabric of Kashmiri culture. It advocates for building a revitalized sense of belonging and cultural continuity, emphasizing architecture's transformational ability to maintain and revitalize cultural narratives.

About the Project: The core of this visionary architectural endeavour lies in its dedication to healing the wounds inflicted upon the displaced Kashmiri Pandit community. The poetic plea*, "Maeji jigarich dagh lochhravav, Aash kar alaav ghar gachh hav",*[2] encapsulates the collective yearning for Home, echoing the sentiments of a community that has endured immense suffering. This project becomes an example of hope, a tribute to perseverance, and a transformational path towards recovering a 5000-year-old cultural history via the architectural perspective. Individuals' deep bond with their ancestral land is a recurring topic throughout this program. The Kashmiri Pandits were forced to watch the loss of their once-rich dwellings and cultural legacy because of the sad events of the 1990s. The whole fabric of their distinct identity was ripped apart, creating a gap that this project aims to fill. This architectural thesis examines present housing colonies and associated areas in downtown Srinagar, a previously lively heart of Kashmiri Pandit life, to adequately resurrect the ethos of a Mohalla that thrived before the 1990s upheavals. Beyond the physical characteristics of Kashmiri Pandit housing, this project seeks to understand how rituals and beliefs were carefully woven into the fabric of their dwellings. By resurrecting these cultural subtleties, the initiative hopes to restore the forgotten corners of legacy, promoting a connectedness that goes beyond the physical repair of structures. The relevance of this project goes much beyond the development of a simple stay area. The project's idea of a Mohalla as a heritage house retreat aims to create spaces beyond built form, encouraging community gatherings and a reinvigorated sense of belonging. It is a testament to the fortitude of a community that, despite unfathomable adversity, is determined to rebuild.

Aim: To design a stay area precisely modelled after the Mohallas that flourished before the 1990s. To develop a setting that closely resembles the essence of Home, incorporating not just individual rooms but also the entire plot. To reignite cultural vibrancy and create a platform for reconnecting with a community's past greatness and rich cultural history.

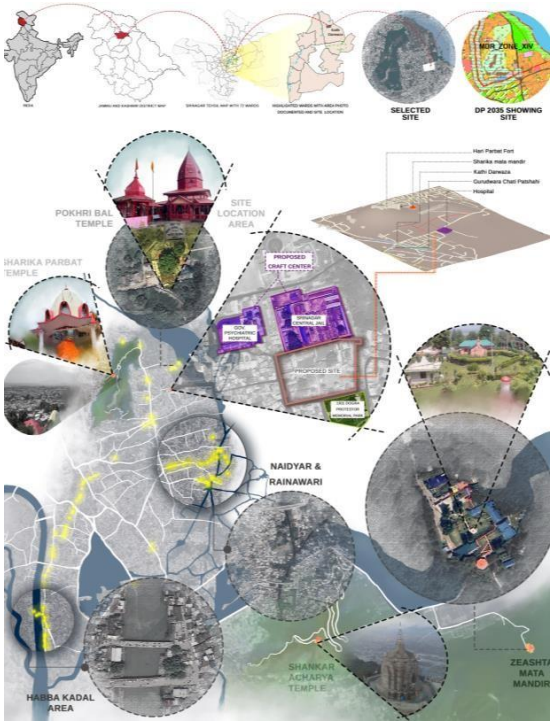

Figure 1: Image Showing Documented Area, Site Location and Surroundings

[2] Jeelani & Shaida, 2018.

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Objective: To authentically replicate the architectural and spatial components of pre-1990s Kashmiri Pandit mohallas to recreate the community's previous living environment. Create and execute a residential neighbourhood representing the Mohalla idea, including community areas and shared facilities. Cultivate a sense of belonging and cultural[3] continuity by integrating traditional Kashmiri Pandit architectural nuances and design elements into the replicated mohalla. Create a sustainable income model for the residential area, providing financial self- sufficiency for upkeep and prospective development while contributing to the community's general well-being. Integrate contemporary facilities with traditional design features to improve resident comfort while maintaining the space's cultural authenticity. To foster the continuance of cultural practices and traditions, provide facilities for rituals, marriages, and cultural events within the residential area, building togetherness and a shared sense of identity among inhabitants.

Implement a thorough documentation process for the project, including architectural plans, cultural narratives, and community comments, which will serve as a useful resource for future projects and academic study.

Scope: To recreate Mohalla for Kashmiri Pandits that create space that gives the essence of home. To provide minimum interventions in the cluster planning and replicate housing plan, exactly how it was. To add spaces according to the current requirement for the community despite the housing introduced as stay areas. To promote a feeling of cultural continuity and belonging, include traditional Kashmiri Pandit architectural details and design features into the reconstructed Mohalla.

Limitations

At this stage of development, the initiative is only focused on Kashmiri Pandits. Services and access will be customized for this community, and pre-registration is required to use the amenities. The design's goal is to capture the spirit of Home. A homestay is a type of hospitality that emphasizes a pleasant and familiar atmosphere rather than a luxury getaway. The main goal is to make inhabitants feel at Home rather than as if staying in a hotel. While the concept aspires to cultural regeneration, it avoids establishing memorials or locations that openly address horrific episodes from the past. This deliberate exclusion stems from a desire to prioritize consumers' psychological well-being and prevent the onset of post-traumatic stress disorder (PTSD). In the prospect of potential expansion, the project contemplates opening its doors to a broader user base. However, it firmly maintains its commitment to refraining from creating spaces that recount the genocide. The core intention remains centered on the recreation of the Mohalla, reviving the cultural fabric, and reinstating the significance of a rich heritage that has been lost. Looking ahead, the project envisions maintaining a singular focus on this subject, recognizing its intrinsic outstanding universal value as a testament to resilience against man-made destruction. It aims to stand as a landmark commemorating the enduring existence of the community over centuries, serving as an initiative to assert its presence despite facing various attempts at complete eradication.

2. LITERATURE REVIEW

1. **Rainawari and Seven Springs Significance:** The literature review on Rainawari by H.L. Raina[4] provided a rich understanding of the historical, cultural, and hydrological heritage of the region. The Seven Springs emerged as vital life sources, contributing to Rainawari's identity as the "Venice of the East."
2. **GHAR KA PATA Documentary:** The analysis of the documentary "GHAR KA PATA"[5] revealed the emotional impact of displacement on the Kashmiri Pandit community. Madhulika Jalali's journey in reconnecting with her roots highlighted the universal theme of loss and the intangible essence of "home."
3. **INTACH Bookcase Study:** The INTACH[6] mapping project identified challenges in Rainawari's cultural revival, emphasizing the need for intangible restoration over structural rehabilitation. The study underscored obstacles to the return of past residents.
4. **Don't tear it down:** This was the book studied to understand the construction techniques Taq and Dhajji dewari and how it is still relevant and earthquake resistant.[7]
5. **A long dream of Home:** This book referred to know more about the exodus and experience of people who suffered.[8]

[3] Know about culture and ritual of Kashmiri pandits refer (kashmiri pandit network.
[4] Seven Springs of Rainawari.
[5] Ghar ka pata, 2020.
[6] Shehar-I-Kashmir Volume 1&2.
[7] Don't Tear it Down!: Preserving the Earthquake Resistant Vernacular Architecture of Kashmir, 2009.
[8] A Long Dream of Home: The Persecution, Exodus and Exile of Kashmiri Pandits.

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3. MATERIAL AND METHODOLOGY

The methodology, comprising deliberate measures, contributes to the resuscitation of the rich cultural heritage of Kashmir.

Preliminary Phases: Needs Identification and Contextual Analysis: The initial steps involve identifying the project's needs, scope, and limitations. This includes an in-depth examination of Kashmir's historical[9] and cultural background to lay the groundwork for the project's goals and constraints. Understanding the causes of the mass migration and massacre faced by Kashmiri Pandits involves thorough pre-contextual research, delving into historical literature such as the Purans and Rajtarangini,[10] as well as contemporary sources like articles, films, and novels. Cultural documentation and site selection play a crucial role. A deep exploration into the culture of Kashmiri Pandits is undertaken using historical records, community involvement, and interviews. The choice of a specific research location considers historical value and its connection to the Kashmiri Pandits. An Intach book study and construction technology analysis provide insights into Srinagar's traditional houses. A comparative chart is created by mapping using Intach's methodology and analyzing findings. Investigating building methods in Srinagar helps us understand the region's architectural fabric.

On-site Documentation: Immersing in the Present: The next phase involves visiting the designated location, particularly when a significant influx of Kashmiri Pandits is returning to Srinagar. A guided map is followed, meticulously documenting houses with location coordinates and assessing their current condition. Observations and interviews become crucial, examining the state of the community, and interacting with customs and culture. This involves speaking with Kashmiri Pandits to learn about their feelings and experiences. Documentation of ghats, springs, and canals that are in disrepair or neglected yet hold cultural importance is undertaken. This documentation serves as a foundation for the restoration process.

Live Case Study: Learning from Cultural Restoration: A relevant case study is selected, drawing inspiration from Indian vernacular architectural preservation initiatives. Interviews are conducted in migrant housing in Jammu to understand the needs and experiences of Kashmiri Pandits living there.

Post-Processing: Refinement and Design: Data collected is processed and analyzed to fine-tune the project's parameters. The project's objectives are modified based on the condition evaluation of the locality. The design phase involves zoning areas according to the design brief and refining them based on identified needs. Comprehensive architectural designs focus on shared spaces and common areas and preserving classic architectural features. Innovative and environmentally responsible solutions are explored, aligning with modern sustainability principles without sacrificing cultural authenticity. A sustainable income model is devised, considering tourism, neighbourhood gatherings, and cultural initiatives.

Documentation: Archiving the Cultural Resurgence: Extensive records are kept, thoroughly documenting every aspect of the project, including community input, architectural designs, and cultural tales. A repository is established as a valuable tool for scholarly study and future ventures. An archival collection for future interventions is gathered, preserving unprocessed data from hard-to-reach locations for academic research and upcoming projects.

4. RESULTS AND DISCUSSION

This project is a transformative architectural endeavour aimed at restoring the cultural legacy of the Kashmiri Pandit community. The study's significant findings are outlined below, along with a discussion of their compliance with existing research, unexpected findings, and justifications.

Major Findings: Cultural Loss and Emotional Impact: The on-site contextual study in Rainawari revealed a profound cultural loss experienced by the Kashmiri Pandit community. **Importance of Cultural Nuances and Cultural Vibrancy During Festivals:** The project emphasizes the significance of intangible cultural aspects in Kashmiri Pandit housing. Beyond bricks and mortar, it delves into the customs and beliefs intricately woven into the fabric of their homes. Despite the challenges, the project observed cultural vibrancy during festivals in Srinagar. The community came together under one roof to celebrate, passing on their legacy. This finding supports the project's objective of creating spaces that foster communal gatherings and a renewed sense of belonging.

[9] In context to historical context, Nilmat Puran by Vedkumari Ghai is referred.

[10] Kalhana, 1148 and 1149.

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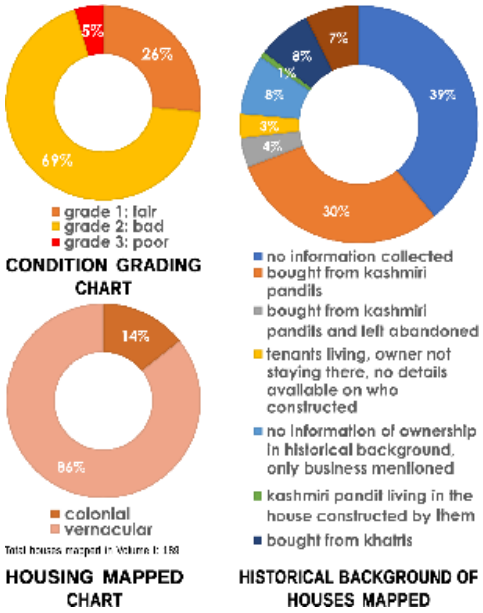

Figure 2: Pie Showing The study of Houses Mapped in INTACH

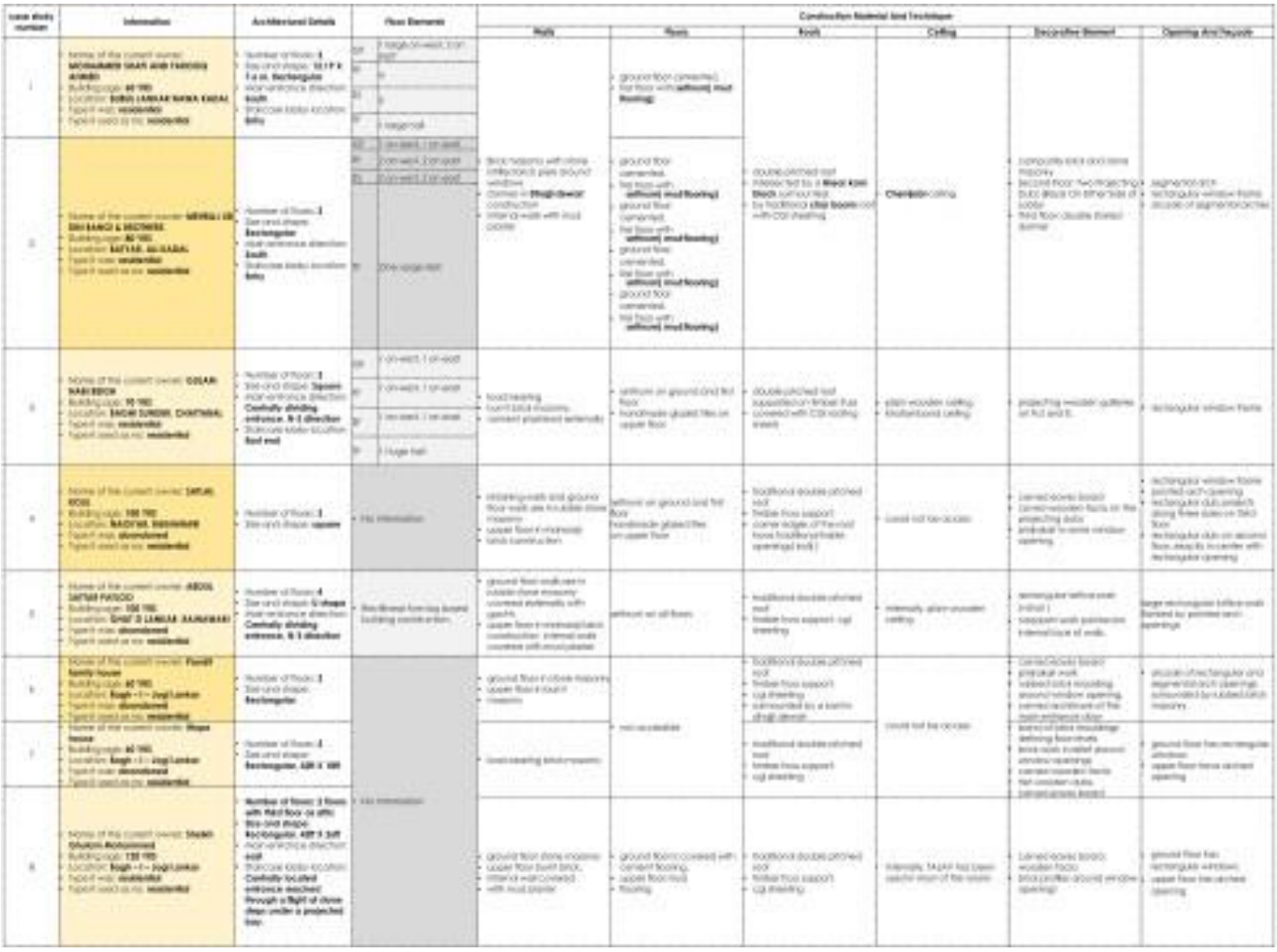

Figure 3: Chart Showing the Houses Studied in INTACH

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Challenges in Rainawari and Gaps in Existing Documentation: The documentation in Rainawari highlighted challenges, including the deteriorating condition of the area, the absence of residents, and the cultural stagnation. The adverse circumstances in Rainawari necessitated a shift in focus towards intangible reintegration, acknowledging the need for a more comprehensive strategy beyond structural restoration. The study identified gaps in existing documentation and historical records, emphasizing the need for a meticulous archival collection for future interventions. The lack of comprehensive data on cultural practices, architectural designs, and community opinions underscored the importance of creating a valuable resource for future endeavours and academic research.

Compliance with other Research: The findings align with insights from the GHAR KA PATA documentary, emphasizing the emotional impact of displacement on the Kashmiri Pandit community. Both sources underscore the intangible essence of "home" and the need for cultural revival beyond physical reconstruction. The challealignsidentified in Rainawari align with the INTACH bookcase study, emphasizing the obstacles to the return of past residents and the need for intangible restoration over structural rehabilitation. The study validates the importance of considering cultural aspects in the restoration process.

Expected vs Not Expected Findings: The identification of cultural loss, emotional impact, and challenges in Rainawari aligns with the project's expectations. The emphasis on cultural nuances and the need for a comprehensive strategy were anticipated, supporting the project's restorative approach. The unexpected findings include the strong reluctance of residents to return, the prevalence of charred buildings acting as devastating memories, and the need for intangible reintegration. These findings highlight the complex emotional and psychological dimensions of the displacement experience, requiring a more nuanced approach.

Justification of Findings: The project's justification lies in its acknowledgment of documented cultural loss and emotional impact, forming the basis for a restorative approach. Emphasizing the importance of cultural nuances justifies the endeavor to go beyond physical reconstruction, aiming to resonate with the Kashmiri Pandit community's identity. The identified challenges in Rainawari validate the project's contextual research focus, recognizing the deteriorating conditions and residents' reluctance to return. Gaps in existing documentation support the project's archival collection emphasis, addressing the lack of data on cultural practices. The observed cultural vibrancy during festivals justifies the project's intent to create spaces fostering communal gatherings and celebrations for cultural continuity. In conclusion, the results and discussion highlight the project's alignment with its objectives, the compliance with existing research, unexpected findings that deepen the understanding of the community's experiences, and justifications for the proposed restorative approach.

5. CONCLUSION

The research offers insights into the emotional impact of cultural loss, highlights the importance of cultural nuances, and acknowledges site challenges. The designed spaces aim to resurrect the essence of home, offering solace even in the absence of one's own dwelling. The program ensures accommodations in traditional housing for every Kashmiri Pandit, whether it's elderly individuals desiring to spend their final days in their homeland or families wishing to celebrate weddings with authentic rituals. The design encompasses specific areas for bride and groom housing, a small community hall, and three large housing units for families. Recognizing the importance of communal gatherings during festivals, particularly Navratri, the addition of ten cluster housing units facilitates shared living. A sizable dining community hall not only accommodates Bhandara but also serves as a venue for Wazwan. The study's adaptability and potential applications for restorative retreats are notable strengths, while recommendations for community involvement address weaknesses. Future research opportunities and raw data can extend to areas like river restoration, contributing to temple and ghat redevelopment. The research goes beyond built structures, providing a foundation for studying rehabilitation that captures the essence of home, fostering a built environment that restores culture.

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Aesthetics through Precast Technology

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ABSTRACT: This research paper explores the dynamic intersection between aesthetics and precast technology in construction. With an increasing emphasis on visually appealing architectural designs, the integration of precast technology has offered new avenues for enhancing aesthetics in buildings and structures. It investigates how precast technology has adapted and expanded to enable architects and designers to achieve architectural forms, textures, and colours it explores how precast technology has evolved to enable the creation of visually stunning and functionally efficient structures. It involves the use of advanced materials, Molds, and casting techniques to produce precast elements with intricate shapes, textures, and colours. It explores how precast technology allows for a seamless blend of form and function, offering creative expression in construction. The modular nature of precast elements provides architects with a versatile palette, enabling the creative the creation of visually striking and functionally efficient structures. Through case studies, analysis, observation, and questionnaire this paper underscores the potential of precast technology to elevate the artistic dimension of architecture.

Keywords: *Aesthetics, Precast Technology, Precast Concrete Structure, Aesthetic Potential, Visually Appealing, Modular.*

1. INTRODUCTION

During the last decade, aesthetics has gained considerable importance in the design of overall structures and precast concrete components. Several factors have influenced the design of buildings and façades; for example, greater design freedom, complex surfaces, use of refined and more costly materials, and demands on quality and durability.

A precast construction system is generally a large panel system, a modular system, or a combination of both. Precast large construction system consists of various precast elements such as walls, beams, slabs, columns, staircase, landing, and some customized elements that are standardized and designed for stability, durability, and structural integrity of the building. It involves design, strategic yard planning, lifting, handling, and transportation of precast elements. This technology is suitable for the construction of high-rise buildings resisting seismic and wind-induced lateral loads along with gravity loads. The building framing is planned in such a way that a maximum number of repetitions of molds are cast in a controlled factory condition. The factory is developed at or near the site which provides an economical solution in terms of storage and transportation.

There are two main types of precast concrete elements:

1. *Precast concrete elements* – concrete components of a building prefabricated in a precast yard or site and shall be installed in the building during construction.
2. *Precast pre-stressed concrete elements* – these shall consist of pre-stressing tendons within the elements to provide a predetermined force needed to resist external loadings and cracks such as hollow core slabs, beams, and planks

2. PRESENT SCENARIO OF PRECAST TECHNOLOGY IN INDIA

- Precast technology is gaining popularity in India's construction sector.
- It is being used in infrastructure, residential, and commercial projects.
- The government was promoting precast technology for large-scale projects.
- Quality control and sustainability were key benefits.
- Challenges include standardizing regulations and addressing logistical issues.

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3. HISTORY OF PRECAST IN INDIA

Though precast has recently become popular in India, rarely do people know that the use of this technology dates back to the mid-1950s. British Military engineers were the introducers of precast materials into the Indian construction industry. Construction costs were a huge factor in the past, leading only significant structures to use precast materials in place of the old technology for construction.

The Napier Bridge in Chennai was built near the Fort area between 1939 and 1943; it was the first pre-stressed concrete bridge in India.

Buildings and houses were still not using precast concrete for construction purposes. For civilian use in 1907, the Victoria Jubilee Technical Institute, in suburban Byculla a four-storey hostel was built using precast masonry. The hostel building was designed by Messrs Taraporvala, and Bharoocha & Co.

From small individual houses to bungalows and villas, precast construction is taking the market by storm.

4. WHY DO WE NEED PRECAST TECHNOLOGY CONSTRUCTION IN TODAY'S TIME

1. **Speed:** Precast construction reduces project timelines.
2. **Quality Control:** Ensures high-quality, consistent components.
3. **Cost Efficiency:** Long-term savings due to reduced labour and wastage.
4. **Sustainability:** Environmentally friendly and resource-efficient.
5. **Safety:** Controlled conditions reduce on-site risks.
6. **Versatility:** Applicable to various construction types.
7. **Reduced Disruption:** Minimizes disturbances to communities.
8. **Infrastructure:** Accelerates critical infrastructure development.
9. The adequate planning and implementation of precast construction can fulfill the requirements of construction demand.

5. BENEFITS OFFERED BY PRECAST

Speed-to-market—it offers flexibility in space planning by allowing for longer spans which create larger open floor plans and increased flexibility in design.

Quality and Durability—precast, prestressed products provide a long service life that far exceeds field-placed concrete partly because members are manufactured in plants under strictly controlled conditions.

Integrated project delivery precast components can be erected in a relatively short period because they interlock to support one another.

Enhances safety—precast products eliminate many of the dangers associated with on-site construction by providing a controlled, off-site fabrication environment.

Sustainability—It's a perfect green building product. Precast reduces the overall life cycle impact on the environment compared to other methods as it has lower wastage and a high potential to recycle waste. **Optimization and flexibility** offer the flexibility of space planning by allowing for longer spans which create large floor plans and increased flexibility in design.

6. STRUCTURES IN WHICH PRECAST TECHNOLOGY IS USED IN TODAY TIME IN INDIA

1. Residential complexes and affordable housing.
2. Commercial buildings and shopping malls.
3. Industrial facilities and warehouses.
4. Bridges, including road and railway bridges.
5. Multi-level parking structures.

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6. Educational facilities such as schools.
7. Hospitals and healthcare building.
8. Mass transit systems like metro stations.
9. Airport terminals.
10. Sports stadiums and arenas.

7. RELATIONSHIP BETWEEN AESTHETICS AND PRECAST TECHNOLOGY

Aesthetics in architecture refers to the visual and sensory aspects of a building, including its design, form, materials, and overall appearance.

The relationship between aesthetics and precast technology in architecture and construction is symbiotic. Precast technology provides architects and designers with tools and materials that enable them to achieve their aesthetic goals while also offering advantages in terms of quality, durability, and sustainability.

7.1 Aim

This research aims to reflect and compare between precast building and cast in-situ construction based on aesthetical features.

7.2 Objectives

- To understand precast technology.
- To study the façade treatment is appealing as in-situ construction method.
- To analyse the relationship between aesthetics and precast technology in architecture and construction.
- To study precast technology has facilitated the execution of aesthetic concepts through case studies.

7.3 Justification

- To get into consideration about precast technology and its ease in the construction industry and the facades are aesthetically pleasing.
- The study of aesthetics through precast technology bridges the gap between artistic imagination and construction reality.
- Precast technology has transformed the way buildings are constructed, offering new possibilities for architects and designers to create visually captivating structures.
- The study shows us how architects can be creative with precast technology. We can learn how different shapes and pieces can come together to make interesting and unique designs.

7.4 Methodology

The methodology for this research is:

- **Observation** of precast building.
- **Analysing** the aesthetics of the building.
- **Participatory**.
- **Questionnaire**.

7.5 Scope

- Scope includes exploring how precast elements can be combined, shaped, and arranged to create visually striking and innovative structures.
- Also includes evaluating how innovative aesthetics can be achieved without significantly increasing construction costs.

7.6 Limitation

This research is limited to the study of buildings in India.

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8. LITERATURE REVIEW

Sr. No.	*Title*	*Author/s*	*Keywords*	*Conclusion*
1.	Design factors influencing the aesthetics of architectural precast concrete	Sidney freedman		This article highlights the importance of choosing a qualified precast concrete producer for architectural projects due to the complexity of the technology. With the right precaster, the resulting quality and aesthetics are worth the effort. The use of architectural precast concrete offers a variety of solutions for aesthetically pleasing structures, aligning with Goethe's idea that the main challenge of art is to create the illusion of a higher reality.
2.	Experimental study on an optimized-section precast slab with structural aesthetics	Hyunjin ju 1 ID, sun- jin han 2, il sup choi 3, seokdong choi 3, min-kook park 2 and kang su kim 2	Zed section; precast slab; structural aesthetic; ribbed slab; composite	The study presents the Optimized Prestressed System (OPS), showcasing its aesthetically pleasing and structurally effective cross-section optimization. Experimental analysis validates its resistance to external forces and composite behaviour. Results indicate accurate evaluation by design codes, with emphasis on proper placement for required capacities. The OPS is deemed suitable for long-span structures, offering high load capacity with economic feasibility and aesthetic appeal.

8.1 Data Collection

The questionnaire was circulated regarding whether the building is aesthetically pleasing or not.

8 Building photographs were circulated and they had to rate the building in accordance with their appearance.

30 responses were collected Out of which 22 people were from a construction background and 7 people were from a non-construction background.

8.2 Data Analysis

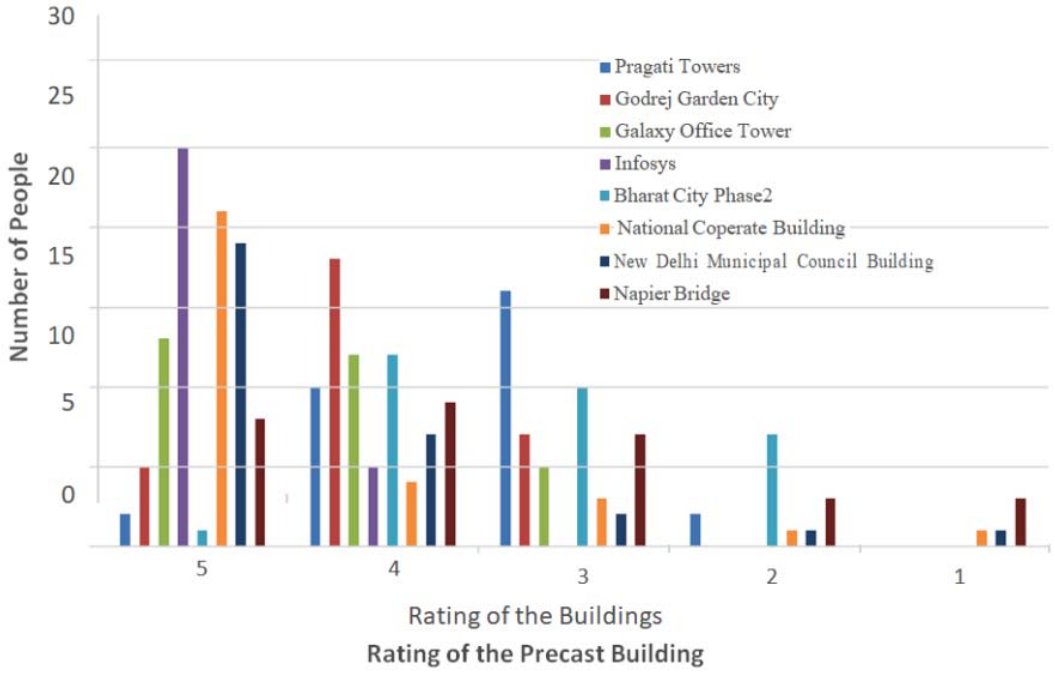

Chart 1

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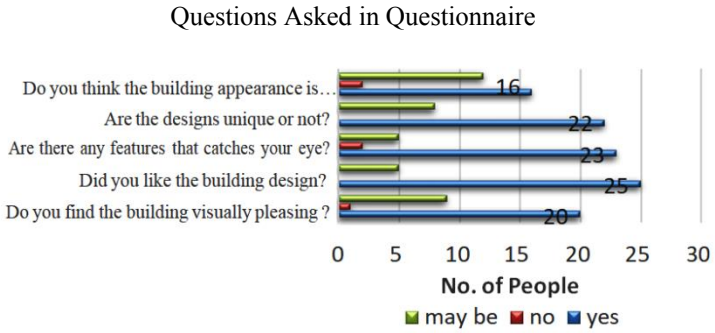

Chart 2

8.3 Data Analysis

According to the answers to the questionnaire:

- The rating of the building is mostly excellent and good.
- Among all the buildings Infosys Pune is the best precast building.
- Questionnaire circulated most of the answers were that the building is aesthetically pleasing and the façade are appealing.

https://www.precastindia.co.in/?page_id=288

Image 1: Infosys Pune is a Multilevel Car Parking

https://galaxy-aurobindo-realty.business.site/

Image 2: Galaxy Towers is a 24-Storey Office Building in Hyderabad

9. CONCLUSION

The myth that precasting leads to little flexibility in façade design no longer holds true on the contrary, because of the inherent properties and varieties in shape, architectural precast concrete is at the forefront of architecture as one of the most flexible contemporary solutions for structural façades.

The application of Precast Construction technology is very effective and efficient in terms of executing large-scale construction projects like housing, commercial, institutional buildings, etc. It is also very efficient concerning saving time, requirement of manpower, providing better construction quality, less wastage of materials, and flexibility in executing all sets of design requirements like façade, and repetitive module blocks.

Also seen that these designs aren't just for looks – they can be practical, affordable, and better for the environment too. This balance between looking good and being useful is changing how we think about architecture.

Studying aesthetics through precast technology reveals how modern building methods can create visually appealing and innovative designs, balancing beauty with practicality and sustainability

ACKNOWLEDGEMENT

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Understanding Quality of Living in Janata Vasahat

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ABSTRACT: Janata vasahat is a Housing of population of about 60,000 people. In fact, Janta Vasahat was initially known as Mohan Nagar, named after a young politician during the ministry of Indira Gandhi, Mohan Dharia, primarily for publicity. The main purpose of the study is to investigate the physical infrastructure and living conditions of the slum residents and give effective solutions and suggestions to the problems faced by them. The study is completely based on primary data collected through questionnaires asked during field survey. And by the help of google earth pro. After three visits and many interviews and observation, this come into conclusion to provide better living condition and physical infrastructure by government to increase quality of living of the Janata vasahat.

Keywords: *Housing Condition, Physical Infrastructure, Quality of Living, Survey, Public Toilet, Parvati Hill, Topography.*

1. INTRODUCTION

Slum can be defined as group settlements within cities that have inadequate housing messy living conditions and unhealthy environment for living. Slums are one of the rising problems in metropolitan cities. To account this problem would be one of great value to the city as well as the inhabitants of the Janata vasahat. It can provides them with better sanitation and well-being condition and satisfies their needs and facilities. In this study analysis of quality of living of many low income migrating families from different parts of Maharashtra, Bihar, Uttar Pradesh, Jharkhand, Andhra Pradesh arrived in scores near a small tekri (hill) of Parvati Hill in Pune, in search of refuge and a livelihood opportunity is undertaken by preparing questionnaire and asking it to slum peoples.

Aim: To study the quality of living of Janata vasahat slum.

Objective

- To analyse physical infrastructure (housing condition, sanitation facilities, water source, electricity, security of tenure, health condition).
- The main objective of slum study is to find the solution to remove the poor living standards of slum dwellers and largely focuses on physical infrastructure of slum dwellers altogether.
- This topic is to provides them with better sanitation and well-being and satisfies their needs.

2. LITERATURE REVIEW

The impact evaluation analysis of the SRS projects on slum dwellers, under SRS schemes in Mumbai, indicates that much of the emphasis has been made on the physical infrastructure Physical Infrastructure provided to slum dwellers has improved remarkably, in terms of Water Supply, Sanitation, Solid Waste Management, Public health protection, and Electricity. Many studies have been done to maximize the efficiency of resource usage, but there exist gaps and limitations on ground, this study has brought up the issues, problems faced on site and try to give better solution to rectify the same.

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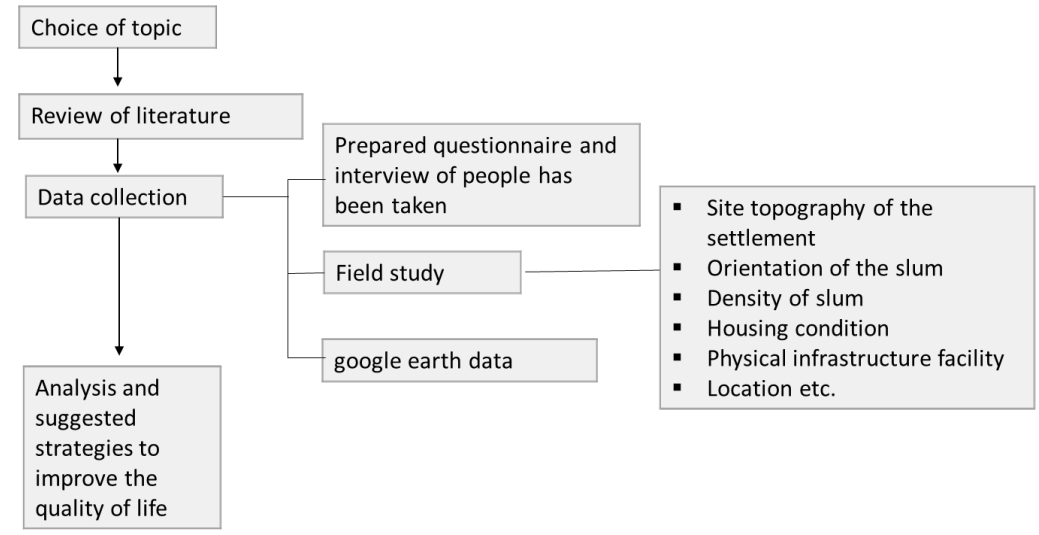
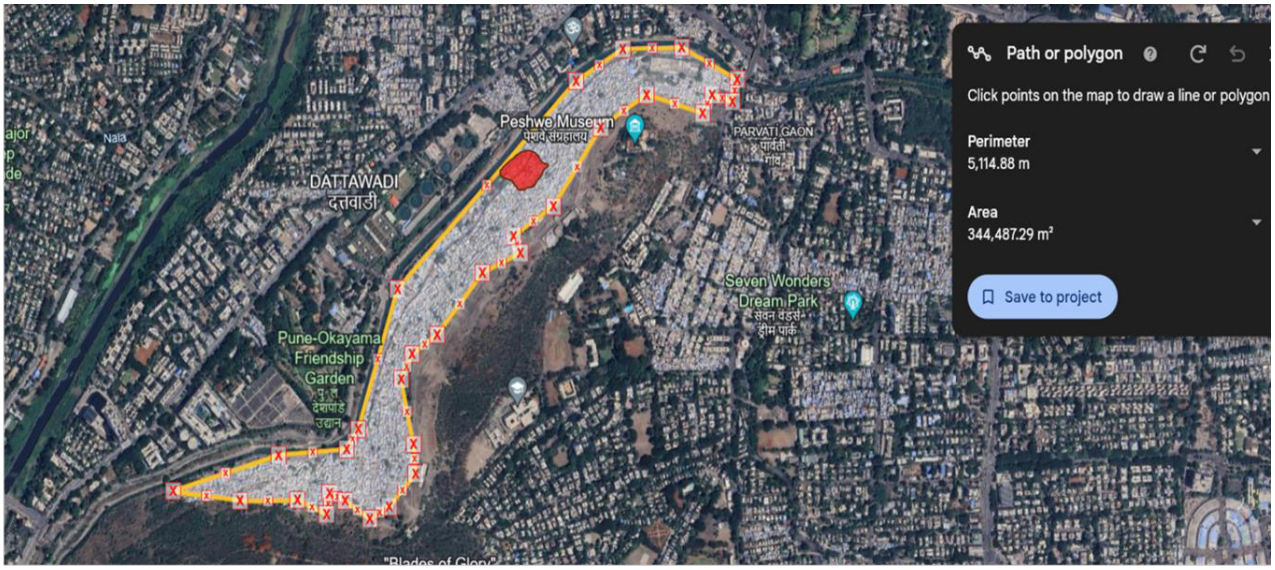
3. MATERIAL AND METHODOLOGY



4. RESULTS AND DISCUSSION

Slums located in the Core city area Near about two centuries back in 18th century, the occurrence of settlements for the poor people took place in the areas which comprise the core of Pune city, today these settlements turned to slums and gathered more and more number of dwellers with the passage of time.



Area calculation of the slum in google earth

No. of Dwelling Unit and Study Area Calculation

The measured dimension for each unit was 3.6 by 3.6 that is 13sqm per unit.

One DUs is 13 sqm.

As per google earth my study area was 455 sqm.

Total surveyed dwelling unit = 35 DUs

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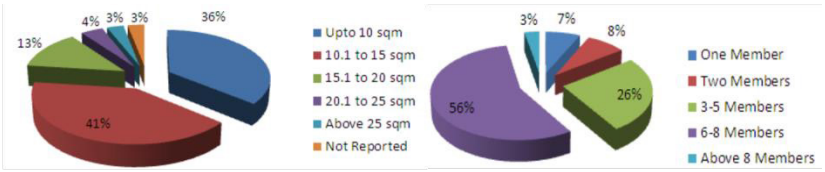


Area occupied by Dus
Source : Pune municipal corporation

Household site distribution

Observation

Houses have level differences as it is located at hills

No security to the infrastructure

Interview with local women

Metal ladder to access the house

Dweller discussing the problem faced by them

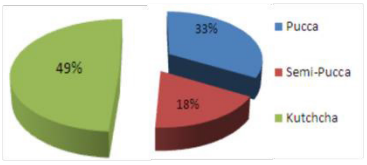
Case study of the Janata vasahat Parvati hill and interview with slum people

Image Source: Author.

Analysis

Housing Condition

- In the slums 49% of the dwelling units are in kutcha category having GI sheets as basic building material being used for the roofs, along with temporary building materials like mud, bamboo, iron sheets, jute mats are used for the walls.



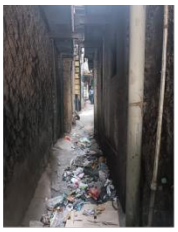
Household distribution by housing condition
Source: Pune municipal corporation

Differences in the living condition of the slum and building due to lack of awareness and proper physical infrastructure.

People who have individual toilet in their house are not maintained or some are converted into storerooms.

Metal ladder were used for access in such levels which is dangerous specially for children.

instead of handing over their property to the government, residents called in their relatives to settle in their houses.



750 mm pathway accessibility to hill houses which is messy and uncomfortable to move also the toilet opening are towards this passages.

Topography is one of the major issues of Janata vasahat as it located on the slope of the Parvati hills. Rough stairs with 300 t0 500 mm riser is difficult to climb upstairs.

One public toilet for every 50 Dus is provided by the government , but no electricity supply to it also poor sanitation, less water supply and poor facilities for women

Government has installed public taps as well as individual taps in every unit for water supply , as per study they get 180 l of water per day for drinking, washing ,bathing etc.

Image source: Author.

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- In semi pucca structures brick wall is used and roofs are generally made of tile or iron sheets.
- Structures with R.C.C. roofs and cement mortar brick walls are only 33 percent, which are categorized as pucca housing.

5. CONCLUSION

The study have been done to understand the living condition of the slum. It has brought up the issues, problems faced by dwellers of the Janata vasahat and have suggested few solution to rectify the same. Following are the major identified problems along with the suggestions:

- Public toilets with all possible facilities like electricity, water supply, proper sanitation and women facilities.
- Passages width should be wider atleast 1.2 m (to maintain anthropometry) for comfortable movement.
- Katchcha houses repairing problem are much more than pacca house as rainwater leakage tremendous heating during summer.
- Water supply timing should be more for each unit.
- Stairs with safety measures and comfortable risers should be ensured.
- As a result better living condition and physical infrastructure can be provide to increase quality of living of the Janata vasahat.

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Accessibility and Universal Design in Landscape Urban Spaces: A Case of Baramati

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ABSTRACT: The study aims to evaluate the use of urban landscape spaces in Baramati City, focusing on the needs of all age groups, genders and disabled individuals. The limitations of structured environments obstruct mobility and participation in urban and social life. The study investigate into the past understanding of disability awareness and the concept of universal design, its principles, and its impact. The research begins by identifying the various landscape spaces in Baramati City and studying the different users of universal design, considering their specific needs and requirements. The study then investigates the different disabilities faced by these users, aiming to identify the most common disabilities prevalent in the area. Furthermore, the research explores the design aids required for different user groups, with a focus on identifying the most common design aids needed for accessibility. Case studies of various landscape spaces in Baramati City are evaluated, assigning appropriate marks to each case study and comparing them against each other.

Additionally, the research categorizes the spaces as accessible or non-accessible, highlighting the barriers that contribute to the inaccessibility of certain areas. By examining these barriers, the study aims to provide insights into improving the accessibility and universal design of landscape urban spaces in Baramati City. Overall, this research paper provides a comprehensive evaluation of accessibility and universal design in landscape urban spaces, with a specific focus on Baramati City. The findings aim to contribute to the enhancement of inclusive and accessible environments for all individuals within the city.

Keywords: *Universal Design, Accessibility, Disability, Landscape Spaces, Design Aids.*

1. INTRODUCTION

Universal design or design for all is a design approach that considers every individual in society and aims to create integrated designs that are accessible, and equal to all users, regardless of skills, disabilities, or ages. This approach is also known as universal design, inclusive design, and lifespan design (Meşhur*, 31 August 2018) Design for all aims to provide equal opportunities and freedom for all individuals, including those with disabilities, children, seniors, and those with diseases. Landscape architecture in cities and rural areas must address challenges, inequity, and inaccessibility faced by inhabitants, as they lead to major challenges in their social lives. To improve landscape architecture in line with universal design, designs must be usable, accessible, and safe, providing a beneficial environment for society and all people. This study aims to contribute to the literature by discussing general principles and related areas of landscape design for all. The increasing life span of humans has led to a rise in the expected life span. However, disabled and elderly individuals face challenges in accessing services in urban spaces due to inadequate planning and architectural design. They are demanding for basic rights to independently move and access activities without external assistance. Inadequate planning in cities marginalizes these individuals, leading to forced loneliness and negatively affects their life quality. To create disabled-friendly spaces, it would be discriminatory to construct disabled-only designs and establish institutions specifically for disabled individuals. Instead, it would be more effective to arrange spaces for all members of the community. All-inclusive arrangements should be conducted to reunite urban spaces with the entire community, rather than discriminating against disabled individuals.

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2. SIGNIFICANCE

Urban spaces are a product of innovation, creativity, and interdependence, allowing for a seamless and accessible environment for all users. Universal design is an essential way of thinking in public space design, but it is often neglected. The current design caters to the differently able, but smaller needs often disappear. For example, right-hand-friendly public spaces make it difficult for left-handed people to perform simple tasks due to workplace efficiency. Differentiation in functional aspects of space can unintentionally lead to self-isolation in shared spaces. The absence of physical obstacles in urban public spaces can help shift from being divisive to inclusive. By considering the interdependence of elements within the space, users, and the community can perceive, utilize, redefine, and induce functionality. Universal design ensures that the urban public space remains accessible and functional for all users.

2.1 Background and Context

In the 21st century, urban habitability, environmental aspects, ecological balance, democratic, and sustainable social utility and design are being discussed. Universal design is the design of the environment and products that can be used by all people, focusing on social structure as much as physical structure. It separates universal design from other design terminologies by focusing on social structure, unifying products with buildings or cities, and aiming to be accessible for everyone. United Nations (UN-Habitat) and other international organizations co-create "Friendly and Safe Cities for Everyone," which is the planning and management of "Friendly and Safe Cities for Everyone." (Meşhur*, 31 August 2018) Universal design is different from other design terminologies like accessibility design or design without disabilities due to its characteristics of not being specifically designed for a certain group of disability, being normal, feeling normal, and being unifying. Universal design creates products, services, and spaces that satisfy the needs of people by taking the different needs and skills of everyone into account in the design process. It is essential for good design to serve as many different users as possible, regardless of age, situation, ability, or disability conditions.

The universal design approach emerged in the 20th century due to social, economic, demographic, and age-related changes. Interest in universal design has grown due to the increasing number of people living with disabilities, increased life expectancy, and increased purchasing power of the disabled population. The term was first used by American architect Ronald L. Mace in 1985, who believed that designs based on average human characteristics were not suitable for real conditions (Meşhur*, 31 August 2018).

The Center for Universal Design determines seven principles of the universal design approach, which are applicable across various design groups, including City Planning, Architecture, Interior Design, Industrial Design, and Landscape Architecture.

These principles include (Meşhur*, 31 August 2018).

1. ***Equitable Use:*** Emphasizing the importance of designing for individuals with different skill sets, including in public spaces, environment regulations, and product designs.
2. ***Flexibility in Use:*** Catering to the user's personal skill and preferences, offering alternatives for different usage methods and accessibility for both left-handed and right-handed individuals.
3. ***Simple and Intuitive Use:*** Design that is easily understood and perceivable, considering the user's experience, information, language, and skills.
4. ***Perceptible Information:*** Product environments should present information about usage without influencing the user's environment or perception skills.
5. ***Tolerance for Error:*** Minimizing negative outcomes and dangers from accidents or unwanted actions.
6. ***Low Physical Effort:*** Designed products and spaces should be efficient and comfortable, allowing users to stay in their natural body forms.
7. ***Size and Space for Approach and Use:*** Providing appropriate space for users, considering their body sizes, postures, and movement characteristics.

Baramati, a small township in Pune district of Maharashtra, is a significant agricultural hub. The town is known for its ago-tourism, which allows visitors to witness the simple lifestyle of agriculture-oriented ethnic India. Baramati is also home to reputed educational institutions in Agriculture, Law, Engineering, and Biotechnology, and is set to establish a medical college. Baramati is well connected to Pune via road and railways and has an airport that currently hosts a flying school. The town has well develop urban infrastructure along with various well designed landscaped urban spaces compare to other cities, Such as:

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1. Nakshatra garden
2. Puna wala garden
3. Ga-di ma auditorium road streetscape
4. Shivaji udyan
5. Nana nani park
6. Municipal garden
7. Canol road streetscape
8. Baramati Bhigwan road

(a)

Baramati city has landscape urban spaces since long time and some are being develop right now, many other cities do not even have landscape spaces. So we are doing this research in Baramati. So let us check weather this spaces incorporate landscape design in it.

3. LITERATURE REVIEW

The research paper titled **evaluation of urban spaces from the perspective of Universal design principles The case of konya/ turkey is written by** H. Fİlİz Alkan Meşhur Selcuk University Faculty of Architecture, Department of City and Regional Planning. It is published in TeMA Journal of Land Use, Mobility and Environment.This research aimed to conduct evaluations on the use of urban outer spaces situated within Konya City Center. In the hypothetical and theoretical part of this paper, the perception of disability throughout historical process has been examined from a sociological perspective. In addition, concept of universal design, its principles and gravity have also been elaborated. In the part dealing with the case study, outer spaces within Konya City Center have been analyzed with respect to universal design principles and a range of suggestions have been developed. The case study of Konya City Center evaluated outer spaces using a universal design approach. It analyzed accessibility and use status for individuals with restricted mobility. The study, conducted in April 2015, examined current conditions, challenges, and opportunities using on-the-map marking, photography, and technical observation methods. The study examined universal design principles in three key areas: entrances and exits, movement and circulation systems, and common-use needs. The paper emphasizes the importance of ensuring that physical spaces used by disabled and elderly individuals are accessible and inclusive for all societal members. It suggests that urban interior and outer spaces should prioritize the needs of all society members, allowing independent movement and pedestrian-focused designs. It also suggests that public transportation should be integrative and all-inclusive, rather than specific solutions for disabled and elderly individuals. The text also calls for increased social awareness and a shift in biased perspectives towards disabled and elderly individuals. The text concludes by suggesting that such arrangements could strengthen life-bonds between disabled and elderly individuals and the city.

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The research paper titled **landscape design for all is written by P**eyzaj Yüksek Mimarı Bilgenur AK and prof. Dr. Elmas Erdoğan Ankara üniversitesi, ziraat fakültesi/fen bilimleri enstitüsü, peyzaj mimarlığı bölümü, ankara/türkİye University Faculty of Architecture, Department of City and Regional Planning. It is published in social sciences Studies journal on 23 July 2019. Vol. 5, Issue 39. This research aimed to contribute to the understanding of landscape design for all. It develop theories, principles and solution suggestions for ensuring that each and every individual uses the solutions developed for physical environment in the widest sense, within the scope of buildings, any area and space that is subjected to landscape design, communication tools or households goods. The study explores design for all principles, landscape design, and universal design through comprehensive literature research, analysis, and anesthetization. Findings are then examined within universal design criteria and landscape components, establishing design for all components. The global population growth, particularly among seniors and people with disabilities, has emphasized the importance of universal design. This approach focuses on accessibility, safety, and inclusion, considering the unique physical and senatorial characteristics of individuals. Landscape architecture, a discipline that affects everyone, must adopt universal design principles alongside general design, aesthetics, and agronomy. The main objective is to ensure equal rights and opportunities for all individuals. A perfect landscape design must be comprehensible, open to development, and consider social structures and life experiences for senility, disability, affection, and childhood. It should be inclusive, sustainable, and adaptable to changes, ensuring a safe and freedom-based living environment.

The research paper titled **Universal Design and Social Sustainability in the City: The Case Study of Tehran Iran is written by** lida Eslami and Mohammad Mehdi Mahmoudi Science and Research Branch of Islamic Azad University, Tehran, Iran It is published online with Open Access by IOS Press, Universal Design 2016: Learning from the Past, Designing for the Future. The main goal of this research is finding solutions for increasing social interaction and greater participation of people with disabilities in public spaces by applying Universal Design. ? The research is based on applied theory, field research methods and a mixed qualitative–quantitative approach. In addition, and the results include both empirical and functional solutions. Universal Design is a social sustainability initiative that offers equal opportunities for all under the protection of law. However, it faces challenges such as lack of accountability, executive guarantees, inefficient management, lax laws, public concern, and an integrated inter sectional approach. Public awareness about disability rights, well-defined laws, and poor law enforcement are also issues. To apply Universal Design effectively, collaboration between experts in various fields, including urban ism, architecture, social behavior, electronic technologies, and telecommunication, is crucial. This approach creates a fair platform where all members of society can live together without discrimination, with strong social ties and a sense of belonging. Universal Design allows people with disabilities to participate in social spheres, enjoy human dignity, and be respected by society.

The research paper titled **Universal Design in Urban Public Space The Case of Zafer Pedestrian Zone Konya-Turkey is written by** H. Filiz Alkan Meşhur Bilgehan Yılmaz Çakmak It is published in International Journal of Architecture & Planning publish in *Volume 6, Special Issue, pp: 15-40 /Published 31 August 2018* .This research aimed to evaluate the usage of urban spaces in Safer Pedestrian Zone, located in Konya city center, within the scope of universal design principles. The concept of universal design in the historical process, universal design's emergence process and it's principles and significance has been discussed in the theoretical infrastructure section of the article. The Zafer Pedestrian Zone in Konya city center was chosen for a study due to its intensive use by pedestrians. The study examined national and international publications and guidelines related to universal design, identifying existing opportunities and obstacles. Various assistive tools were used to determine the needs of visually impaired, hearing impaired, physically handicapped, kids, elders, and individuals carrying tools or other loads. Analyses were conducted on scaled maps to determine the feasibility of building accessible places in public spaces. Movement limiting factors, such as non-standard sidewalks, staircases, and street furniture, were also assessed. An assessment table was created to assess the suitability of universal design principles and sub-principles. The study examined four main categories: usage of transportation and circulation systems, usage of transportation zones, usage of city furniture, and signs and navigation resources. Suitability criteria and tables were created using literature and national and international standards.

Universal design is a concept that aims to make urban areas accessible and comfortable for all people, regardless of their physical abilities. It is not just for disabled or elderly individuals, but for people with different needs and abilities. Universal design should be inclusive and safe for all users, including those with disabilities. It should be designed to facilitate mobility, both indoors and outdoors, and should consider all user groups. The field study suggests eliminating deficiencies and redesigning integrated city furniture, including barrier-free pedestrian crossings and accessible entrances. Additionally, railing arrangements should be used to secure intersection points between vehicles and pedestrian roads and pools.

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The research paper titled **design guidelines: The relationship between well-being, Universal design and landscape architecture is written by** Jingyi Ma publish in 2022 Lincoln University Digital Dissertation.This research aimed to identify the relationship between universal design guidelines, landscape architecture and well-being by using a qualitative content analysis method to propose a new framework for future study. The study aims to explore the connection between universal design guidelines, landscape architecture, and well-being, and propose new frameworks for future research in this area. This dissertation explores the connection between universal design guidelines, landscape architecture, and mental health, aiming to create a framework for landscape architects to address mental health and well-being through universal design principles. The research uses qualitative content analysis, data collection, methods, and a summary. This study uses a summative content analysis to understand the relationship between the UDG, well-being, and landscape architecture. The method involves counting and comparing keywords, interpreting the underlying context, and identifying meaning units. The assumptive approach is suitable for this research, as the object text is different. The steps suggested by Erlingsson and Brysiewicz (2017) will be substituted with the methods mentioned in the summative approach. The COVID-19 pandemic has increased the need for health and well-being design guidelines, making it challenging for landscape architects to find suitable guidelines. This study aimed to examine landscape design guidelines focusing on universal design or well-being. A literature review identified six themes: 'Content Specific to Keywords', 'Safety', 'User Groups', 'Physical and Mental Well-being', 'Culture', and 'Details in Design'. Both universal design guidelines and health and well-being design guidelines in landscape architecture focus on user groups, safety, physical and mental well-being, and culture. However, the perception of the relationship between these guidelines is inconsistent. The literature review suggests designing for wellness and health should be an important part of universal design guidelines, but the results are different. The study suggests adopting Steinfeld's (2012) eight goals in universal design as a basic framework for future landscape architecture guidelines.

4. RESEARCH FOCUS

4.1 Research Question

How the universal landscape design is included in landscaped spaces of Baramati.

4.2.1 *Aim*

To study inclusion of universal design in landscaped urban spaces in Baramati city.

4.2.2 *Objective*

- To make a list of landscape urban spaces in Baramati city.
- Looking for literature to understand parameters and standards of universal design.
- To understand different user groups in universal design and their needs.
- To check the provision of necessary universal element in landscape urban spaces and check their current condition.
- To analyse and compare with standards of universal design.

4.3.1 *Scope*

There are 8–9 landscape urban spaces in Baramati and some spaces are currently being constructed but I have only studied 4 spaces which are Nakshatra udyan, Puna wala garden, Gadima auditorium road streetscape, and Municipal garden, and study is only situated in baramati city.

4.3.2 *Limitations*

The research focuses on the physical infrastructure provided and its compliance with universal design parameters, without examining its actual usage or its impact on accessibility for the disabled or the increase in the use of such spaces.

5. RESEARCH METHODOLOGY

The research method for this study is mixed method consisting of both quantitative and qualitative data collection. The research instrument for this study will include observation checklists and physical analysis.

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6. DISCUSSION ABOUT DATA COLLECTION

6.1 Research Method

The research method for this study is mixed method consisting of both quantitative and qualitative data collection.

6.2 Processes Followed

The case studies has been selected as the study area. Prior to study, Publication guides for regulations related to universal design has been examined. With these research in mind, existing opportunities and problematic constraints and obstacles has been detected by doing physical analyses in study areas. Detected obstacles have been evaluated according to universal design approach and principles.

7. ANALYSIS AND INFERENCES

Understanding Disability & Diversity

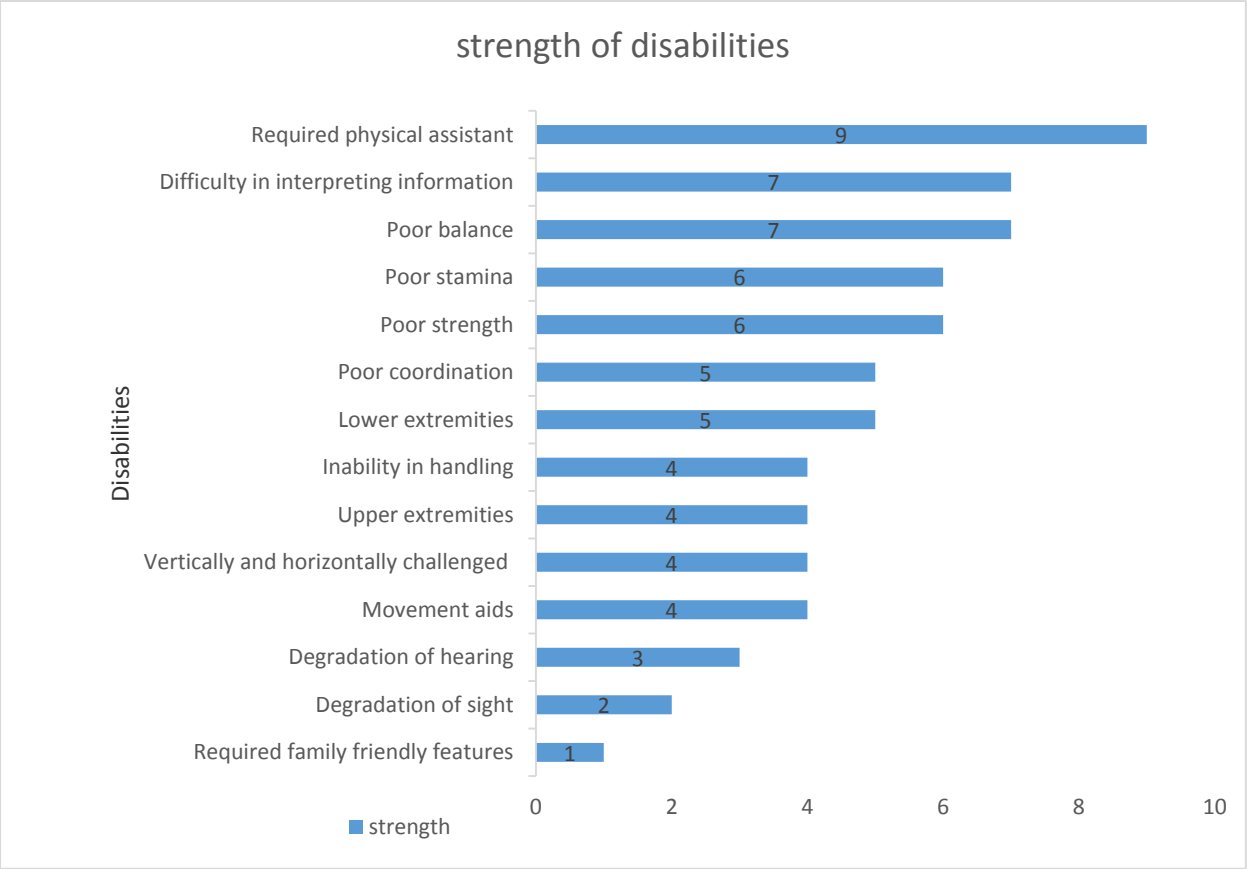

Figure 1: Strengths of Disabilities

The bar chart depicting the strength of disabilities in universal design provides valuable insights into areas that require attention. The top five disabilities, showcasing high strengths between 6 to 9 are crucial to address during the design process. Focusing on these disabilities can significantly improve the accessibility and inclusive design. The medium strength disabilities, represented by bars ranging from 4 to 5, also require attention to ensure that the design is more accessible. While not as desperate as the top five disabilities, addressing these areas can still have a positive impact on the inclusive design. The lower bars with strengths ranging from 1 to 3 have the least strength and require less attention during the design process. However, it's still essential to consider these disabilities to create a truly accessible and inclusive environment. Overall, the bar chart highlights the importance of considering disabilities of varying strengths during the design process to ensure that the design is accessible to all individuals.

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Understanding the design aids required for different user group

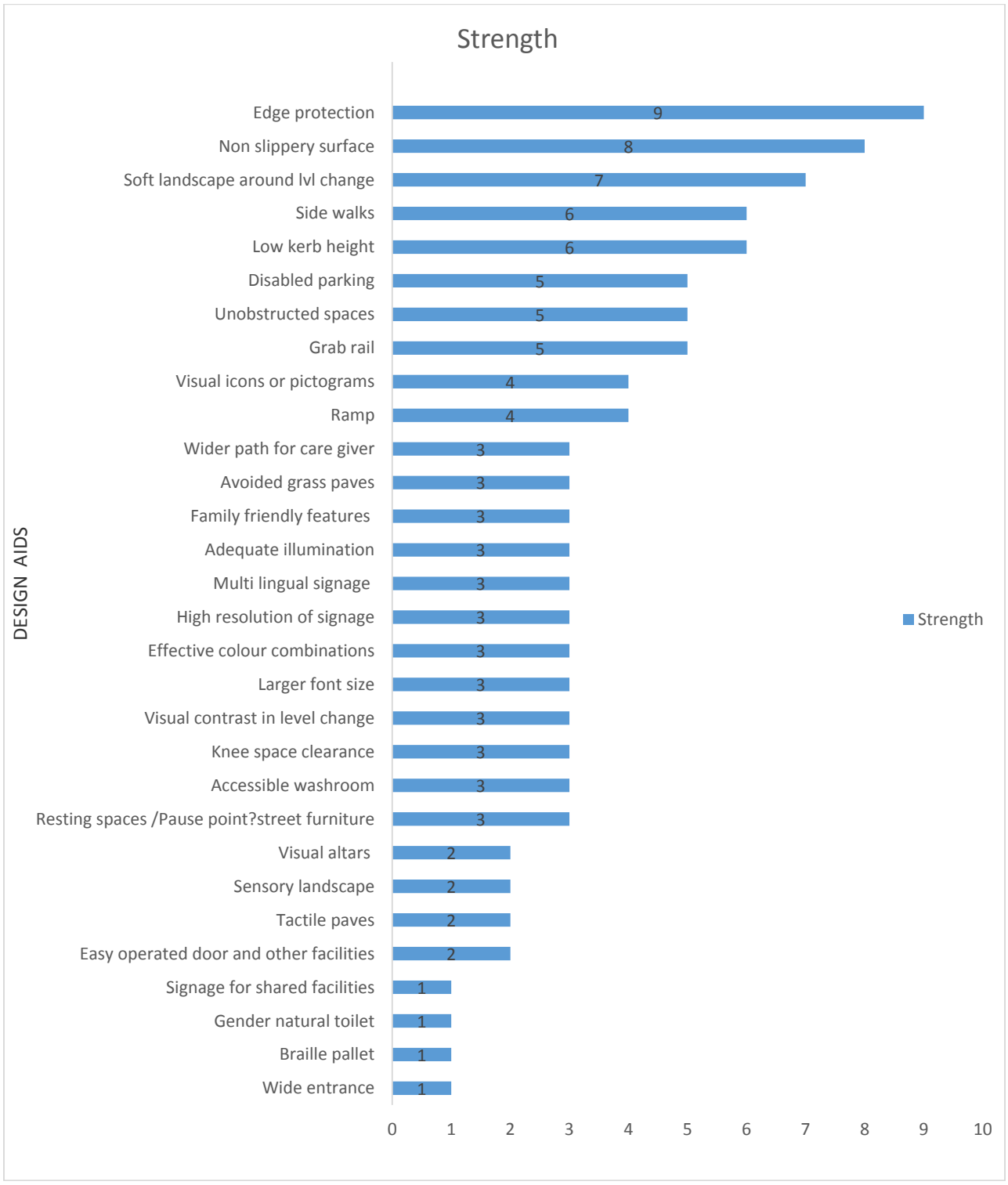

Figure 2: Strength of Design Aids

In the tracing of creating inclusive and accessible environments, universal design aids play a crucial role. A bar chart depicting the strengths of various design aids provides valuable understanding into their effectiveness. By assigning marks based on the strength of each aid, we can establish a comprehensive criteria that highlights their respective capabilities. The top bars, showcasing strengths ranging from 6 to 9, are allocated a significant 20 marks, acknowledging their high strength.

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Following closely, design aids with strengths between 4 and 5 receive 15 marks and those with a strength of 3 are granted 10 marks, signifying their moderate strength. Lastly, the design aid group with the lowest strength, ranging from 1 to 2, receives 5 marks. Through this criteria, we can evaluate and prioritize universal design aids based on their strengths, ultimately encourage environments that cater to the diverse needs of all individuals.

The case studies are evaluated by using above marking criteria.

Table 1: Table of Evaluation of Case Studies

Sr. No.	*Design Aids*	*Case 1*	*Case 2*	*Case 3*
1.	Wide entrance	5	5	5
2.	Braille pallet	0	0	0
3.	Gender natural toilet	0	0	0
4.	Signage for shared facilities	0	0	0
5.	Easy operated door and other facilities	0	0	0
6.	Tactile paves	0	0	5
7.	Sensory landscape	0	5	5
8.	Visual altars	0	0	5
9.	Resting spaces /Pause point?street furniture	0	0	10
10.	Accessible washroom	0	0	0
11.	Knee space clearance	0	0	0
12.	Visual contrast in level change	0	0	10
13.	Larger font size	0	5	10
14.	Effective colour combinations	0	5	10
15.	High resolution of signage	0	5	10
16.	Multi lingual signage	0	5	10
17.	Adequate illumination	10	5	10
18.	Family friendly features	10	5	10
19.	Avoided grass paves	5	10	10
20.	Wider path for care giver	10	5	5
21.	Ramp/kerb ramp	0	0	15
22.	Visual icons or pictograms	0	0	15
23.	Grab rail	0	0	0
24.	Unobstructed spaces	15	15	5
25.	Disabled parking	10	10	5
26.	Low kerb height	15	5	20
27.	Side walks	15	20	20
28.	Soft landscape around level change	15	20	20
29.	Non slippery surface	10	20	20
30.	Edge protection	10	15	5
	Total	**130**	**160**	**240**

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Case 1: Poonawala garden

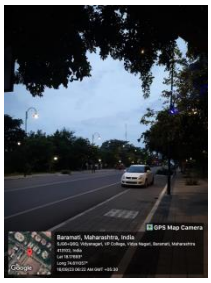
Case 2: Nakshatra udyan

Case 3: Gadima auditorium road streets-cap

Case Study 1: It shows a moderate level of fulfill to universal design, with a total of 130 points. This suggests that some areas have successfully integrated universal design, but there may be elements that do not meet the standard or are absent. Further analysis of the specific elements would provide a more comprehensive understanding of areas for improvement.

Case Study 2: Shows a higher level of fulfillment to universal design, with a total of 160 points. This suggests that the Nakshtra garden has incorporated a greater number of universal design elements, indicating a conscious effort to create a more inclusive and accessible environment. However, further analysis of the specific elements is necessary to understand the extent of universal design principles' implementation.

Case Study 3: Shows a significant level of fulfillment to universal design principles, with a total of 240 points. This indicates a strong commitment to inclusivity and accessibility, with a wide range of design considerations taken into account to cater to diverse user needs.



High Resolution Text

Tactile paves and kerb ramp

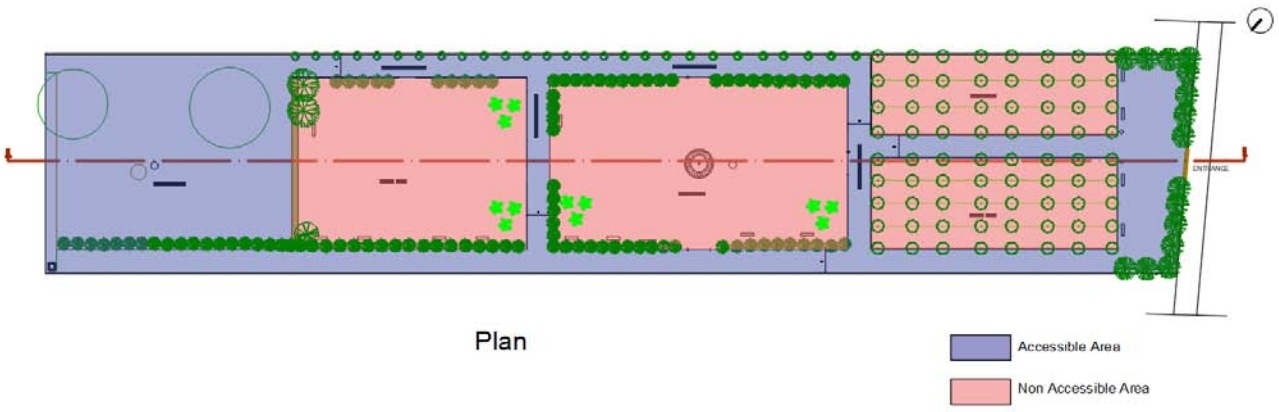
High Resolution signage's

Pause Points and Seating

Reachable dustbin

Adequate lightning

Case 1: Poona Wala Garden



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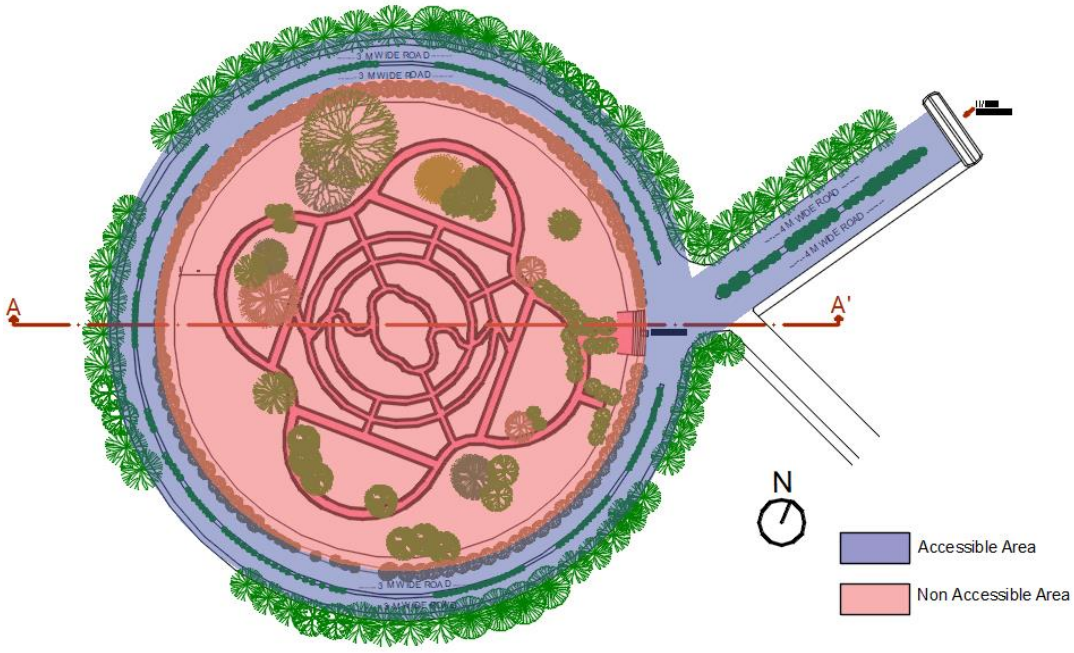
Absence of kerb ramp at level change

Planters causing barriers to access green area

Improper road gradient along width

Barriers for vehicle create barriers for accessibility

Case 2: Nakshtra Garden



Plan

Absence of Ramp and Grab Rail

Narrow Pathways

Inaccessible Drinking Water Facility

No. Kerb Ramps

No. Seating Areas and Furniture

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A zoning approach to the planning of landscape spaces, which distinguishes between accessible and non-accessible areas based on the presence of universal design features. The study finds that the absence of universal design features in some areas limits the ability of certain user groups to access and benefit from these spaces.

10. CONCLUSION

The research paper on emphasizes the importance of inclusive and accessible design. It highlights the need to consider the varying strengths of disabilities during the design process to ensure accessibility for all individuals. Focusing on top disabilities and addressing medium and lower strength disabilities can significantly improve inclusive design. The evaluation of design aids based on their strengths emphasizes the significance of prioritizing universal design aids to create environments catering to diverse needs. The case studies of Poonawala Garden, Nakshatra Udyan, and Gadima Auditorium Road Streetscape provide insights into the level of fulfillment of universal design principles. The paper emphasizes the need to distinguish accessible and non-accessible areas based on the presence or absence of universal design features. By considering these findings, urban planners and designers can create more inclusive and accessible environments that benefit all individuals, regardless of their abilities or disabilities. The research paper highlights the importance of universal design in landscape urban spaces to ensure equal access and usability for all individuals, particularly those with diverse abilities. The research underscores the need for greater awareness and implementation of universal design principles in landscape urban spaces to promote inclusivity and accessibility. The paper recommends that designers and planners should prioritize the integration of universal design features in all areas of landscape spaces, including non-accessible areas, to ensure equal access and usability for all individuals. Overall, this research highlights the significance of universal design in creating more equitable and inclusive urban environments and calls for a concerted effort to promote the adoption of universal design principles in landscape urban spaces.

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Identifying Conceptual Application of Biophilia in Heritage Buildings of India

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ABSTRACT: This paper is about identifying conceptual applications of biophilia in the heritage buildings of India. It is believed that the concept of biophilia is adopted from the modern western culture. In this paper the above point is cross-examined and the Indian heritage buildings are studied in order to prove that the biophilic philosophy is used from olden times in India. Furthermore the structures are studied using five main principles as the base of the examination. After all the analysis of the case studies the study is segregated in three main points to come to conclusion about the common points and differences witnessed throughout the structures.

Keywords: *Biophilia, Restorative Patterns, Geographic Compatibility.*

1. INTRODUCTION

The concept of biophilia is the human instinct to connect with the nature and the other living beings. This philosophy is used to bring in peace to the manmade structures. Using things like plants to cut down the sharpness of the surrounding as the most man-made structures are in 90 degree and natural shapes are organic. There are also many proved mental health benefits of a biophilic design. Biophilic design uses elements of nature to provide respite and joy to people in man-made spaces. Biophlia can be noticed in various ways. The ways are classified in three main categories. They are:

- **Nature in space:** It refers to the direct presence of nature.
- **Nature of the space:** It is about mimicking or being inspired by spatial configurations in nature.
- **Natural analogues** use indirect methods to reflect nature, such as the use of naturally inspired patterns and shapes with non-natural materials or materials that have been extensively altered. (Vidovich).

This concept of biophilia was used in olden times only to be rediscovered in the modern era. It was used and valued in the olden times, this was one of the many reasons the heritage structures are still found peaceful and glorious. Those are further studied in the paper.

This research will cover the biophilic applications used in heritage Indian Architecture. This research will be unique to Indian structures only and no other parts of the world will be covered. Right now this research is limited to western India but other parts of India can be covered at a later stage. The objectives of this research will be.

- To prove that biophilia has been used since olden times.
- To cover different structures occurring in different natural stretches like mountains, rivers, and lakes.
- To analyze the common approach of biophilia in the old Indian structures.

2. LITERATURE REVIEW

2.1 Natural Connectors: Biophilic Design Takes Root (JSTOR)

Introduction: This paper elaborates on the benefits of biophilic designs. It also specifies on the ways people have incorporated biophilia in their design and its benefits. The paper has been reviewed in order to understand the basic application of biophilic design in the available small space. Application of these small ideas will make a difference in the health and will make a way to a peaceful mind.

Base Theories: The author adds detail to the biophilia and its advantages. Furthermore some application are given in the paper that can be easily applied in the home "Biophilia, when interpreted through biophilic design , helps reduce everyday

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stresses by providing people greater daily exposure to the nature and bring the gap of disconnect" Author also adds about the changing lifestyle and effects design.

Methodology: The author has done research using case studies of some:

- Celebrated examples of biophilic architecture.
- Strategies used in the small semi open spaces
- Public levelprojects.

Author has also looked at 101 students around the world to examine the benefits of nature on physical and mental well-being.

Observations and Conclusions: The author has summarized the findings of the survey and the case study and has also come up with applications for biophilic design. "Key insights from natural balance research include access to greater quality of life". But the author has not touched upon the reasoning of this application which can help more. (Dominique Hes, 2018)

A typological, environmental and socio-cultural study of semi-open spaces in the Eastern Mediterranean vernacular architecture: The case of Cyprus

Introduction: This paper elaborates on the semi open spaces largely incorporated in vernacular dwellings in Cyprus during the 19th and 20th century which are significant socio-cultural function and environmental features of the vernacular architecture of the area. This paper has been reviewed in order to study the nature's connection with the architectural structure through the means of semi-open spaces.

Base Theories: The author adds to detail about the semi-open spaces constituted as a fundamental design element of vernacular residential architecture. The author has also studied the whole time-line of these semi-open spaces throughout history." Despite their proven advantages and long-lasting presence throughout the centuries, semi open spaces are often incorporated in contemporary architecture, indicating a decline of this well-suited traditional architectural feature." The author has added on how these principles of semi open spaces can be applied in the modern age.

Methodology: The author has done analytical research with some historical base to it. The author has identified some historical semi open spaces of the Cyprus with the help of the maps. Then conducted a survey throughout the age groups to recognize the effects of those spaces.

Observations and Conclusions: The author has come up with the findings that semi open spaces are nature responsive and act as the connection between structure and nature. (Maria Philokyprou, 2021).

Biophilic Design: An Introduction to Designers

Introduction: This paper talks about the principles of biophilia. The applications that make a design biophilic are discussed in this paper with help of the appropriate case studies. It also further adds on the timeline of biophilia concepts origination and further development. This paper is reviewed to understand the principles of biophilia through which one can understand "what is" and "what is not" a biophilic design.

Base Theories: The author shines light on the basic principles of biophilia and takes an approach of myth busting, and questions the wrong ideas that people have developed over the years. The biophilia concept is fairly new when it comes to definition but people have been practicing this for many years. "The successful application of biophilic design fundamentally depends on adopting a new consciousness towards nature recognizing how much our physically and mental well-being continues to rely on the quality of our connections to the world beyond of which we still remain"

Methodology: The author has done analytical research with the help of the books and multiple case studies and finding the common aspects between the two.

Observations and Conclusions: The conclusion of the research is that biophilic design appears to most as simple common sense but there is more to it. It is about the whole experience of the environment. The author has ended with that designers should be conscious about these misconceptions. (Rory Martin, 2018)

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3. METHODOLOGY

The method of research will be based on the case studies. The research will include a thorough study of the biophilic principles and then studying its applications in the selected case studies. The selection criteria of the case studies are based on the different natural occurring like mountains, rivers, and lakes and the structures placed in these vicinities. One more selection criteria that is covered is gathering space, residence, and religious place. After the analysis of these structures, their similarities and differences will be obtained. The case studies include

1. Karla caves, Maharashtra
2. Sangameshwar Temple, Saswad, Maharashtra
3. Udaipur Lake Palace, Rajasthan

3.1 Principles of Biophilia and Case Study Findings

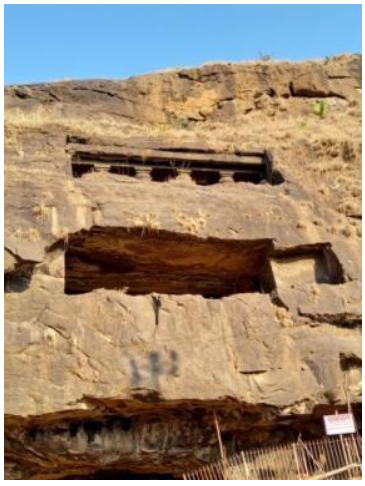
The concept biophilia is bifurcated into five principles. The principles of biophilia are distinguished into five categories.

- One is the **environmental features**. This specifies the direct contact with vegetation in and around the built environment; it is one of the most successful strategies for fostering human-nature connection in design and the presence of plants.
- The second is **natural shapes and forms**. It states the connection between the forms and inspirations that anchor nature and structure frames feeds our need for diverse forms.
- The third principle is **Restorative patterns and processes**. It is essential to find opportunities to connect to the richness of our sensory system, in and around the built environment. This is the main point that this principle states. The senses generally explored in this principle are sound and smell.
- The fourth principle is about **light and space**. This is about the exploration of light and spatial relationships.
- The last principle is about **place-based relationships**. This element focuses on connection to ecology and prominent geographical features (e.g. - mountains, deserts, rivers, lakes). The way a structure is placed on the site and its significance. Based on these five principles the whole concept of biophilia is rooted. Biophilic designs are planned to take all or some principles into the consideration. (Bochart)

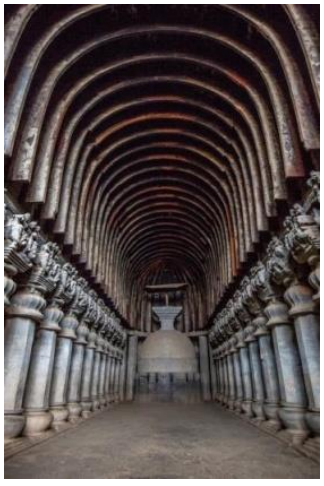
3.1.1 *Karla Caves*

The Karla Caves are a complex of ancient Buddhist Indian rock-cut caves in Karla Maharashtra. Other caves in the area are Bhaja Caves, Patan Buddhist Cave, Bedse Caves, and Nasik Caves. The shrines were developed over the period – from the 2nd century BCE to the 5th century CE. These caves have arisen near a major ancient trade route, running eastward from the Arabian Sea into the Deccan. These caves consist of the Chaitya hall and Viharas (Residence of the monks). Chaitya hall is man-made cave that has height of six to eight meters. Viharas are cell like rooms for the monks.

This structure was selected as it fulfills the criteria of a prior residence and religious place. The journey to reach the structure includes trekking through a trail and in the monsoon various waterfalls appear so connection to the nature is more dense.



Viharas in the Mountain of the Karla



Chaitya Hall

Natural Texture Inside the Viharas

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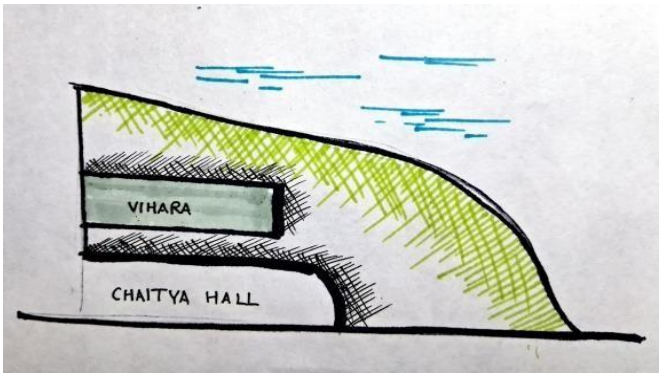
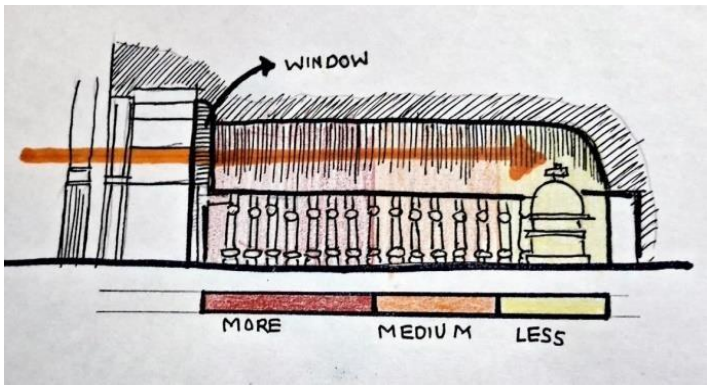
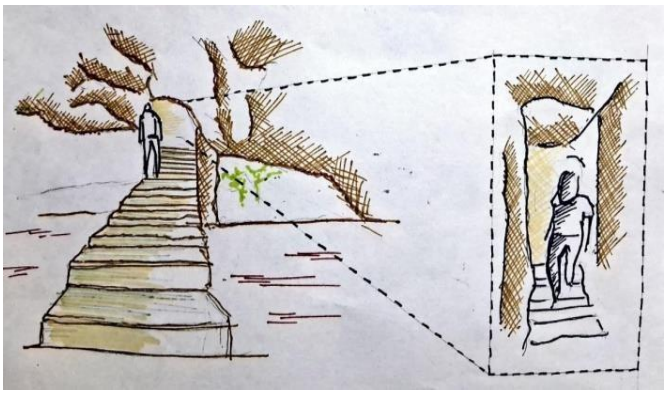
The Trail Leading to the Structure



Both the Structures are Carved Completely in the Mountain



The window is placed in such a way that the light reaches till the end and its intensity gradually decreases



The access to the Viharas is from a staircase carved in the mountain it gives feeling of being inside a cave.

The following case study is done considering the five principles of biophilia stated above:

- ***Environmental Features:*** The structure is in the middle of the forest in the mountains of Karla. There is a trail leading to the structure surrounded by trees. The structure is surrounded by rock and the structure itself is made of rock. In monsoon, the structure is surrounded by waterfalls which add up another natural element to it.
- ***Natural Shapes and Forms:*** Ornamentation in the pillars of chaityas. The facade makes it look as if the entire structure rested on the back of an elephant with ivory tusks, elephant being a significant symbol in Buddhism. Motifs are made of floral patterns and animals.
- ***Restorative Patterns and Processes:*** The texture of the rock is kept unpolished. The wind and the smell of the surroundings along the way, feeling of walking through a forest while walking on the trail. These all are the senses that remind of nature. Chaityas were influenced by the hermit that follows living in solitude. The staircase to the viharas is not grand it gives the feeling that one is enclosed in the rock.
- ***Light and Space:*** The dark and light in the chaitya hall represent the intensity of light and the solitude of the dark. The use of light in the staircase to the viharas. The sun window at the entrance is to bring in the light and give it a feeling of a natural cave. The light from the window in the vihara reaches the end of the room this shows the strategic placement of the window
- ***Place-based relationship:*** This structure has a very close place-based relationship because it is carved inside the mountain. In monsoon, a water element is added because a waterfall flows from above. A relationship between rock and the structure is established. The structure is strategically placed on the small plateau of the mountain.
- ***Present Human Activity Status:*** Right now this place is not active for the purpose it was created. This place is a historic site right now. So the functions are not performed in the space like religious gatherings.

3.1.2 *Sangameshwar Temple*

Sangameshwar temple is located in Saswad, Pune, Maharashtra. Lord Shiva is the presiding deity in this temple, represented as a Shiv Ling in the garbha ghriha. It was built during the Yadava Empire‟ s reign. It is a very beautiful temple. It seems that the shikhar was carved out of a single rock. A few big pillars support the roof of the temple. One can enter the

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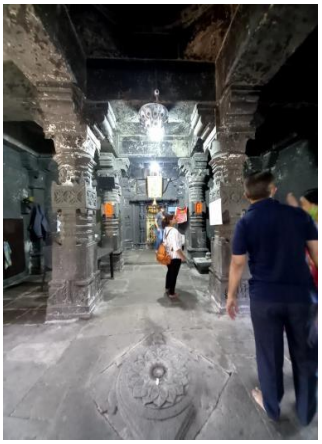
garbha ghriha and take the darshan of Shivling. The temple is not in great condition as it is a very old temple, but still, it has its own glory. There is one smaller Shiva temple on the left side of the temple. The temple campus also consists of two large deepstambha.

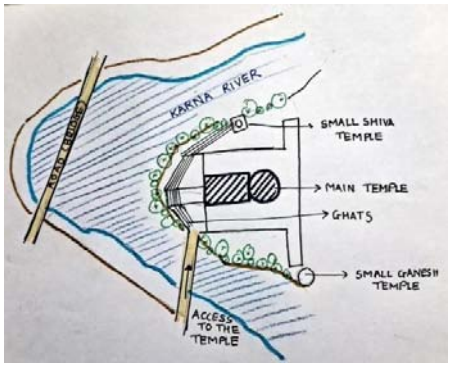
This structure was selected as it fulfills the criteria of just a religious place. The journey to the structure includes crossing a river bridge and it surrounded by Ghats and is connected to the river.

River near the temple.
This showcases the surroundings



The garbha ghriha of the temple

The carvings on the pillars of the temple



The plan of the temple and surroundings

The sound of the river those not reach the garbha griha because of the vegetation

The following case study is done considering the five principles of biophilia stated above:

- ***Environmental Features:*** It is situated on the confluence of the rivers namely Karha and Chambli. There are many trees and fields around the temple today. The temple still has not lost its connection to nature after so many years.
- ***Natural Shapes and Forms:*** Ornamentation of flowers, animals, and leaves along the pillars, ceiling, Shikhar of the temple. There are two finely ornamented Nandi in the temple. There is also a turtle that is considered a holy symbol.
- ***Restorative Patterns and Processes:*** The peaceful sound of the river along the ghats are there in the whole premises. But the sound does not reach the garbha ghriha and a sense of solitude is created. The textures along the pathway of the stone are maintained and are not polished and the natural form is respected.
- ***Light and Space:*** The light intensity becomes less as the person goes more towards the core which is the garbha ghriha. So much so that the natural light does not reach the core and artificial lighting is used to light it up. This is done to avoid disturbance between the deity and the devotee. There are two lamp towers to illuminate the temple surroundings during the nighttime. This creates a peaceful atmosphere during the nighttime and festivals.
- ***Place-Based Relationship:*** The temple is just beside the river. To visit the river that has been developed. The plinth of the temple is taken very high to prevent flooding in the temple.
- ***Present Human Activity Status:*** The Temple is still active and religious gatherings do take place here. The structure is still used for the purpose it was built. This place is still being used after so many years of its raising.

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3.1.3 *Udaipur Lake Palace*

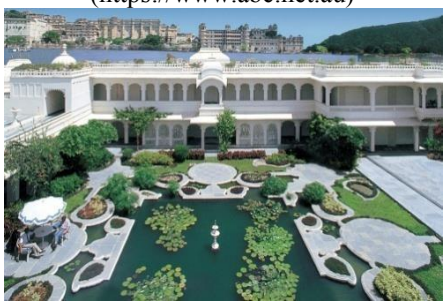
The lake palace of Udaipur is known for its exquisite setting. It is surrounded by lake Pichola from all the sides. This was originally palace of Maharaja of Mewar now converted into a five star hotel. This place is known for its Rajasthani architecture style. It is made of white sandstone. The Structure stands out in the lake.

This structure was selected as it fulfills the criteria of just a residential place. The journey to the structure includes crossing the lake by the boat. The experience of living on the lake brings one closer to the nature.

(https://www.udaipurblog.com)

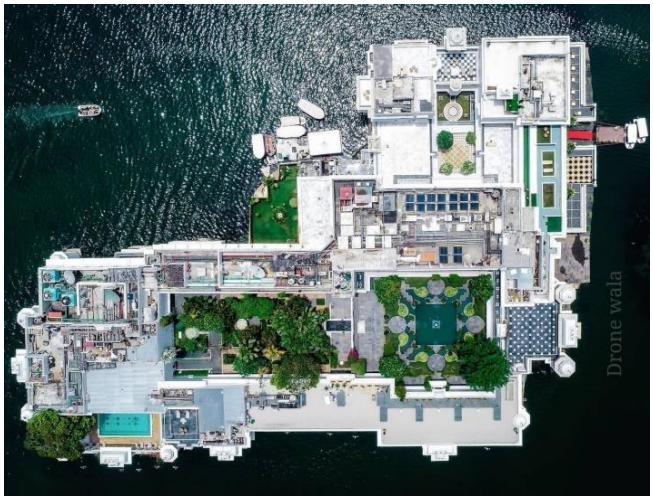
The palace in the lake

(https://www.abc.net.au)



Courtyard of the palace

(https://www.padharo.co)



Aerial View of the Palace

The following case study is done considering the five principles of biophilia stated above:

- ***Environmental Features:*** It is placed in the middle of Lake Pichola. This connects the structure with the water element. This makes the palace very peaceful place. There are efforts made to keep the structure connected to water as much as possible, like the steps leading into the water.
- ***Natural Shapes and Forms:*** The Rajasthani Architecture has some elements that are inspired from the nature like the floral patterns carved on the columns. The idea of creating little ponds inside the hotel is also aroused from the lake.
- ***Restorative Patterns and Processes:*** There are many lake birds and peaceful atmosphere of still water contributes to a tranquil setting. Even if the city is busy this place is detached from the hassle and Basel.
- ***Light and Space:*** Efforts are made to take in maximum light by introducing courtyards, large windows and balconies. There are also places were light is blocked for meditation.
- ***Place-based Relationship:*** As the structure is directly placed in the water. It makes it seem that the structure is floating on the water. Attempts are made to keep the structure closely related to the water.
- ***Present Human Activity Status:*** This place is now a wellness retreat. People come relax here. Some additions are there to the main structure but they are added respecting the original style of the architecture.

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4. DISCUSSIONS/INFERENCES/CONCLUSIONS

After studying all the case studies it comes to a conclusion that biophilia is present from the olden times in India. It also confirms the point that it has good health benefits as the palace is used as a wellness retreat. It is seen that whichever natural setting the structure is placed in the design respects that and is evolved accordingly.

Case Study	*Nature in Space*	*Nature of Space*	*Natural Analogs*
Karla Caves	• Environmental features • Relation of the structure with the site	• Ornamentation in the chaitya hall • Sun window • Arc of the chaitya hall.	• The unfinished texture of the walls and pillars • The one man width of the staircase
Sangameshwar Temple	• Environmental features • Strategic placement on the confluence of the rivers	• Ornamentation in the garbha ghriha and around the temple	
Udaipur Lake Palace	• Placement of the structure in the middle of the lake	• Ornamentation • Strategic placement of windows	• Mimicking the lake in form of small pond in the courtyards

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[9] https://www.sciencedirect.com/science/article/pii/S1877042815007338
[10] https://www.ucem.ac.uk/whats-happening/articles/biophilia-examples-built-environment/

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Evaluation of Daylight in Studios of BVDU, College of Architecture, Pune

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ABSTRACT: Daylight is very important factor in architecture college due to the expected drafting/drawing work on boards. So, every desk should get good amount of daylight and drafting shouldn't be stressful. If the use of daylight is planned appropriately, then there will be less electricity consumption. Purpose of study of daylight evaluation in studio of architecture college is that to get idea about lux in a room, what is the ideal lux for a studio for drafting. Understanding about good orientation of building, sizes of window openings, glazing and shading devices. Empirical research methodology was adopted to conduct the whole process through primary data collection of measuring daylight intensity at three different time slots by lux meter. Dividing the studio in the grid of 3 m × 3 m. Analyzing the different area for better lux in the studio. Concluding the research by application of daylight in different areas of studio.

Keywords: *Daylight Intensity, Architecture Studio, Window Openings, Orientation, Climate and Season.*

1. INTRODUCTION

Daylighting is a passive strategy that help in improving energy performance and user's visual comfort. Lighting can be divided into two types such as natural light and artificial light. The good natural lighting strategies will reduce the energy consumption spent on lighting while providing adequate illuminance. Daylight is important for studio of architecture college as the studio of architecture college is bigger so that large size of window openings are needed and it need sufficient lux to get the ideal daylight in the studio. The ideal lux for drawing studio is 750 lux. This helps to reduce the electricity bill as energy consumption decreases. It promotes sustainable architecture. Lux can be in three categories: low, medium and high. Ensure the ideal lux in the studio so that students find it comfortable and their performance improves. Daylight performance changes as per seasons. Seasonal or everyday variation of daylight related to geography and climate. If a studio hasn't sufficient daylight, then it leads to higher consumption of electricity. Daylight design in a building used for energy saving. The use of natural laylight in the building reduces the electric energy consumption by minimizing the use of artificial lighting during the day. Architecture college should have courtyard so that passage connected to courtyard gets daylight and the rooms which are connected to that passage gets daylight if there is window opening in the passage.

Aim: To evaluate daylight in Studio of architecture college of Bharati Vidyapeeth college of Architecture.

Objective

1. To understand about orientation and climate of building for efficient daylight.
2. To analyze about window size, window type, color of wall, shading devices, Courtyard effect.

Scope: This project will discuss daylighting specific to a college of architecture and not in regards to other building types. As a result, it is not a generic model for any design pertaining daylighting. It is designed to take the geographical location that it is established. All possible methods of improving daylighting for the design would be considered.

2. LITERATURE REVIEW

(Muhammad Anas Bin Othman, 2017) mentions that One of the most significant strategies for reducing the energy consumption effectively in a building is by the design and selection of a suitable window system. For architecture studio facilities, there are certain window designs to be accomplished such as the window head should be as high as possible; at least 2 meter above the floor level to provide a clearer view and space upon designing a project. Next, the window sill must not be higher than 1 meter from level because it can prevent someone to see out when sitting. Furthermore, the window surface is should be evenly distributed over the outside wall and the window heights and widths must not be too small in relating to

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the window wall because this reduces the uniformity of lighting and produces undesirable shadows. Shadows in studios will affect students' eye-comfort and may attract them to use artificial lighting. **(A Mandala, 2019)** mentions the requirement for uniform illumination of 150 Lux generally in the room, and 1500 Lux in the work plane to perform visual tasks for drawing the illumination level requirement for drawing studio is 750 Lux. For technical drawing activities, 750 Lux illumination is required, while for other activities it ranges from 200–500 Lux.

3. MATERIAL AND METHODOLOGY

The methodology applied followed the sequence of steps. The first step is to analyze the geography of Pune city and orientation of college building. Students will be asked to assess daylight within a given space, and answer quantitative and qualitative questions about their daylighting preferences and knowledge. The second step will be getting data of daylight of three different classrooms in different direction in the morning, afternoon and at evening The third step involved a comparison of the results obtained by collecting lux data followed by a formulating the general conclusions on methods and tools used.

4. RESULTS AND DISCUSSION

4.1 Data Collection and Analysis

Data collected for: second floor of college

Number of rooms: 3

Room sizes are from 160 sqm to 320 sqm

Climate: semi-arid

Season: October to November

Grid of 3 × 3 m for lux calculation

Building surrounded by palm trees of height 15 m. It shades very less.

Wall color: white

Floor color: light grey

Required lux for drafting in a studio: 750 lux (600–1000 lux)

Number of drafting tables in room 2: 45, room 1 has 12–14 computer desk, room 3 is multipurpose hall with very less furniture.

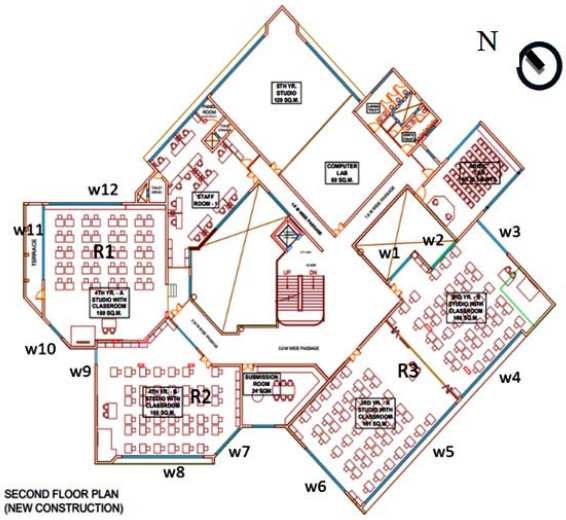

Figure 1: Second Floor Plan

Source: BVDUCOA, Pune.

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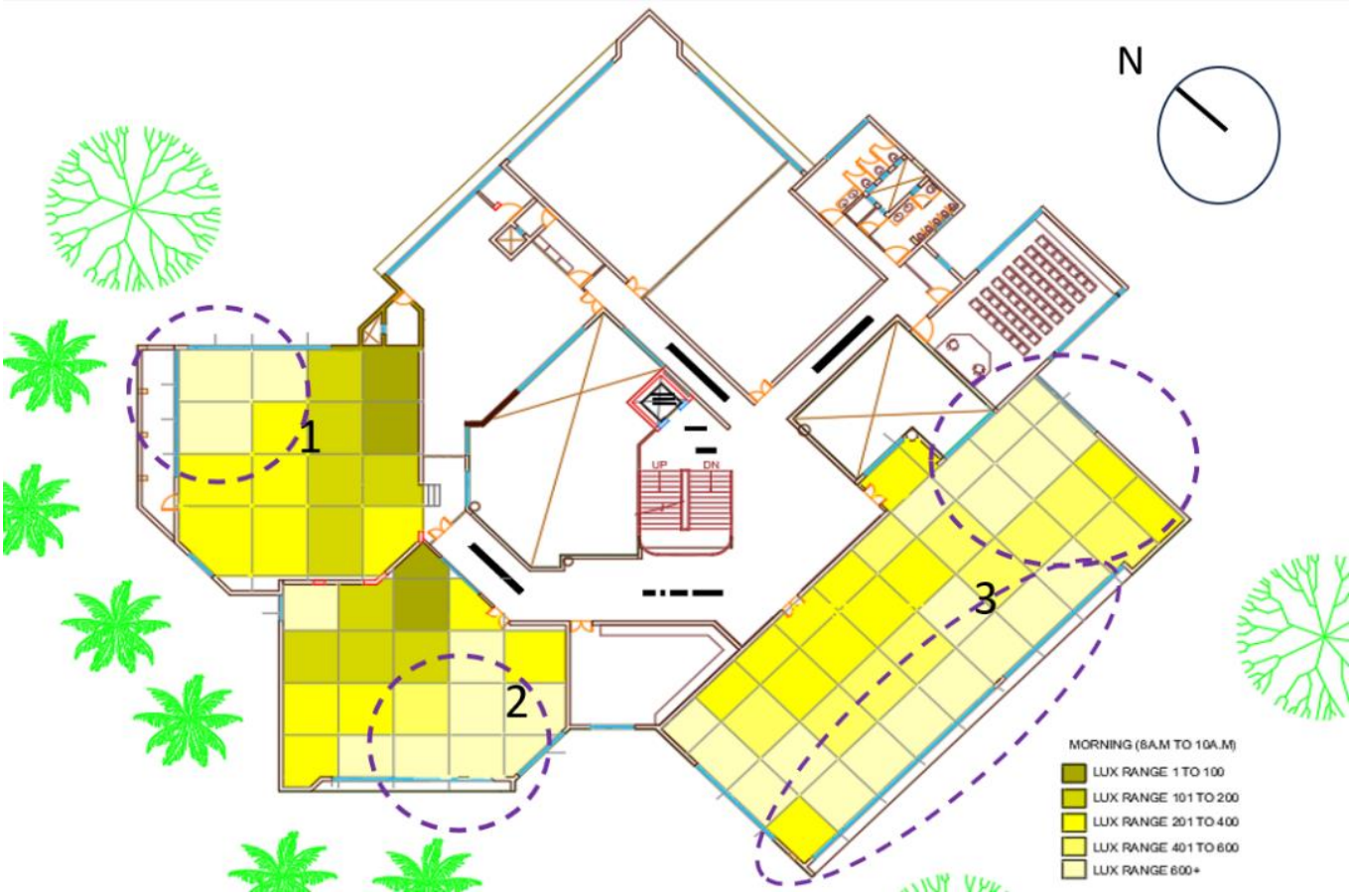
Table 1: Window Sizes

WINDOWS SIZES			
W.NOS	SILL (M)	HEIGHT (M)	WIDTH (M)
W1	0.94	1.2	3.0
W2	0.94	1.2	3.7
W3	0.94	1.2	4.6
W4	0.24	2.16	9.0
W5	0.24	2.16	13.8
W6	0.20	2.2	6.0
W7	0.30	2.12	3.5
W8	0.46	1.96	8.7
W9	1.00	1.13	1.4
W10	0.75	1.64	1.8
W11	0.48	1.91	7.3
W12	0.48	1.91	7.7



Morning (8 am–10 am)

- High lux on the opening side of the window.
- R1 receives more daylight from north side.
- R2 receives more daylight from East and South.
- R3 receives more daylight from East and South.

Figure 2: Morning Analysis

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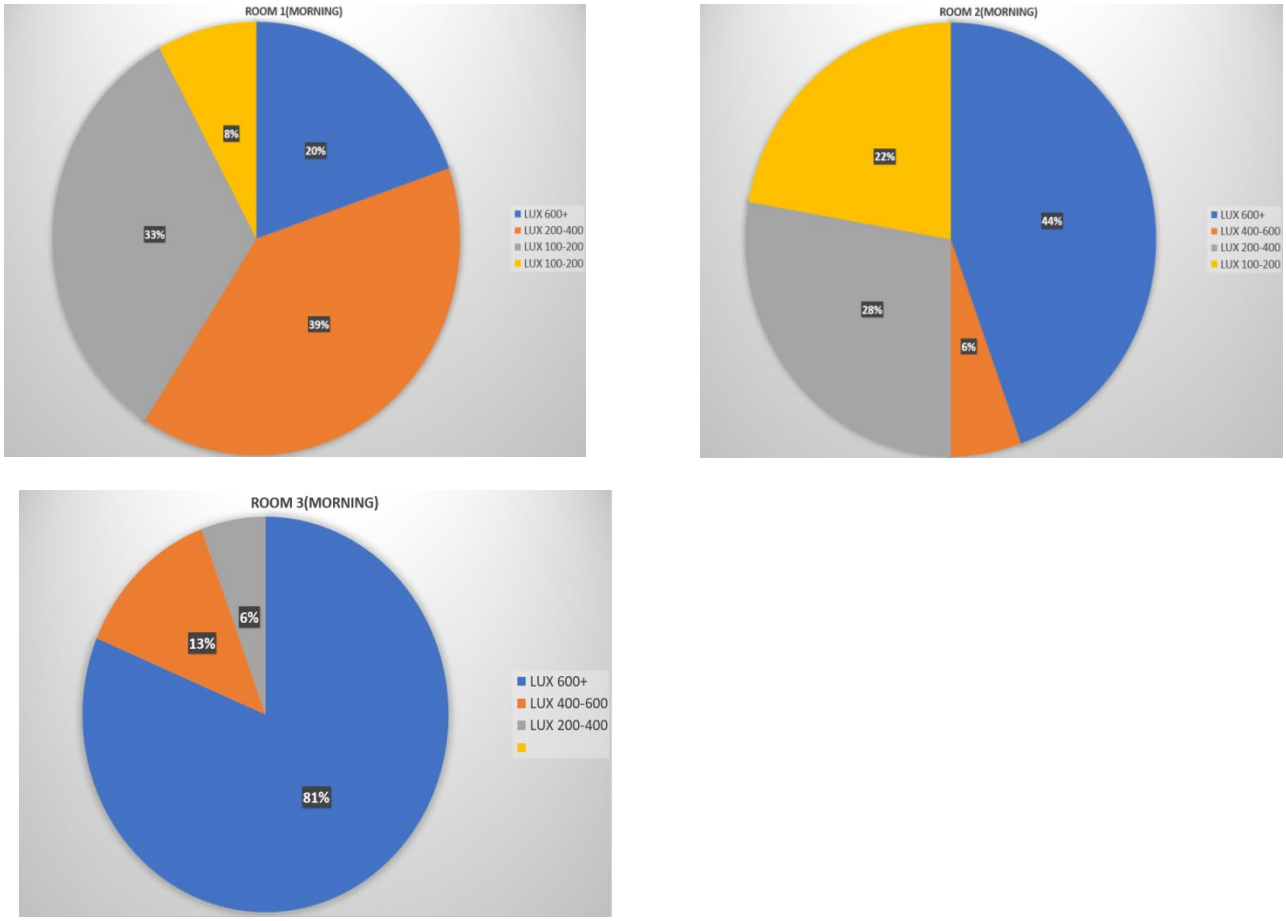

Figure 3: Analysis of Three Different Rooms in Different Time Slot

Afternoon (1 pm–2 pm)

- Room 1 receives more daylight from North-west.
- Room 2 receives more daylight from South and South-west.
- Room 3 receives more daylight from East, South and South-west.

Figure 4: Afternoon Analysis

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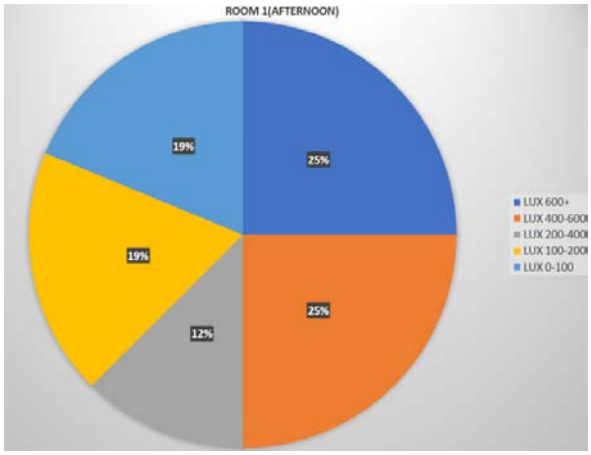

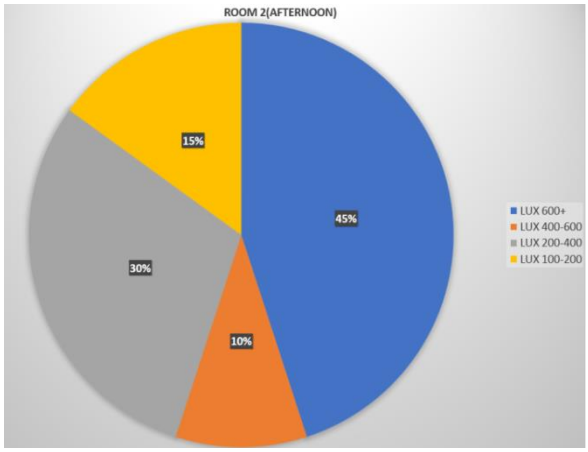

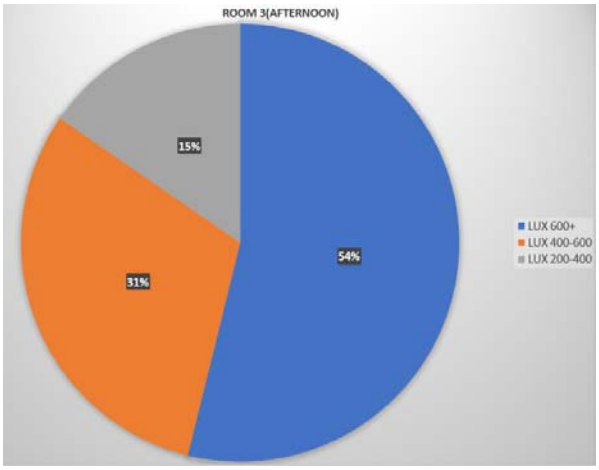

Evening (4 pm–5 pm)

- Room 1 receives more daylight from West.
- Room 2 receives more daylight from South-west.
- Room 3 receives more daylight from South and South-west.

Figure 4: Evening Analysis

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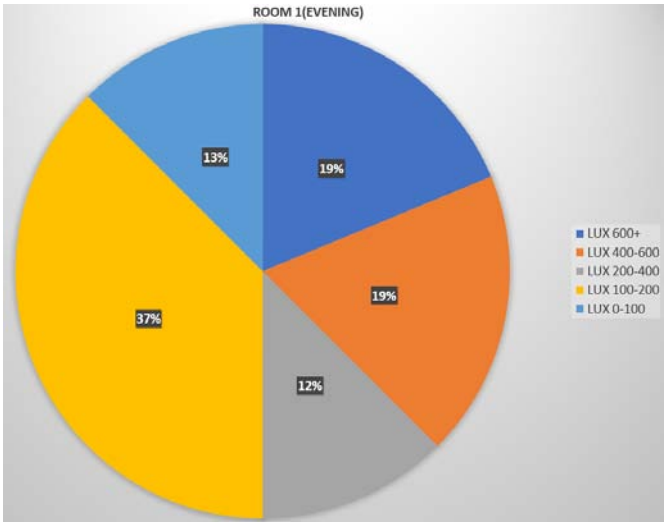

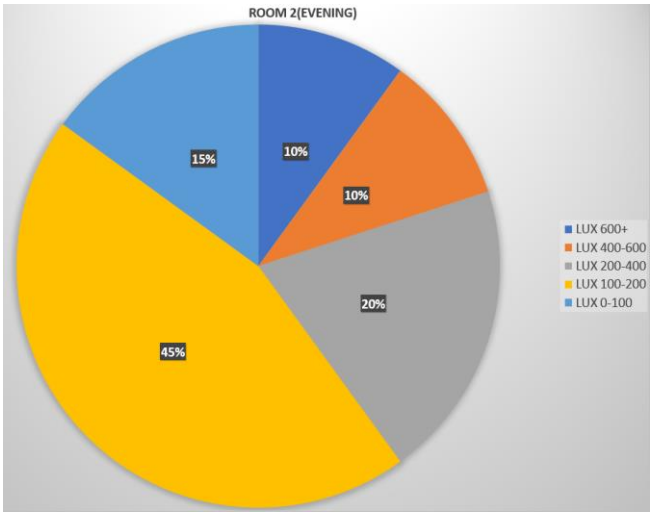

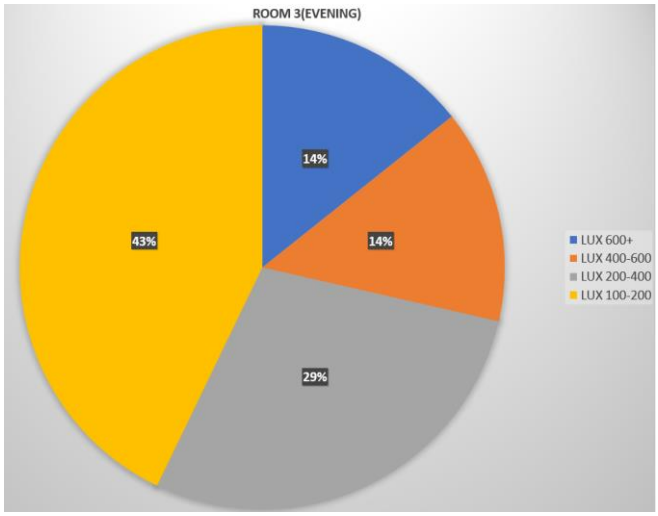

5. CONCLUSION

Daylighting is an important factor for saving energy consumption and promote sustainable architecture. By the help of lux meter, measures the lux level and according to lux at different time zone, design should be planned for better area for different activities. As it's a drawing studio, ideal lux should be 750 lux. It also helps for interior planning for dark or bright area of studios. Authors are aware about the fact that this data should be collected throughout the year as longitudinal research for getting authentic research but due to time limitation, data is collected in the month of October and November. The same procedure will be repeated to collect data and analysis for yearly research.

ACKNOWLEDGEMENT

Highest gratitude to my advisors, Ar. Shubhashree Upasani and Dr. Kavita Murugkar for the guide on this paper and Ar. Tejas Patil and Ar. Amey Naphade for providing the necessary data, plan of college and lux meter.

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Preserving the Tangible and Intangible Cultural Heritage Through Architectural Lens: A Case of Ratnagiri, Maharashtra

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ABSTRACT: Cultural heritage encompasses tangible and intangible assets inherited from past generations, reflecting cultural, historical, artistic, religious, and social dimensions. It is a source of pride, identity, and shared experiences, contributing to cultural diversity. Currently, neglection and various other factors threaten its erasure, impacting identity and belonging. Governments, organizations, and NGOs prioritize protection through institutions and initiatives, recognizing educational and economical influence.

Spaces for preservation will serve as repositories of history and character, ensuring the enduring significance of cultural heritage for current and future generations. Architectural spaces can play a vital role in this process of preservation of cultural heritage by providing physical context for the display and celebration of cultural heritage. Need for architectural spaces lies in their ability to safeguard and showcase cultural heritage, fostering a deeper understanding and appreciation of diverse elements that constitute to our shared narrative.

This research investigates, global as well as national perspectives on cultural heritage, attempting to understand issues in its preservation. Through this study developing a set of parameters that will help in designing spaces required for the preservation of cultural heritage. Further scoping down to a region (Ratnagiri) to apply theorized set of parameters. Ratnagiri is one of the districts that is in need for preservation of its tangible and intangible cultural heritage which is diminishing due to issues like urbanization and tourism. Hence, understanding the reasons, impacts and the ways to preserve the cultural heritage of Ratnagiri with help of an architectural intervention adhering to spatial requirements for required functions.

Keywords: *Cultural Heritage, Tangible, Intangible, Sense of Belonging, Preservation.*

1. INTRODUCTION

Culture refers to the shared set of beliefs, values, customs, behaviours, traditions, language, and practices that characterize a particular group of people. It encompasses the way of life and social norms of a community, society, or even a specific organization. Culture is passed down from generation to generation through various means, including communication, observation, and education. It is also dynamic and can evolve over time due to factors such as technological advancements, migration, and intercultural interactions. As a result, cultures can exhibit both continuity and change, adapting to new circumstances while maintaining core elements of identity. Heritage refers to the inherited or preserved cultural, historical, and natural assets that hold significant value and importance to a particular group, community, society, or even humanity as a whole. It encompasses tangible and intangible aspects of the past that are passed down through generations and contribute to a sense of identity, continuity, and connection to history. Culture is the larger context within which both tangible and intangible heritage exist.

Cultural heritage connects the past and future generation through the efforts and approaches of the present generation. It connects us to our roots and is an individual's identity which gives them a sense of belonging and helps in passing down the legacy as well as knowledge to the future generations. It is a legacy or knowledge that is being passed on further from a generation to the next one. It transcends mere historical artifacts and traditions; it serves as a dynamic reflection of an individual's self-perception and their worldview. Cultural heritage always keeps us bounded/connected to our traditions, customs, beliefs, religion, etc. There are many such aspects to cultural heritage. They are as follows:

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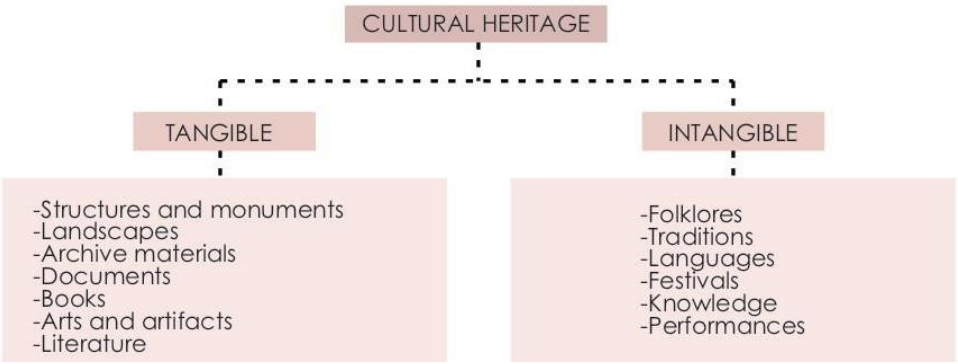

Flowchart 1: Elements of Cultural Heritage

Cultural heritage frequently faces neglection and is susceptible to eradication due to conflicts, globalization, urbanization, and natural disasters. The consequences of losing cultural heritage are profound, impacting the identity and belonging of affected communities. Recognizing its importance, governments, international organizations, and NGOs worldwide prioritize its preservation. Governments establish cultural ministries to formulate protective policies, while national institutions like museums and archives play a crucial role in preserving and displaying cultural artifacts. International bodies such as UNESCO, ICCROM, and WIPO collaborate globally, and NGOs like ICOM, WMF, IFLA, the Blue Shield, the Aga Khan Foundation, the Getty Foundation, and the Smithsonian actively contribute to heritage conservation through advocacy, funding, expertise, and on- ground projects.

Preserving cultural heritage not only protects the past but also enhances modern civic life. It serves as an educational tool, enabling people to discover their history, traditions, and identity. Additionally, cultural heritage contributes positively to the economy by attracting tourism and supporting local businesses. Despite significant efforts, challenges such as funding constraints, armed conflicts, climate change, and the balance between preservation and sustainable development persist. Also, the migration of locals in search of income poses a risk to transmitting intangible aspects like carpentry skills and performing arts to future generations which leads to neglection of cultural heritage preservation which not only diminishes the dynamism of our world but also hampers the economic development of regions. Therefore, continued commitment and collaboration are vital to ensure the thriving of cultural heritage for future generations. For the same, global and national initiatives are underway to address these challenges and preserve cultural heritage in various aspects.

However, even after various initiatives by government as well as private sectors, cultural heritage of India faces many issues and hence preservation of cultural heritage becomes a crucial point. Along with the world, India as well faces several challenges and issues, stemming from factors such as rapid urbanization, environmental changes, economic development, and changing societal values. Some of the key issues in the preservation of cultural heritage in India include:

- Urbanization and development pressure
- Lack of awareness and education
- Insufficient funds and resources
- Lack of proper legislation and enforcement
- Natural disasters and climate change
- Neglect and deterioration
- Unregulated Tourism
- Commercialization and Modernization

Cultural Erosion and Changing Values

- Conflict and Unrest
- Lack of Documentation and Research
- Illegal Trade and Looting
- Inadequate Planning and Conservation Expertise
- Fragmentation of Ownership
- Political and Administrative Challenges

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Addressing these challenges requires a multi-faceted approach involving legal reforms, public awareness campaigns, community involvement, collaboration between government and non-governmental organizations, sustainable tourism practices, and the integration of heritage preservation into urban planning and development processes.

All the stated factors are the reason why the preservation of the tangible and intangible aspects of cultural heritage becomes important to connect the future generations to our roots, to develop many income sources for the local people and artists and to create proper overview of history how people used to live. Hence the preservation of cultural heritage is required and the best way to preserve anything is to share it and allow the people to explore it which will lead to a connection between past and future generation through the approaches of present generation towards the cultural heritage. Even the lack of knowledge about the cultural heritage leads to misinterpretation among the visitors or tourists about the cultural heritage. Hence this research aims to the cultural heritage and learn about the methods of preserving it, which will help in developing the spaces that will preserve the tangible and intangible cultural heritage.

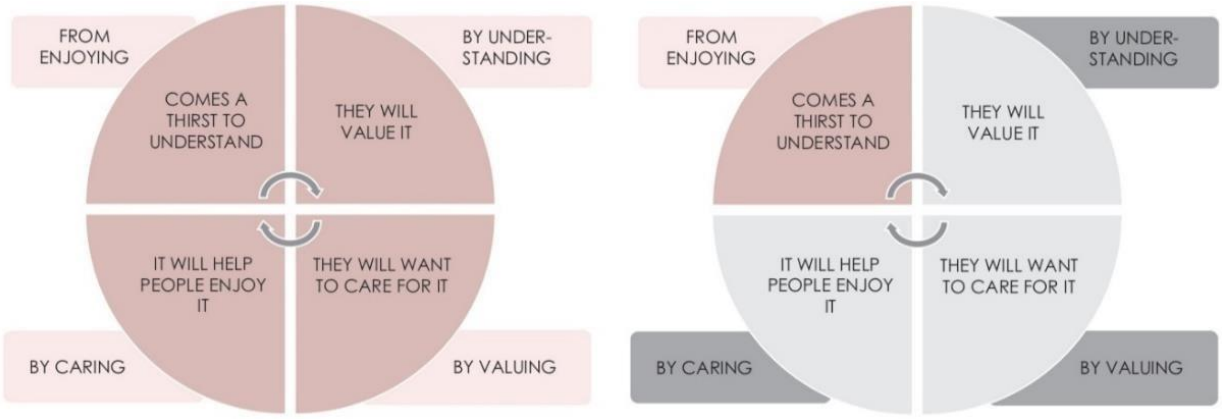

Figure 1: Cycle of Cultural Heritage (viii below) (Left) and Missing Points in Cycle of Cultural Heritage (Right)

2. LITERATURE REVIEW

Literature review of the articles, news, journals, documents, etc. is done to understand, analyse the research topic more efficiently and to know if any similar initiatives are being taken by any organisations or any individual, so that it can be catered to properly in the research. Following are the parameters that were considered according to which the literature review is done.

1. **Understanding Cultural Heritage for Architectural Decisions:** Informed by Dallen J. Timothy's chapter-1 (Volume 7 in the series Aspects of Tourism Texts), architectural decisions should not only consider physical structures but also the cultural and historical values associated with a place, acknowledging the impact of cultural heritage on tourism.
2. **Values Associated with Cultural Heritage:** Ayesha Pamela Rogers' chapter-12 (Values and relationships between tangible and intangible dimensions of heritage places, Values in heritage management) emphasizes the interconnected web of values shaping the identity of heritage places. Architects, as highlighted, contribute significantly by designing spaces that capture both tangible and intangible aspects of cultural heritage.
3. **Creating Visitor-Friendly Spaces:** Achieving a delicate balance between preserving historical significance and meeting the evolving needs of modern visitors is a fundamental principle in architectural design, as underscored by insights from various sources. This delicate equilibrium is crucial in crafting spaces that serve as meaningful reflections of the past while remaining relevant and accessible to contemporary demands. Architects are challenged to navigate the intersection between tradition and modernity, ensuring that the architectural spaces not only preserve the cultural heritage embedded in history but also provide a welcoming environment that meets the expectations and preferences of present-day visitors. By thoughtfully integrating the richness of the past with the practicalities of the present, these spaces become dynamic and versatile, appealing to a broad audience and contributing to the continuity of cultural narratives across time. (v below)
4. **Interplay Between Tourism and Cultural Heritage:** Drawing from Dallen J. Timothy's (Chapter-1, Volume 7 in the series Aspects of Tourism Texts) insights, recognizing the crucial link between tourism and cultural heritage is essential. Designing spaces that attract visitors while respecting cultural values helps tackle challenges without disturbing beliefs.

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5. **Global Perspective on Heritage Preservation:** Eric Baldwin's article (Architecture & UNESCO: Rethinking Preservation and Cultural Heritage) brings attention to the global and national viewpoints in heritage preservation. Understanding international policies and organizations, as suggested, is crucial for architects focusing on the preservation of cultural heritage.
6. **Local and Vernacular Architectural Practices:** Illustrated in Asha Baste's book (Sheltering Angle - Grammar for house planning, By Asha Baste), local and vernacular materials and techniques enhance structures and surroundings, making them more workable and comfortable. This approach, balancing tradition and modernity, promotes sustainable architectural practices, contributing to the preservation of cultural identity.
7. **Media's Role in Architectural Heritage:** As highlighted by multiple sources, including Eric Baldwin's article, media plays a crucial role in promoting cultural heritage and architectural significance. This underscores the importance of creating spaces that cater to media requirements for effective heritage preservation.

Therefore, the ideal architectural spaces should intricately weave together physical structures with the cultural and historical values of a place. Architects bear the responsibility, as emphasized by various sources, to capture both tangible and intangible aspects of cultural heritage, striking a delicate balance between preserving the past and meeting contemporary visitor needs. Recognizing the interplay between tourism and cultural heritage is crucial, requiring spaces that attract visitors while respecting cultural values, as outlined in insights from different perspectives. A global viewpoint on heritage preservation, coupled with an understanding of local and vernacular practices, advocates for a sustainable synthesis of tradition and modernity. Lastly, acknowledging the pivotal role of media underscores the need to design spaces that cater to media requirements, ensuring effective promotion and preservation of our diverse cultural heritage. In essence, the architectural spaces of the future must harmoniously blend tradition, modernity, and cultural sensitivity to stand as lasting testaments to our rich heritage.

3. CASE STUDIES

To understand the spaces required for preservation of cultural heritage, certain parameters are considered and based on that certain case studies are done which also help to know how the circulation should happen, the services required, materials and how the characters of the spaces are decided.

1. **Virasat-e-Khalsa, Punjab** (2010, 40 acres, Architect- Moshe Safdie Architects): Concept of a narrative music that endeavours to tell a story, 5 towers depict 5 virtues of Sikhism, local material- sandstone, use of natural and artificial lighting.
2. **Dakshinachitra Heritage Museum, Chennai** (1996, 10 acres, Architects- Laurie Baker and Benny Kuriakose): a picture of the south, is a cross cultural living museum of art, architecture, lifestyles, crafts and performing arts of south India, sensitive and vernacular architecture, human scale proportions, moat through site for rainwater harvesting.
3. **Prachin Konkan Museum, Ratnagiri** (2004, 3 acres): Open air museum, reflects ancient Konkan lifestyle, surrounded by forest.
4. **Indian Crafts Museum, Delhi** (1956, 6800 sq. m., Architect- Charles Correa): Human scale proportions, skylights, geometric structures, vernacular architecture.
5. **Indian Heritage centre, Singapore** (2015, 3090 sq. m., Architect- Robert Greg Shand Architects): balancing a careful museological approach with innovative multimedia that would bring the rich collection to life, creates a people-centred storyline, spread over five themes.

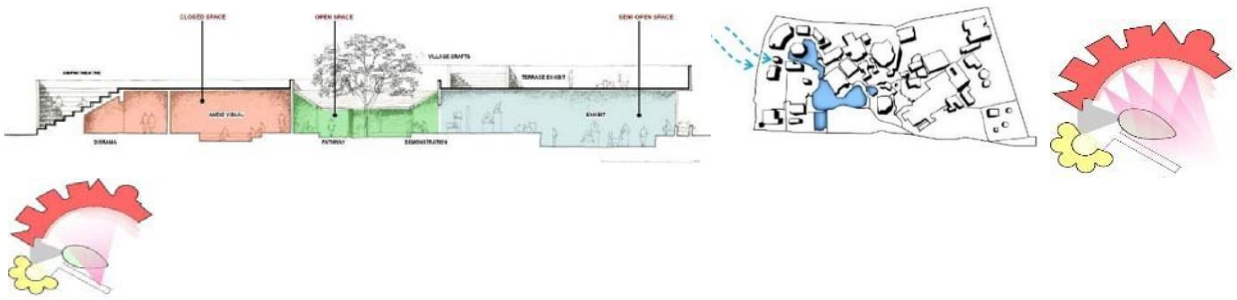

Figure 2: Connection between Open, Semi Open and Closed Spaces; Moat for Rainwater Harvesting; Visual Connections

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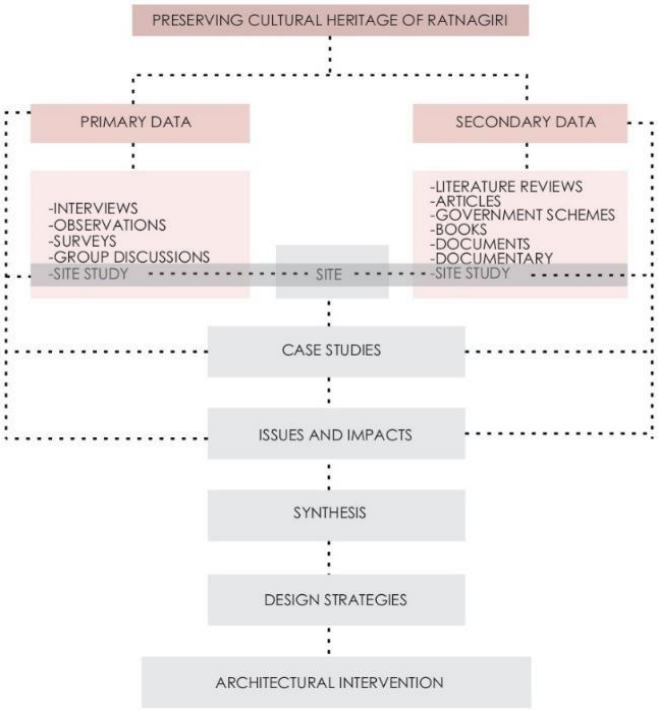
Table 1: Parameters Considered for Case Studies

PARAMETERS	Virasat-e-Khalsa, Punjab	Dakshinachitra Heritage museum, Chennai	Prachin Konkan Museum, Ratnagiri	Indian Craft Museum, Delhi	Indian Heritage Centre, Singapore
Provides platforms for local artists		●	●	●	
Co-relation between tangible and intangible	●	●	●	●	●
Preserves and promotes cultural heritage	●	●	●	●	●
Provides interaction and experience	●	●	●	●	
Proper use of materials according to the spaces and climate	●	●	●	●	●
Efforts on global or national level					●
Connects and helps to understand to the cultural heritage	●	●	●	●	●

All the above case studies were studied to understand how spaces should be designed according to the required characteristics of the function, crucial role of natural and artificial lighting in the enhancement of the space. These case studies depict how spaces can be user-friendly. The material and architecture styles are defining the local cultural heritage. While designing both the tangible and intangible aspects are looked at and preserved properly through the areas. Even the common spaces are arranged properly on the nodes for human interactions.

4. MATERIALS AND METHODOLOGY



Flowchart 2: Methodology

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The research contributing to the study of the topic has been carried out to understand the need of spaces which will help in the process of preserving the cultural heritage. For the same, the cultural heritage is studied in more depth according to the elements of cultural heritage i.e. tangible, intangible and natural have been studied. Further, learning about the co-relation between these elements.

Taking Ratnagiri district of Maharashtra as the study region, certain surveys of people directly related to or living in Ratnagiri, people who have visited Ratnagiri for work/tourists and an expert interview of Ar. Rahul Chemburkar were taken for understanding the issues in preservation of Ratnagiri's cultural heritage.

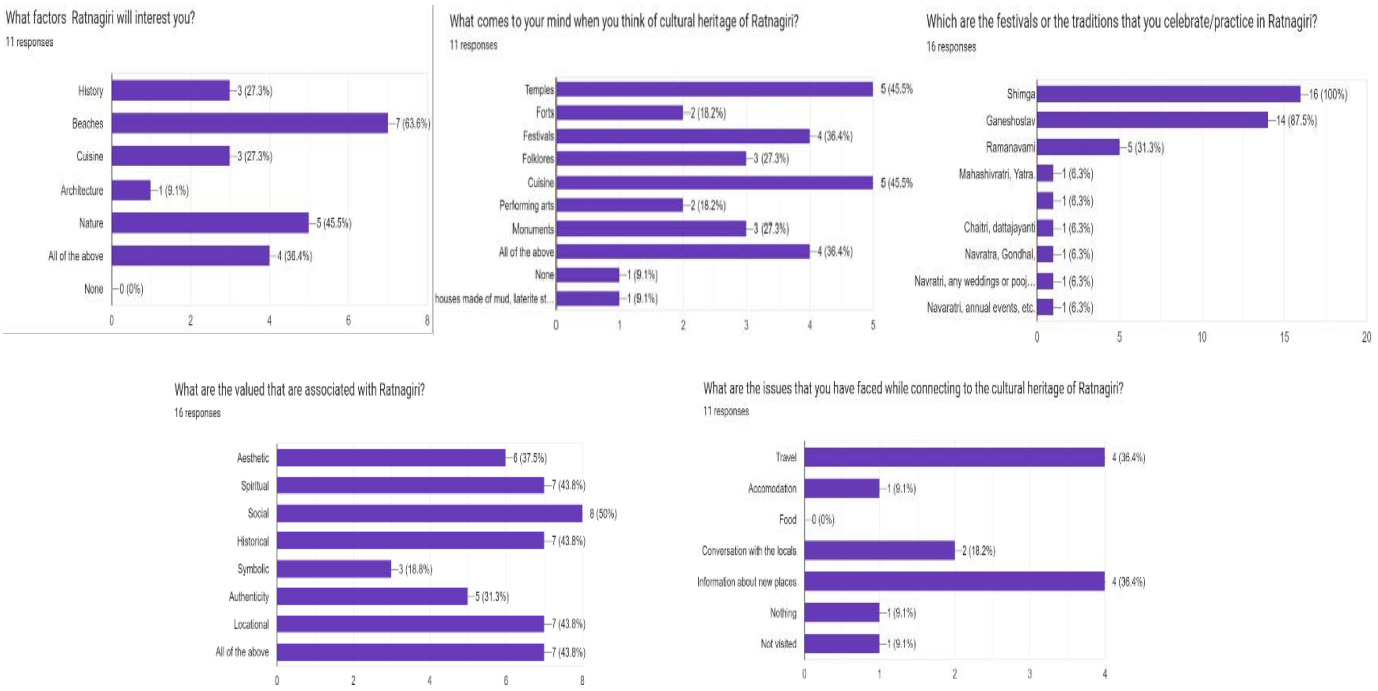

Figure 3: Data collection

Surveys conducted among individuals directly or indirectly connected to Ratnagiri, including visitors and locals, have identified both challenges and positive aspects. These findings serve as a foundation for addressing issues through architectural interventions, emphasizing the consideration of tangible and intangible aspects while respecting diverse beliefs. The group discussions highlight the impact of cultural heritage on local people and artists, emphasizing its role in generating income. These discussions identify areas that need attention, guiding the creation of solutions or spaces to address issues. The insights gained from these conversations shed light on local policies, methods, and initiatives for preserving cultural heritage, showcasing its importance in maintaining identity and uniqueness. The expert interview provides a broader perspective on the definition and significance of cultural heritage, urging a deeper understanding of its history and logic for the benefit of current and future generations in Ratnagiri.

5. RESULTS AND DISCUSSION

In architecture, cultural heritage extends beyond physical structures, serving as a dynamic force shaping design and aesthetics. Architectural spaces embody tangible and intangible elements of cultural identity, preserving stories, beliefs, and values. Architects play a crucial role in conserving this heritage through thoughtful restoration and integration of traditional elements into modern structures. These spaces, repositories of collective memory, bridge the past and present, offering insights into societal evolution. Amidst a changing world, the preservation of cultural heritage in architecture becomes a symbol of resilience, grounding individuals in a sense of continuity. Such spaces foster a sense of belonging and pride, connecting individuals to their roots. In essence, conserving cultural heritage in architectural spaces is not just about physical structures but a commitment to sustaining community essence and values, contributing to a richer understanding of shared history.

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Following are some of the set of parameters of spaces that are required to help in the process of preservation:

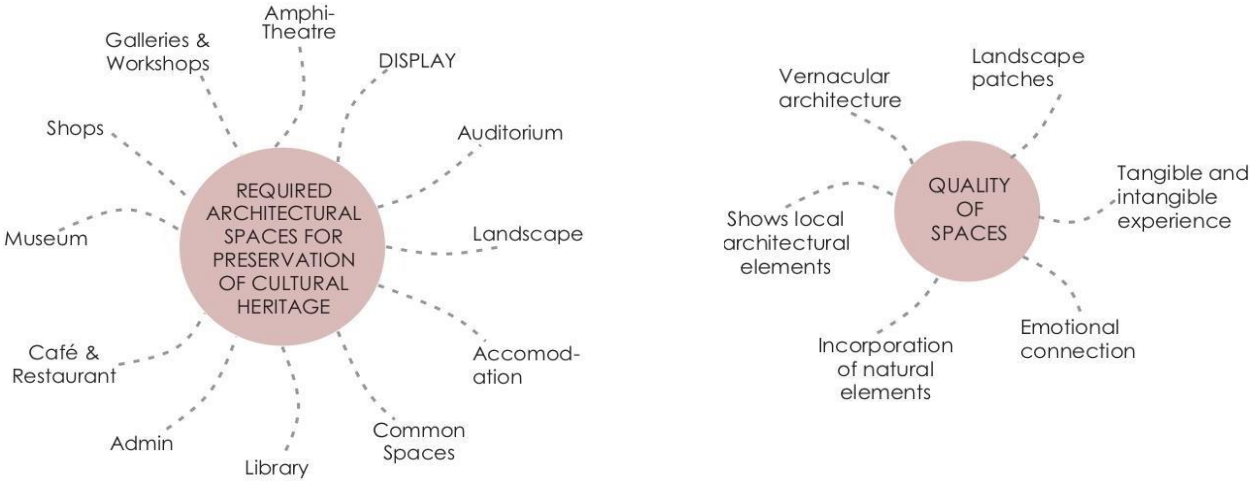

Figure 4: Tool kit of Required Spaces and Quality of Spaces

In India, Maharashtra is a state with incredibly diverse and rich cultural heritage which reflects the historical, social, religious, and artistic aspects of the region. Like many other regions, the cultural heritage of Ratnagiri district from Maharashtra is also getting affected. Even though majority of the people from Ratnagiri are trying to preserve the intangible aspects through storytelling, visiting their ancestral house, attending festivals and events, etc. but somewhere the preservation of tangible aspects is lacking due to many factors and challenges due to urbanization, migration for job opportunities which leads to artists leaving the region for job opportunities and thus lesser practice of the arts and performances.

Set of parameters applied to Ratnagiri according to its vernacular architecture:

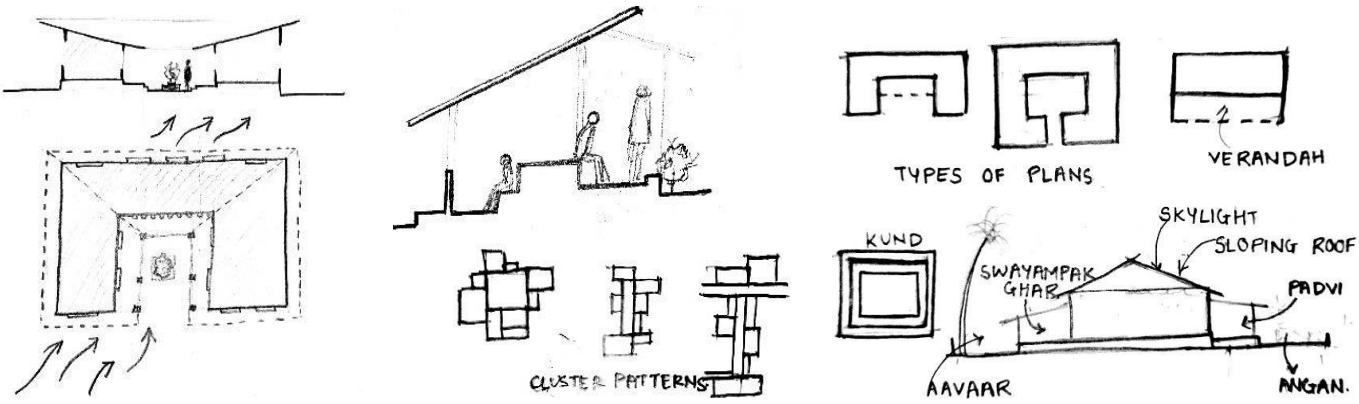

Figure 5: Possible Spaces in Ratnagiri

In Ratnagiri, the spaces with cultural heritage importance are now just looked like a tourist place or a destination for vacation. Due to the enjoyment factor, the knowledge and legacy are somewhere left behind. Therefore, an architectural intervention is required to tackle these issues and spread awareness about them.

Therefore, by applying the prepared tool kit of required spaces on Ratnagiri helps in coming up with a design module and ideas which will help in the process of preservation of cultural heritage of the place. It will help in determining the elements of the vernacular architecture of Ratnagiri and would further develop the quality of spaces in which the local people will be able to come together and preserve their cultural heritage more efficiently and can spread the knowledge and beauty of their cultural heritage among the visitors or the tourists, because spreading and acknowledging is the best way to preserve anything.

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6. CONCLUSION

The role of cultural heritage in architecture extends far beyond physical structures, influencing design and aesthetics. Architectural spaces serve as vessels for tangible and intangible cultural elements, preserving stories, beliefs, and values by blending traditional elements into modern structures.

Hence, emphasising the need for architectural interventions and coming up with a tool kit of parameters are requirements. By doing so, the aim is not only to preserve tangible and intangible heritage but also to revitalize cultural practices and establish a renewed connection between the present generation and their cultural roots. Ultimately, preserving cultural heritage through architectural spaces is more than preserving physical structures.

Therefore, the preservation of cultural heritage in architectural spaces is not solely about physical structures; it represents a commitment to sustaining community essence and values. This contributes to a richer understanding of shared history and symbolizes resilience in the face of a changing world. The study advocates for architectural spaces and tool kit of parameters for the same and applying it in Ratnagiri to address challenges and emphasizes the need for continued efforts to ensure the thriving of cultural heritage for future generations.

ACKNOLEDGEMENT

I would like to give my sincere and heartfelt thanks to my mentor and guide Prof. Ar. Tanvee Joshi who has helped, encouraged and guided me throughout the process. I would also like to extend my gratitude towards my friends and family who have helped and encouraged me with their necessary suggestions and support by showing keen interest in my research topic and guiding me in every possible way.

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Well-Being of Millennial Minds: Healing Environs and Verdant Spaces

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ABSTRACT: In a world where the relentless pulse of modern life can lead to an overwhelming sense of weariness, the realm of architecture can offer an escape from the ordinary and a chance to find peace and rejuvenation within a healing environment. Gen Z and Millennials face stress due to economic instability, high student loan debt, and limited job prospects. Social media exacerbates these issues by fostering comparison culture and a constant need for validation. The constant pressure to adapt to rapidly changing technology, coupled with societal expectations and the impact of global events like the COVID-19 pandemic, contributes to heightened anxiety and mental health challenges in these generations.

This research traverses to understand the day-to-day weariness faced by generation of GenZ and millennials and the creation of healing environs, weaving design artistry with the science of well-being to offer refuge from the weariness of modern life the body's innate capacity for self-rejuvenation is embraced in this, fostering restoration for body, mind, and spirit. Inspired by nature's beauty—the tranquil forest glade, meandering river, and nurturing sunbeam—the research explores the alchemy of light, texture, and space, turning mundane rooms into vibrant environments. This artistic endeavor seeks to redefine healing environments, awakening senses, and nurturing souls, contributing a fresh perspective on transformative spaces for holistic rejuvenation.

Keywords: *Healing Environment, Millennials, GenZ, Nature, Mental Well-being, Social Environment.*

1. INTRODUCTION

Elevated stress and anxiety result from economic instability, intensified by job insecurity and financial pressures. Social media fosters a culture of comparison and unrealistic expectations, while rapid technological changes demand continual adaptation. Concurrent global events, such as pandemics, compound these challenges, contributing to heightened stress levels.

Gen Z and millennials face unique stressors in today's fast-paced lifestyle, particularly impacting mental well-being, especially for students. This research focuses on studying how healing environments affect specific user groups.

One often neglected aspect of student life is psychological well-being. University students navigate a wave of emotions tied to new experiences, loneliness, home-sickness and assignments, sometimes leading to isolation and social anxiety. "Investigating whether social anxiety is associated with students' age and psychological well-being is valuable in the development of successful treatments for social anxiety because withdrawal and social isolation appear to be the factors that impact the most socially anxious persons' overall quality of life" (Brown, 2007).

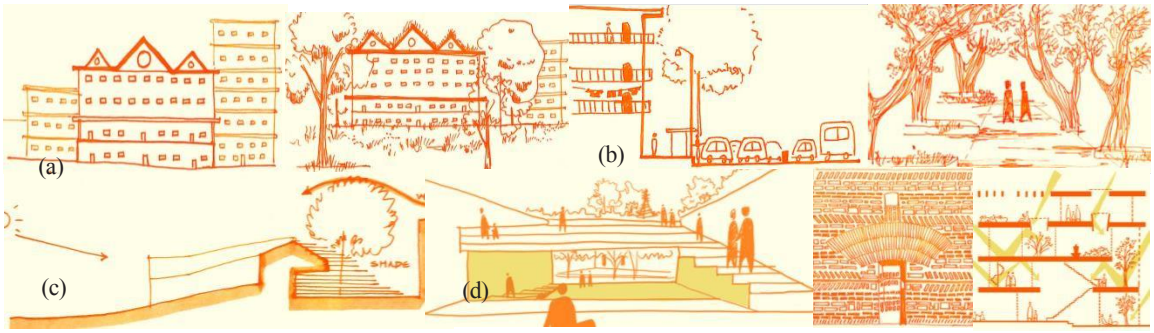

Figure 1: How Environment Affects People (a) Quality of Spaces Affected by Surroundings, (b) Disharmonious and Harmonious Space, (c) Co-Existence with Nature, (d) Sensory Qualities in a Space

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The body's ability to tap into its internal pharmacies and respond to the surrounding environment facilitates healing. Elements like color palettes, lighting, and natural landscapes can enhance the body's self-healing capacities, promoting quick recovery.

1.1.1 *Stress and Its Impact*

Stress is a mental, emotional, or physical reaction to changes that require attention or action. It can be caused by fears, uncertainty, and unexpected shifts in plans. Different people handle and respond to stress in their own ways, which affects their overall well-being. Gen Z and millennials copes with stress by using digital platforms for support, relying on mindfulness apps, and embracing creative outlets like art and music. Open communication about mental health plays a crucial role in reducing stigma and creating a supportive environment.

1.1.2 *Environment Patterns*

- Each of the environment pattern plays a vital role in influencing the healing potential of a space:
- ***Natural Environment:*** The rationale behind nature's therapeutic influence lies in its ability to strike a harmonious balance between order and disorder, tranquillity.
- ***The Built Environment:*** The built environment encompasses the surroundings, shaping the way humans perceive and interact with their environment.
- ***The Social Environment:*** Healing, at its core, is a community effort, with a symbiotic interplay between individuals from various backgrounds engaging in a rich and diverse social environment.

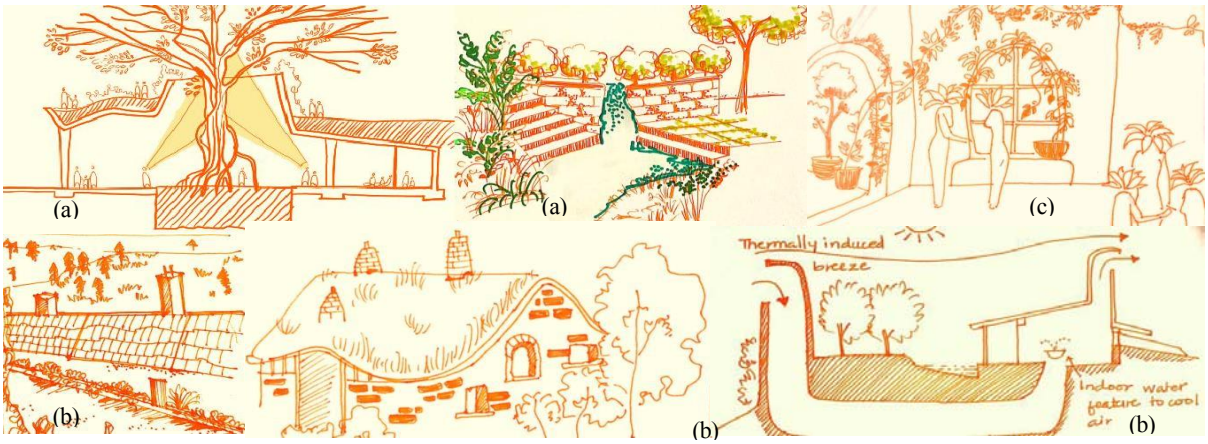

Figure 2: Environment and Its Types, (a) Natural Environment, (b) Built Environment, (c) Social Environment

1.2 Aim

The research aims to analyse and explore the built and unbuilt environment for the well-being of specific user group along with understanding the natural elements and their impact on GenZ as well as millennial generation.

1.3 Objectives

1. To understand the process of healing and it's impact on architectural spaces.
2. To explore the healing environments and their effects on specific user group.
3. Study a user group's challenges and evaluate the benefits and necessity of a healing environment.
4. To study the impact of the surroundings on the built healing environment.

1.4 Research Question

How can architecture design tools for mental pressure release and establish universal healing measures? Sub-Questions: Literature Review:

1. Explore architectural elements contributing to improved well-being.

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2. Investigate the impact of nature and social aspects on an individual's well-being. Empirical Research:
   (a) Examine how architecture alleviates stress factors.
   (b) Assess the role of social spaces in enhancing user health and comfort.

1.5 Scope and Limitation

The study focuses on understanding the healing characteristics of built and unbuilt environments through the influence of Nature and their impact on the user group of GenZ and Millennial generation feeling stress, anxiety, and pressures of everyday life. The user group falls under the age category of 16 to 30 years old. It will focus on the general feeling of burnout in society and investigate the spaces working with mental healing. The psychological aspect will only be considered in spaces.

2. LITERATURE REVIEW

Literature study provides many physical, psychological, and social aspects that positively affect a person's well- being.

2.1 Parameters of Literature Review

- ***The Healing Power of Nature:*** Nature has healing properties, linking it to a space's physical design. Providing a sense of control and improving vitality helps people recover from physical, spiritual and mental illnesses.
- ***Spatial Interaction:*** Interaction refers to the situation where a space prompts individuals to share thoughts and emotions and create lasting memories.
- ***Sensory qualities:*** Sensory qualities in architecture refer to the intentional design elements that engage human senses, such as sight, sound, touch, smell, and taste, to create a holistic and immersive spatial experience. It aims to evoke emotional responses, enhance well-being, and establish a meaningful connection between individuals and their built environment.

Book 1	***Book 2***	***Book 3***
(Places of the soul: by Christopher Day.) The book seeks to redefine traditional approaches to building design, promoting a paradigm shift towards creating healing spaces. Prioritizing the well-being of occupants, the author advocates for innovative design methods that integrate nature's benefits.	(Atmospheres by Peter Zumthor) "Atmospheres" by Peter Zumthor illuminates the symbiotic relationship between buildings and their surroundings, emphasizing sensory aspects. The book distills architectural excellence, offering nine fundamental principles to achieve perfect harmony in design.	(A Question of Healing by J. William Thompson) Typically, evidence centers on specifics like natural light, while design guidelines tackle individual aspects. Yet, solving problems separately lacks the holistic brilliance seen in Jorn Utzon's work, essential for creating genuinely healing spaces.
Book 4	***Article 2***	***Article 1***
(Healing with Nature by Claire Latane.) The book is solely based on connecting with nature and the sensory elements that help improve well-being. The author mentions different ways in which indoor and outdoor spaces can be connected.	The Article mentions nature's role in the well-being of a person. To improve the healthcare setting of architectural buildings, integration with nature is important. The author advocates for prioritizing high-touch over high-tech spaces.	It is evidence-based research that mentions the linking of spaces with nature, surroundings, and self. This can eventually help improve the well-being of a person or help in self-healing.

Table 1: Parameters and Literature Review

Nature	***Spatial Interaction***	***Sensory Qualities***
Nature in healing environments, with elements like greenery and sunlight, reduces stress and enhances well-being. This integration, through architectural design or outdoor spaces, optimizes outcomes. The therapeutic effects extend to mental and emotional states, supporting a holistic approach.	Spatial interaction in healing environments, as studied in literature, shows that well- designed spaces positively impact well-being, reduce stress, and contribute to positive interactions. Proximity to nature, access to natural light, and thoughtful communal areas play a crucial role in fostering a therapeutic atmosphere.	Sensory qualities profoundly influence healing environments, as indicated by literature studies. Engaging the senses, such as through soothing colors, pleasant scents, and calming sounds, contributes to a positive impact on patient well-being. Incorporating tactile and visual stimuli enhances the therapeutic atmosphere, reducing stress and promoting healing.

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Book	*Inferences*
Places of the soul	The spatial configuration impacts the stress factor, which leads to a distinct response, soft spaces with the help of light, texture and materials and it's effect on humans.
Atmospheres	Atmosphere is an experience of built environment and how space is transformed with the help of it's surroundings, people, texture and materials.
A Question of Healing	Evidence based research of spaces such as- Linking with light, nature, surrounding and self can drastically improve the well-being of a person and help in self-healing.
Healing with Nature	Exposure to nature & daylight improves the recovery rates, creates an interactive ground, a sense of belonging, an area of freedom, access to light and outdoor spaces.
Healing architecture	Both the quantitative and qualitative are essential, measuring the impact of indoor public spaces on the user's psychosocial wellbeing, focusing on the way-finding and social interaction.
Article 2	Healing environment includes thermal and visual comfort, positive distraction using a beautiful view or art, access to the landscape. Importance of self, surrounding, nature, and sunlight.

3. MATERIAL AND METHODOLOGY

The research is structured into two components: Primary data collection, which involves live case studies and meticulous observation of surroundings, while Secondary data is sourced through extensive book case studies and literature reviews.

This dataset is employed to understand healing parameters and discern challenges faced by the user group under study. Subsequently, the research delves into an in-depth examination of healing architectural spaces, synthesizing insights learned from literature reviews and case studies.

Following a comprehensive survey to pinpoint specific issues, the study culminates in the formulation of a well-defined design typology. This systematic approach ensures a thorough exploration and understanding of healing architecture principles and their practical application.

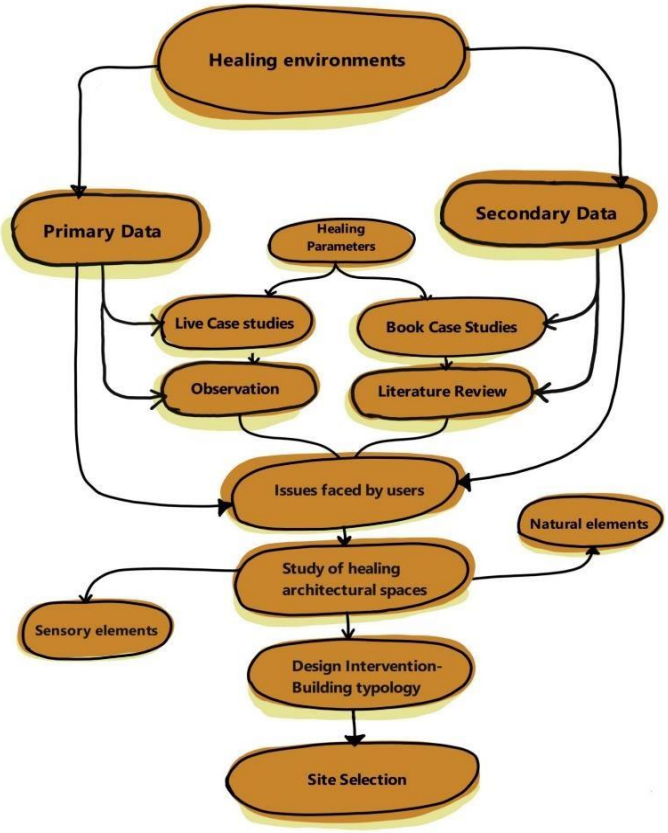

Figure 3: Methodology

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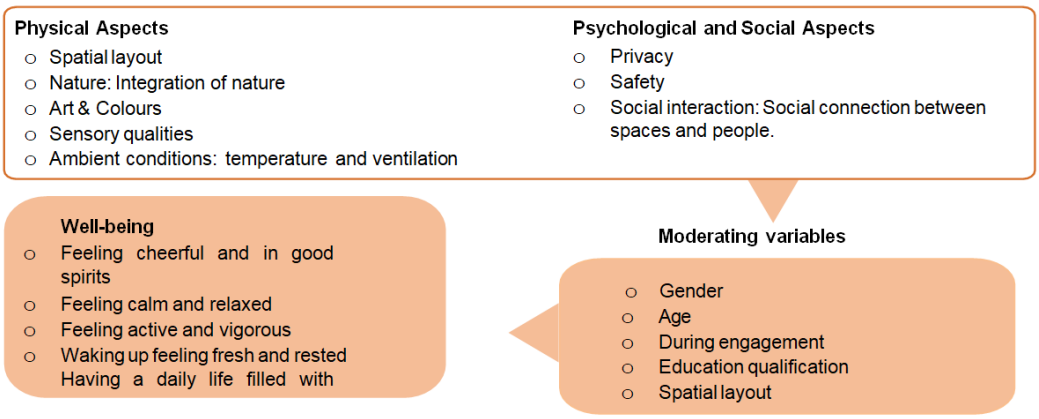
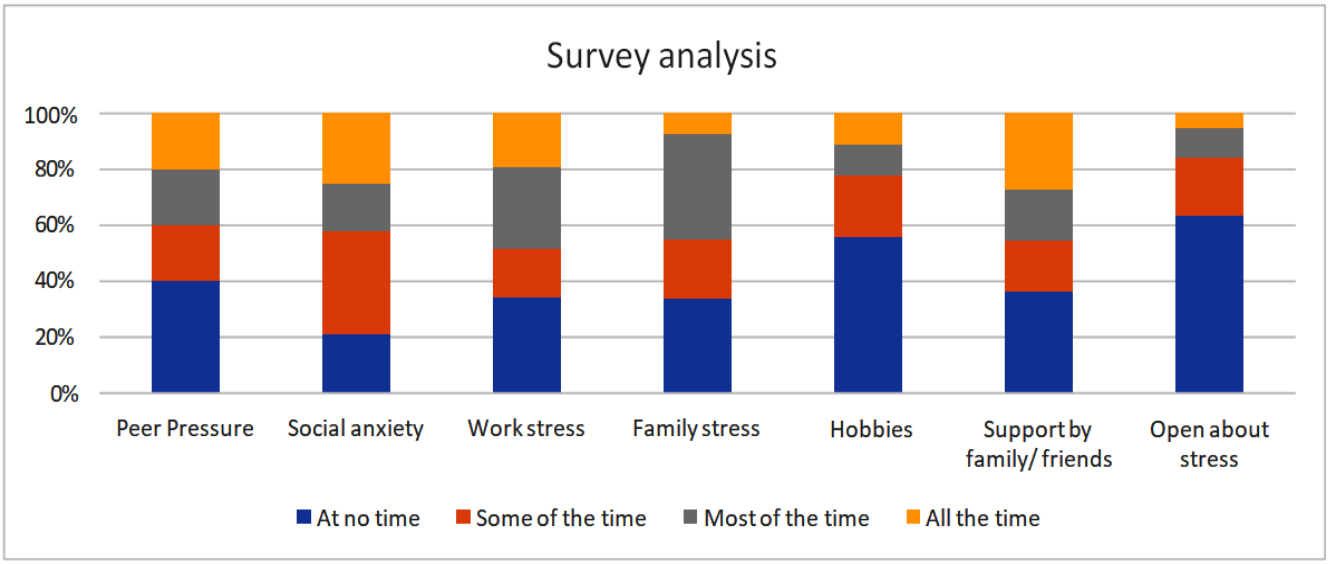
The empirical research employed a questionnaire to assess people's well-being and perceptions of various environmental aspects. Divided into three sections aligned with the theoretical framework, the questionnaire measured overall well-being using the WHO-5 scale. Subsequent sections inquired about participants' current mental health and their perceptions of healing environment aspects. Statistical analysis aims to elucidate practical relationships between these aspects and people's well-being, ensuring the questionnaire's structured approach minimizes potential influences on respondents' well-being from other survey questions.

Table 2: Survey Analysis of Stressful Environment





The questionnaire results reveal the correlation between perceived healing environment aspects and well-being through factor analysis and regression. The findings underscore the necessity for a dedicated healing space tailored to the Millennial and Gen Z generation, especially given their predominant time spent in universities and hostels. Consequently, the proposed design intervention focuses on creating a co-living hostel space for these demographic groups.

4. CASE STUDY

The cases studied to understand similar projects, which demonstrate the varied possibilities and challenges of healing architecture in different contexts.

4.1 Parameters of Case Studies

- **Integration with Nature**: Nature has healing properties, linking it to a space's physical design. Providing a sense of control and improving vitality helps people recover from physical, spiritual and mental illnesses.

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- **Spatial Interaction**: Interaction refers to the situation where a space prompts individuals to share thoughts and emotions and create lasting memories. This connection serves as a reminder of the space and its impact on the user.
- **Capability of Materials**: The relationship between materials in a design creates endless possibilities to explore. Each material has its own unique properties, lending a sense of presence and understanding through experience and time.
- **Context and surrounding**: A quiet atmosphere around can help people relax better and create a healing atmosphere in itself.
- **Sensory qualities**: Sensory qualities in architecture refer to the intentional design elements that engage human senses, such as sight, sound, touch, smell, and taste, to create a holistic and immersive spatial experience.
- **Similar typology**: Typology of hostel buildings is considered.

4.1.1 *Kasturba and Jawahar Bhawan- IIT Roorkee- (LIVE CASE STUDY)*

Location: Roorkee, Area: 365 acres, Parameters: Nature, Spatial Interaction, Context.

The hostel offers a well-rounded selection of recreational activities, including indoor sports like badminton, as well as outdoor sports, games and activities. The aim is to encourage interaction with nature, promoting physical and mental well-being, while also providing a comfortable and vibrant space for students.

4.1.2 *CDSA Pune (LIVE CASE STUDY)*

Location: Pune, Area: 15-acre, Parameters: Nature, Sensory qualities, Materials, Context. Architect Benninger's campus design seamlessly combines support, enclosure, and span using basalt and steel, creating a harmonious blend of load-bearing elements. The integration of basalt in east-west walls while transparent sliding glass panels eliminates the need for artificial climate control and transform it into a continuous, healing environment.

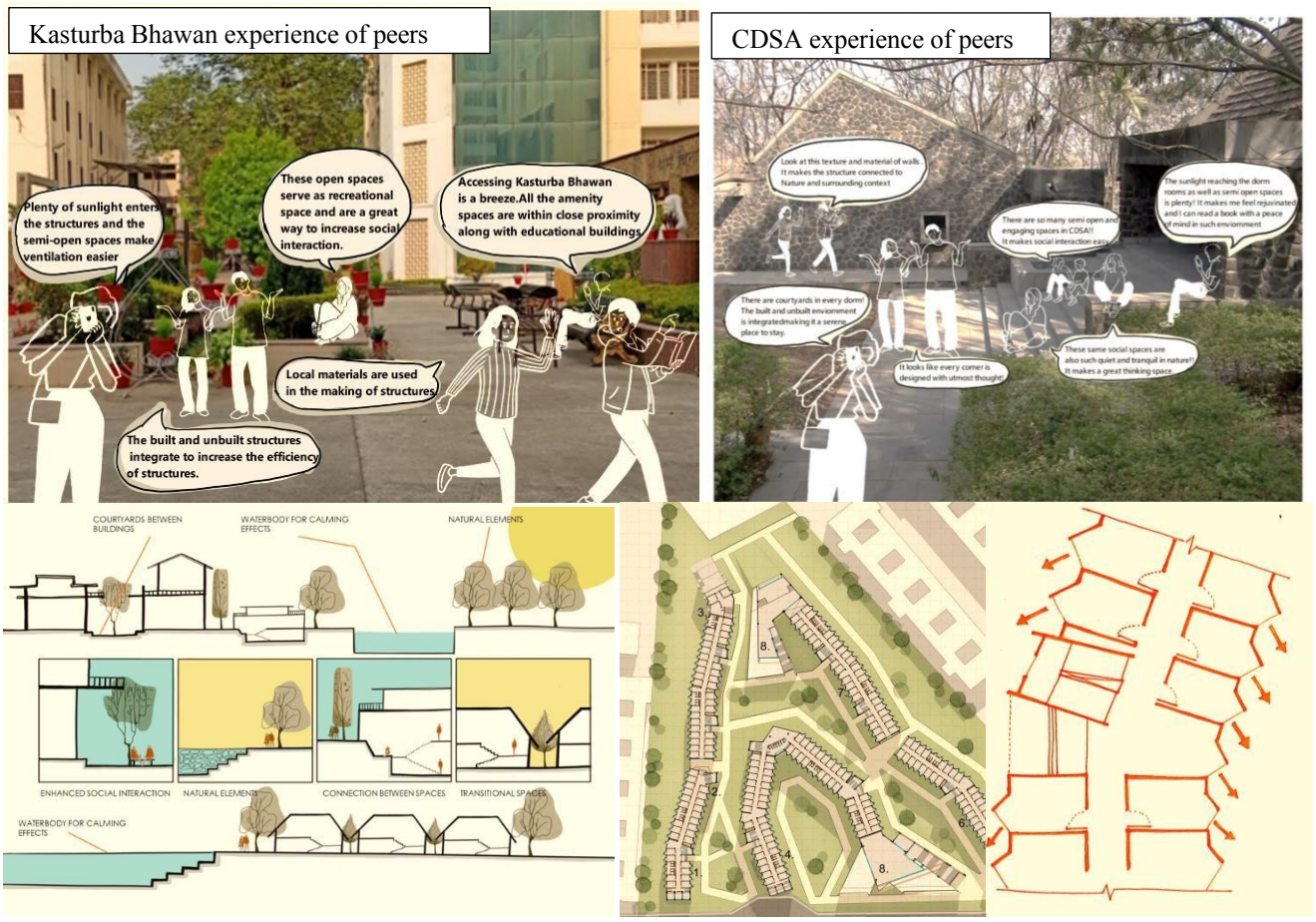

Figure 5: Experience of Peers in Livecase Studies

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4.1.3 *SwaSwara Retreat Centre*

Location: Karnataka, Area: 26 acres, Parameters: Nature, Sensory qualities, Materials, Context. Nestled on Gokarna's Om Beach, SwaSwara resort draws inspiration from the primal "OM," providing an idyllic backdrop for inner reflection. Seamlessly blending earthy hues and oceanic elements, it embodies simplicity and purity, a commitment to holistic well-being. This harmonious amalgamation transforms it into a healing haven, uniquely nurturing the individual self.

4.1.4 *The street- Mathura*

Location: Mathura, Area: 215,000, Parameters: Nature, Materials, Colours (Sensory qualities), Context. Inspired by the narrow, winding streets of Mathura, India, where it's located, this student hostel with 800 rooms creates welcoming and natural spaces.

5. CONCLUSION

In summary, the case studies on healing environments in hostels underscore the significance of thoughtful design for residents' well-being. Incorporating elements such as natural light and communal spaces can positively impact physical and mental health, transforming hostels into spaces that contribute to overall life quality.

6. RESULT AND DISCUSSION

One of the key aspects of healing architecture is its ability to create a unique and recognizable artistic icon of the building. This not only adds to the aesthetic appeal of the environment but also plays a crucial role in evoking positive emotions and feelings. It is important to note that these emotions have a significant impact on the process and duration of a sick person's recovery.

Research on the healing properties of the architectural environment is relatively new but holds great promise and necessity. Architects and designers must carefully consider the visual approaches they choose, as this contributes to the overall well-being and health of patients. By creating a harmonious and soothing environment that promotes a sense of calm and relaxation, people are more likely to experience improved healing outcomes. In addition to the visual aspects of healing architecture, the acoustic environment also plays a significant role in recovery (Xuan, (2016, December 19)).

6.1 Senses: Gateway to the World

Senses contribute more to ambient quality than concrete form, forming the bridge between the external world and our emotions. Environmental design, or architecture, nurtures these sensory encounters beyond the traditional five senses. While we may not consciously touch buildings, textures play a pivotal role in creating approachable spaces. The balance between routine and variety, termed "difference within sameness," is crucial for maintaining active and strong senses. Psychologists emphasize that while regularity can be soothing, a mix of different experiences keeps our senses vibrant and life interesting.

6.1.1 *Lightscapes: Shaping Spaces with Light*

Strategic window orientation captures seasonal sunlight, enhancing breakfast and providing captivating views, avoiding the sense of feeling trapped. (Hobday) Dynamic sunlight changes create rhythmic shifts, enlivening enduring structures and positively impacting mood and well-being.

> *This is about the working of the living (light) on the enduring (matter). This life enlivens us. – Christopher Day.*

6.1.2 *Healing Silence: Architecture of Peace*

Silence is not just the absence of sound but a calming absence of constant noise, acknowledged as a form of pollution by the World Health Organization. Window placement, soundproofing, and strategic use of materials minimize noise infiltration and transmission, promoting a crucial pursuit of silence for stress reduction and recuperation.

6.1.3 *Architecture of Touch*

In the comprehension of touch within healing architecture, critical considerations encompass Aesthetic Expression, Tactile Sensation, Structural Integrity, Contextual Harmony, and Wayfinding and Signage. These elements collectively contribute to a comprehensive understanding of the sensory dimension of touch in the architectural context.

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6.1.4 *Vivid Vistas: Creating Emotion through Color*

Color in architecture profoundly influences the sensory experience, shaping emotions and perceptions. Warm tones like red evoke energy, while cool hues induce calmness. Spatially, colors impact room perception, with lighter shades expanding space and darker tones creating intimacy. Beyond aesthetics, color considerations in architecture have far-reaching effects on mood, spatial perception, wayfinding, and cultural significance.

5.2 Space for Living in: Shape, Form, Spaces, and Life

6.2.1 *The Green Connection: Integrating Nature into Modern Spaces*

Landscaping alters climate, shielding against noise and enhancing natural sounds. Lush greenery serves as a sound buffer, purifying air and rejuvenating spirits, mitigating stress in urban environments. Strategic interventions recalibrate perceived density, ensuring harmony between conflicting demands of urban living. (S. Sandifer, 2000)

6.2.2 *Beyond Four Walls: Rethinking Privacy in Modern Architecture*

Elevating privacy is vital for comfort, achieved traditionally through visual barriers like elevated living spaces. Contemporary designs prioritize inclusivity, addressing challenges for individuals with disabilities. Cultural nuances emphasize transitional zones between private and public spheres. (Bell, 2006)

6.2.3 *Social Interaction*

Fostering social interaction is crucial for well-being, achieved through thoughtful environmental design. Social engagement is influenced by the design of spaces, with certain settings fostering or hindering meaningful connections, highlighting the importance of thoughtful design in mitigating stressors and enhancing community ties. (Theo J.M. Vandervoot, 2013).

6.3 Quality and Quantity of Space

In the realm of healing environments, the quality of spaces involves thoughtful design considerations that positively impact well-being. This encompasses elements such as optimal natural light, calming color palettes, and ergonomic furnishings, which collectively contribute to a soothing and supportive atmosphere.

Conversely, the quantity of spaces refers to their size, distribution, and overall accessibility. Ensuring an adequate number of well-designed spaces is crucial for accommodating therapeutic activities and facilitating a sense of inclusivity within the environment. Striking a harmonious balance between the qualitative and quantitative aspects of space design is paramount, as it ensures a holistic and effective approach to promoting healing and wellness.

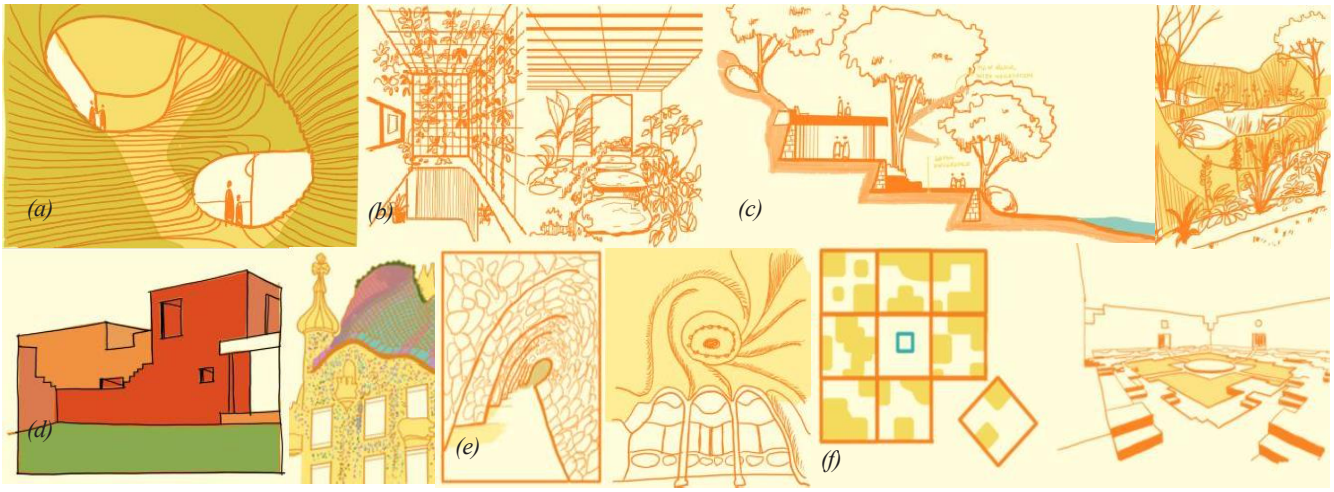

Figure 6: Sensory Elements, Quality and Quality of Spaces (a) Effect of light and texture in space, (b) Integration of nature, (c) Privacy in spaces, (d) Use of colour, (e)Use of Materials, (f)Spatial arrangement and social interaction

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In architecture, quantities encompass physical dimensions, spatial layout, cost, structural integrity, and adherence to codes. Size, spatial configuration, cost considerations, and structural elements are crucial for well- designed and sustainable solutions. Balancing these quantities is essential. Healing architecture, prioritizing aesthetic, spatial, and material qualities, integrates functionality, sustainability, and context. It emphasizes comfort, sensory stimulation, flexibility, privacy, accessibility, holistic wellness, and community connection. This approach ensures a comprehensive user experience, harmonizing both qualities and quantities in architectural design.

7. CONCLUSION

In conclusion, this research advocates for the implementation of healing architecture principles in a dedicated hostel space tailored to the Millennial and Gen Z generation. The proposed site selection near nature, with a rich historical backdrop, aims to embody values of timelessness and critical regionalism. Through a comprehensive study of sensory elements, including considerations for privacy, social interaction, safety, good orientation, and proper circulation, the envisioned hostel space seeks to provide a holistic environment that fosters well-being, connectivity, and a sense of place. This integration of architectural elements and thoughtful design strategies aims to create not just a living space but a transformative experience aligning with the unique needs and aspirations of the target demographic.

ACKNOWLEDGEMENT

I express my heartfelt gratitude to Prof. Ar. Tanvee Joshi for their invaluable guidance and unwavering support throughout the process of writing this research paper. Their expertise, encouragement, and constructive feedback have been instrumental in shaping the clarity and depth of this work. I am truly thankful for their mentorship and commitment to academic excellence.

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5. Exploring the Concept of Healing Spaces | Request PDF (researchgate.net).

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Evaluating Occupant Behaviour in Various Building Layouts during Evacuation Using HLA Simulation

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ABSTRACT: The study aims to evaluate occupant behaviour during the evacuation in the occasion of a disaster. It focuses primarily on alternative architectural layouts of a primary school building. The research framework is rooted in the use of a high-level architecture (HLA) simulation platform. This platform enables the seamless integration and coordination of different disaster simulators and technologies, providing a holistic approach to disaster response. The occupant evacuation behaviour simulation module at the heart of this research involves interplay of pedestrian movement and decision-making processes during evacuation. Using AnyLogic's suite of simulation models, the study examines various evacuation scenarios. This evacuation analysis is a powerful tool for identifying conflicting and problematic intersections on evacuation routes. This research will greatly contribute to disaster management in complex environments. Using the AnyLogic simulation models, the study provides a comprehensive view of pedestrian behaviour in emergency situations. The results are the basis for strengthening disaster preparedness strategies and ensuring the safety of residents in the event of catastrophic events even before construction of the building. For this study, six primary school building layouts have been analysed for pedestrian behaviour during the disaster.

Keywords: *Disaster Response Management, Building Evacuation, AnyLogic Simulation, High-Level Architecture (HLA) Simulation Models, Occupant Safety, Occupant Evacuation Simulation*.

1. INTRODUCTION

Natural or man-made disasters constantly threaten the safety and well-being of people in various facilities such as schools, office buildings and hospitals. In such emergency situations, the ability to evacuate passengers quickly and safely becomes paramount. Therefore, evacuation strategies must be carefully evaluated and refined to ensure the highest level of preparedness and response. This research paper deals with an important area of disaster management, with a special focus on building evacuation. The study uses AnyLogic's advanced simulation modelling techniques to investigate and improve our understanding of passenger behaviour during evacuation. These simulations allow a detailed analysis of different building layouts, which provides a more complete picture of evacuation dynamics. The focus of our research is the deployment of a high-level architecture (HLA) compatible distributed simulation platform. This platform acts as a unifying force for the seamless integration of various disaster simulators and technologies.

In this study, the occupant behaviour simulation module is one of these models, which consists of two critical elements: the Fraktion Effective Dose (FED) calculation module and the Evacuant Behavior Simulation module. The FED calculation module is coupled with fire gas simulations, allowing accurate quantification of toxic gas exposure of individual occupants. This is a key indicator for assessing the health effects caused by fire. The occupant evacuation behavior simulation module at the heart of our research dives deep into the complex interplay of passenger movement and decision-making processes during evacuation. Using carefully designed AnyLogic simulation models, we explore various evacuation scenarios. These simulations show how different building layouts affect the reactions and decisions of residents in different disaster scenarios. The importance of this research goes beyond academic research; it has practical implications for disaster management. The occupant behaviour simulation module's ability to predict evacuation times and improve occupant safety during a fire provides practical insights for facility managers and disaster managers. Overall, this study contributes to disaster management by providing a deeper understanding of passenger behaviour in emergency situations. It aims to lay the foundation for better disaster preparedness strategies and protection of residents in the event of disasters. Using advanced simulation modelling and a holistic approach, this study aims to improve security measures and emergency preparedness, resulting in more sustainable and safer facilities.

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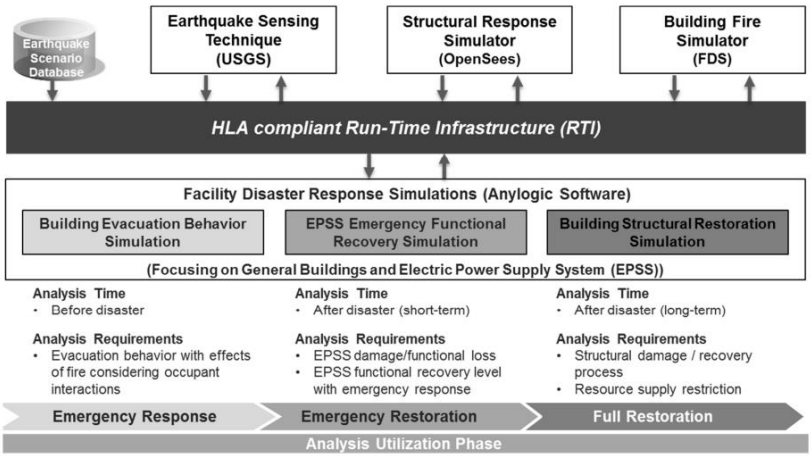

Figure 1: The Scope and Roles of Disaster Preparedness and Response System (T.M.K. Roeder, 2016)

2. METHODOLOGY

1. *Data Collection*

- ***Building Layouts:*** Gather architectural plans and layout details for various building scenarios, including those with multiple exits, single exits, centre-aligned staircases, and corner-aligned staircases.
- ***Pedestrian Parameters:*** Collect data on pedestrian density, walking speeds, and exit capacities from established research and real-world sources.

2. *Simulation Model Development*

- Utilize AnyLogic software to create accurate and realistic simulation models of the selected building layouts and scenarios.
- Use the Pedestrian Library to simulate the pedestrian behaviour.

3. *Parameter Definition*

- Define and calibrate simulation parameters, including pedestrian density, walking speeds, exit capacities.
- Configure the simulation to represent occupant characteristics and behaviours during evacuation.

4. *Scenario Simulations*

- Run a series of simulations for each building layout to generate data on congestion patterns, and emergent behaviours.
- Vary input parameters to explore a wide range of scenarios, including different building layouts.

5. *Data Analysis*

- Analyse simulation results to assess evacuation efficiency, identify bottlenecks, and evaluate the impact of building layout on occupant behaviour.

6. *Comparison and Interpretation*

- Compare the outcomes of different building layouts to discern trends, strengths, and weaknesses in evacuation strategies.

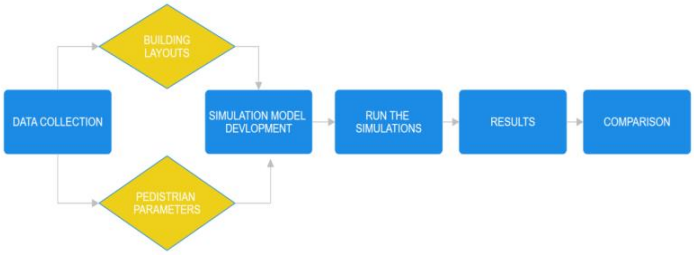

Figure 2: Methodology Flow Chart

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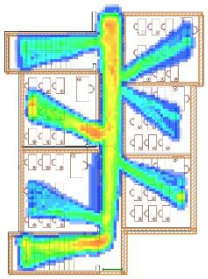
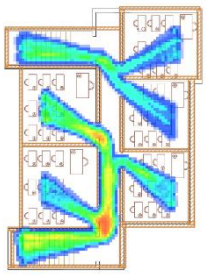
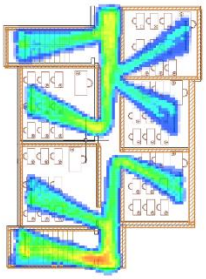
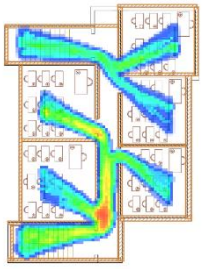
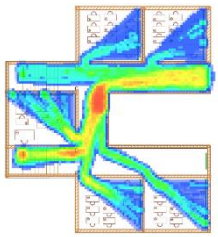
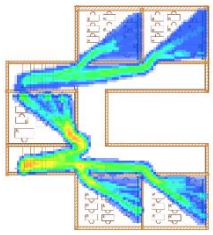
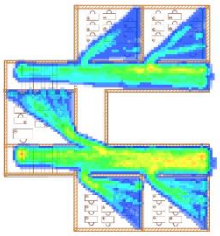
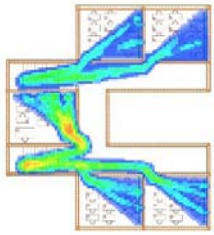
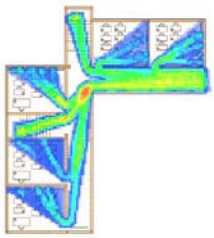
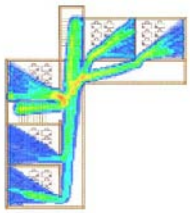
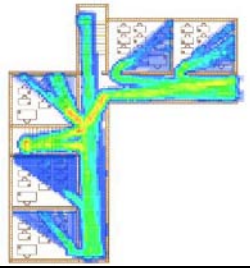
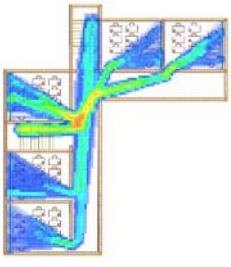
3. RESULTS

Ground Floor	*First Floor*	*Descriptive Analysis*
		**Linear Layout with Single Exit** • Five problematic junctions with high-density congestion were observed
		**Linear Layout with Multiple Exits** • Two problematic junctions with high-density congestion were observed
		**U-Shaped Layout with Single Exit** • Three problematic junctions were observed • One of which is of very high-density congestion • One is of high-density congestion and • One is of medium-density congestion
		**U-Shaped Layout with Multiple Exit** • Two problematic junctions were observed • One is of high-density congestion and • One is of medium-density congestion
		**L-Shaped Layout with Single Exit** • Two problematic junctions with high-density congestion were observed
		**L-Shaped Layout with Multiple Exit** • Two problematic junctions with high-density congestion were observed

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4. CONCLUSION

In the field of disaster response management, understanding occupant behaviour during evacuations within diverse building layouts is paramount. This study embarked on an exploration of the High-Level Architecture (HLA) Simulation Platform. Through a rigorous analysis, we have unveiled noteworthy findings that shed light on the intricacies of occupant behaviour during emergency evacuations.

Our investigation revealed that the layout of a building exerts a significant influence on the efficiency and challenges of evacuations. Linear layouts with single exits posed considerable hurdles, with five problematic junctions characterised by high-density occupant congestion. In contrast, linear layouts with multiple exits exhibited a marked improvement, with only two problematic junctions facing high-density congestion. This underscores the potential benefits of multiple exits in enhancing evacuation outcomes.

The U-shaped layouts presented an interesting scenario. When equipped with a single exit, three problematic junctions were identified, one of which experienced very high-density congestion, highlighting the need for careful planning in such configurations. However, U-shaped layouts with multiple exits showed promise, with only two problematic junctions, one with high-density congestion and the other with medium-density congestion.

Similarly, L-shaped layouts, both with single and multiple exits, encountered challenges at two problematic junctions characterised by high-density congestion. These findings emphasise that the presence of multiple exits can alleviate congestion, potentially improving evacuation efficiency.

The significance of these observations transcends academic curiosity, carrying profound implications for real-world disaster response management. They underscore the need for tailored evacuation plans that account for building layout nuances, particularly the identification and mitigation of potential congestion points. Such considerations can significantly enhance safety during evacuations and minimise response time during critical disaster events.

In conclusion, this research contributes substantially to the field of disaster response management. It enhances our understanding of occupant behaviour during emergencies, providing a foundation for more effective and targeted evacuation strategies. As we move forward, leveraging these findings in disaster preparedness and response planning can pave the way for safer and more resilient facilities, ultimately safeguarding lives and property during disasters.

ACKNOWLEDGMENT

I am grateful to Ar. Jaspreet Kaur Chhabda for her invaluable guidance. My thanks also go to Aayojan School of Architecture and Design for fostering an environment conducive to research and learning.

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Implications of the Metro Layout on the Pune's Historic Core

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ABSTRACT: While the metro rail transit systems have been developed rapidly, the nearby heritage buildings and historic sites are facing possible threats of unexpected damages. In particular, a metro rail project has a potential impact on numerous heritage buildings and sites in the old Pune city. Thus, to better protect these heritage buildings and sites,it is crucial for decision-makers to be able to rapidly and accurately evaluate these threats.

This research aims to comprehend and analyze the impact of the Pune Metro on the city's heritage. Objectives surrounds layout analysis, marking historic sites, analyze the Metro influence zone, understanding Metro station bylaws, and heritage laws. Thescope is restricted to the Pune Metro layout from Shivaji nagar to Mandai market.

Employing a deductive approach, the hypothesis seeks to map the Metro layout and identify heritage sites within the influence zone. This study underscores the challengeof preserving heritage amidst urban development.

Keywords: *Heritage Conservation, Metro Rail System, Urban Development.*

1. INTRODUCTION

Pune has a long and illustrious history that includes being center of power, culture, and trade for centuries. From being the seat of the Maratha Empire to playing an important role in India's independence moment, Pune has left an indelible mark on India's history. The city has been a hub of culture, art, and education for a long time. It has nurtured various forms of classical music, dance, and literature. Pune's cultural heritage is reflected in its historic architecture, traditions, and festivals.

The proposed Pune Metro routes traverse through the historic and culturally rich landscape of the city. Pune boasts an impressive heritage with 246 listed heritage sites (Prajakta Divekar, 2016) These include various types of structures such as wadas (traditional Maharashtrian houses), chawls (multi-story residential buildings), temples, market buildings, bridges, educational institutes, water tanks,streetscapes, and more.

- **Grade-I** structures are of the highest heritage significance.
- **Grade-II** structures are of significant heritage value.
- **Grade-III** structures are also important but to a slightly lesser degree.

The build heritage was mapped under the Pune Metro study, the line of Metro Influence Zone was marked and it was identified that 46% of the total listed built heritage of Pune is going to be affected by the Pune Metro Layout.

2. LITERATURE REVIEW

2.1 Heritage and its Importance

India's heritage is like a treasure chest filled with the customs, traditions, and values that have been passed down through the generations. It forms the very core of our cultural identity, serving as a timeless bridge that connects us to ourroots and ensures the continuity of our way of life. Distinguished scholars like Romila Thapar and Amartya Sen underscore the vital role heritage plays in preserving and nurturing our rich cultural heritage.

But our heritage is more than just a source of cultural pride. It's also a significant driver of economic prosperity. When millions of tourists flock to iconic sites like the Taj Mahal and the palaces of Rajasthan, they bring in substantial revenue. (Kapur, 2022) Research conducted by organizations such as the World Travel and Tourism Council and the Ministry of

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Tourism highlights the undeniable economic importance of heritage tourism in India, contributing substantially to our nation's economic growth and stability.

Furthermore, our heritage acts as a window into the annals of Indian history, providing invaluable insights into the journey of our nation. Esteemed historians like R.S. Sharma and Irfan Habib have dedicated their lives to unraveling the secrets of our past, enhancing our understanding of Indian history, and connecting us with our historical roots.

The spiritual and religious significance of our heritage is profound. Spiritual sites like Varanasi, Bodh Gaya, and the Golden Temple hold deep spiritual value for millions of people. Scholars like Diana L. Eck have delved into the religious diversity and spiritual essence of these sites, emphasizing their significance in the spiritual lives of many.

However, the path to preserving our heritage is not without hurdles. Urbanization, pollution, encroachment, and inadequate preservation efforts pose significant threats. Fortunately, organizations like the Archaeological Survey of India (ASI) and non-governmental organizations like INTACH (Indian National Trust for Art and Cultural Heritage) are actively engaged in heritage conservation, working tirelessly to safeguard our heritage for generations to come.

(Kapur, 2022) In conclusion, India's heritage is a dynamic and multifaceted force that shapes our nation's cultural identity, economic growth, historical understanding, spiritual experiences, and environmental well-being. Preserving it is not just a matter of pride but also a shared responsibility to ensure that the legacy of our nation endures for generations to come. It encapsulates who we are, where we come from, and the path we envision for our future.

2.2 Heritage Section in Draft Development Plan

Heritage within the framework of the proposed Draft DP is limited to built heritage structures. This limits the scope of conservation to merely architectural interventions to buildings or sites. The definitions of various heritage terms are inadequate in further listing of local heritage sites and structures, for instance, in case of heritage precinct a lot is left to the imagination of the team that is listing the heritage sites and structures. (Buddhivant & Narkhede, 2023a)

Considering that the Draft DP is applicable for a period of twenty years the vision for heritage as expressed through the DCRs is myopic and weak. The proposed draft for the Old City limits states as its objective in DP the '*revitalisation of the old city by decongesting the core area through relocation of specific economic infrastructure like markets, wholesale and trade centres etc. to appropriate locations on periphery'*. (Kanpur, 2016) Since there is no description of what type of businesses will be relocated one wonders if this also implies displacement of traditional occupations or small businesses that thrive on cultural resources available in the historic areas. This point can be further linked to the DCR for the proposed Metro Project where instead of decongesting historic areas in Metro Influence Zone, PMC has proposed densification. (Kanpur, 2016)

PMC has drafted the heritage regulations on the lines of the Model Building Byelaws but while doing so it has ignored important sections that refer to decisive action against those who violate the regulations. The Model Byelaws states that in case of a proved deliberate neglect of and/or damage to Heritage Buildings and Precincts or if the same is allowed to be damaged or destroyed then a strict action should be taken based on the Unauthorized Construction Act and additionally no new building permission should be granted without appropriate permission of Municipal Commissioner who acts as per the advice of the Heritage Committee (Planning Commission of India, 2014). (Deulkar & Shaikh, 2023)

DP further states regulated development in the surrounding areas of Grade I structures however, it doesn't mention any specific rules regarding the nature of permissible development or re-development in the said area. (Prajakta Divekar, 2016)

2.3 Pune's Urban Planning Vision

Pune's Development Plan (DP) is a vital document offering logical and scientific solutions to the city's evolving needs. Initially established in 1958–60 (Butsch *et al*., 2017) under the Bombay Town Planning Act of 1954, it was published in 1966 but left unimplemented due to the disruptive 1961 Panshet Floods. (Saha *et al*., 2021) The DP was revised in 1987 after a land survey and base map creation. (Butsch *et al*., 2017) Subsequently, the Maharashtra (Pensia & Singh, 2022) Regional and Town Planning (MRTP) Act of 1966 mandated another revision by 2007, but the final revised DP only surfaced in March 2013, sparking debates and collecting 87,000 suggestions and objections.

Currently awaiting state government approval, the DP influences heritage preservation and urban transport development, with the comprehensive mobility plan hinging on its endorsement. It remains pivotal to Pune's future. (Butsch *et al*., 2017)

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2.4 Heritage in India and its Threats

2.4.1 Urbanization and Development

Rapid urban growth often leads to thedestruction or encroachment upon heritage sites, as modern infrastructure takes precedence over preservation. (Butsch *et al*., 2017)

2.4.2 *Pollution*

Air pollution, industrial emissions, and water pollution can corrodeand erode ancient structures and artworks, gradually erasing their historical significance.

2.4.3 *Neglect and Lack of Maintenance*

Many heritage sites suffer from neglect and inadequate maintenance due to insufficient funds, awareness, orgovernmental support.

2.4.4 *Over-Tourism*

Excessive tourism can overwhelm heritage sites, resulting in overcrowding, littering, and damage to delicate structures andartworks.

2.5 Understanding of Grades in Heritage

Understanding grades in heritage refers to comprehending the categorization or classification system used to assess and evaluate the historical, cultural, or architectural significance of heritage sites, structures, or objects. Heritage grades help in prioritizing preservation efforts, planning conservation strategies, and ensuring theappropriate management of cultural and historical assets employed worldwide, and while the specifics may vary, they typically include thefollowing grades or categories:

Grade 1 or World Heritage	Grade II or National Heritage	Grade III or Regional Heritage	Grade IV or Local Heritage	Grade V or Contributory Heritage	Grade VI or Non-contributory Heritage:
Reserved for sites, structures, or objects of exceptional global importance. These are often designated as UNESCO World Heritage Sites.	Denotes sites, structures, or objects of national significance, contributing significantly to a country's cultural identity and historyW	Represents heritage assets of regional importance, often reflecting the history and culture of a specific area or community	Pertains to heritage elements significant at the local level, typically associated with specific towns, villages, or neighborhoods.	Includes elements that, while not individually significant, contribute to the overall historical or architectural character of a heritage area.	Encompasses elements that, while old or historic, do not significantly contribute to the heritage character and may not require preservation efforts.

3. DATA COLLECTION

The research methodology for studying the metro's implications on Pune's historic core combines case study analysis and deductive reasoning. Case studies focus on specific metro projects impacting the historic core, involving data collection through observations and stakeholder interviews. Qualitative methods like content analysis reveal patterns. The deductive approach starts with a theoretical framework based on existing literature, urban planning, and heritage conservation theories, forming research questions and hypotheses. This framework allows systematic testing within case studies and generalization of findings beyond, offering broader insights into the impact of metro systems on urban historic cores. This integrated approach ensures a thorough examination of the complex relationship between urban development, heritage preservation, and transportation in Pune's historic core.

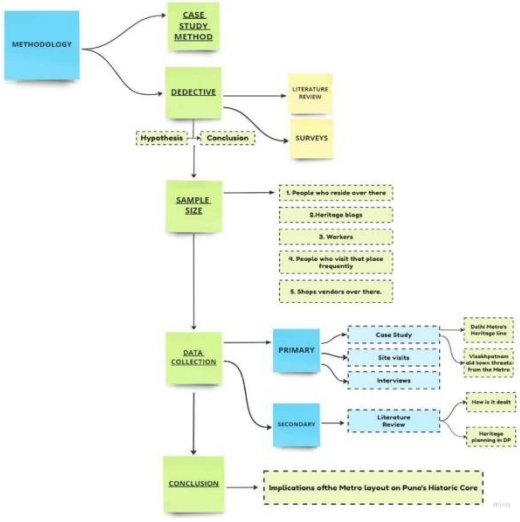

Figure 1: Evolution of Pune City

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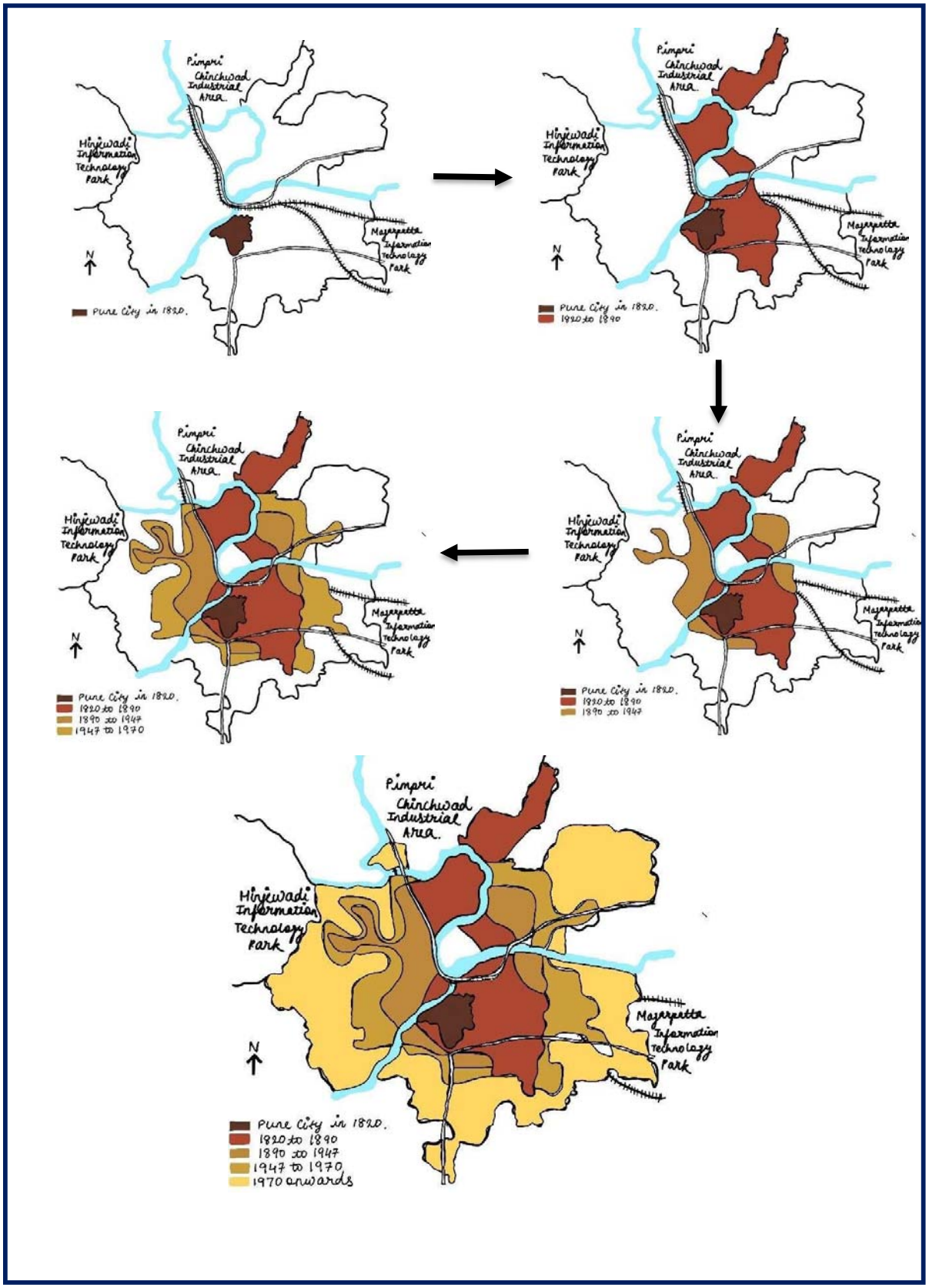
4. DATA COLLECTION



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4.1 Classification of Pune's Heritage Sites by Their Functionality

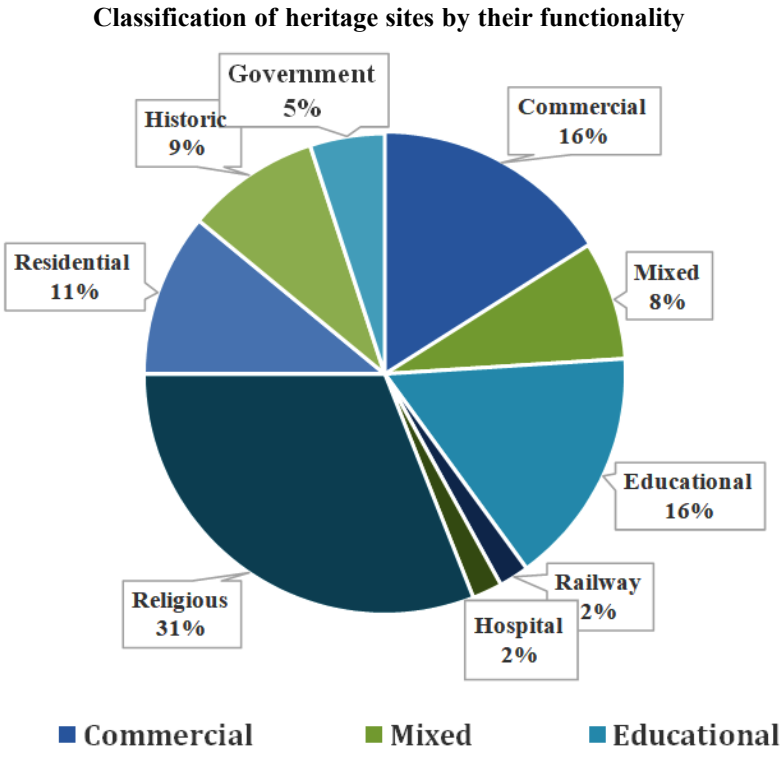
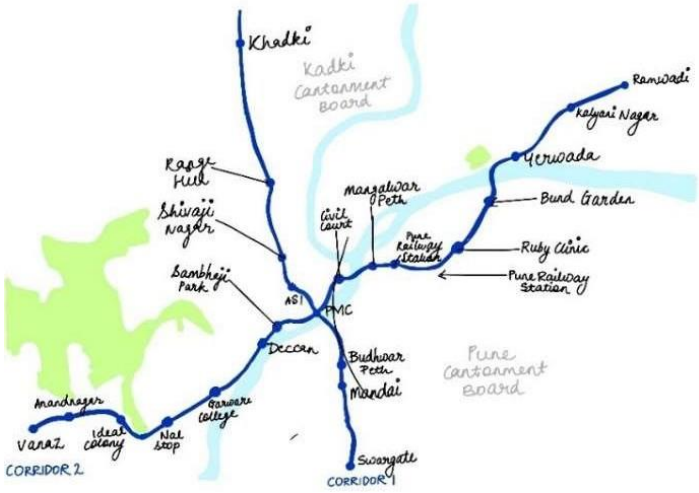


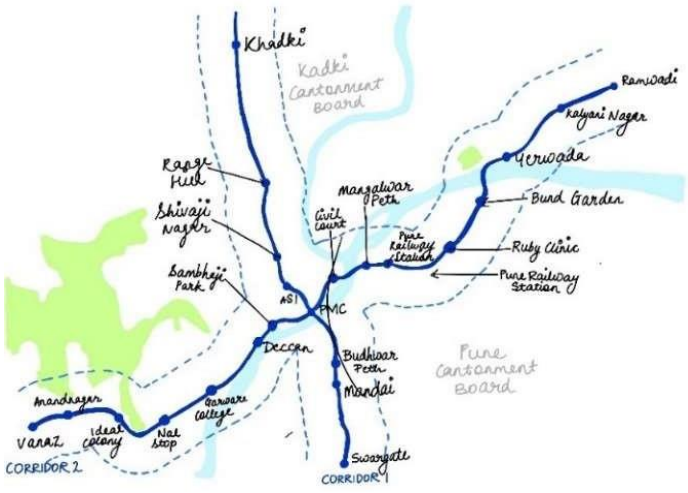
Figure 2: Classification of Heritage Sites by Their Functionality

The figure above shows the classification of heritage sites by their functionality. Majority of the heritage sites are of religious importance. 31 percent of heritage sites in MIZ are religious sites including temples, darga and church. Almost all major hospitals in Pune city are located in MIZ. 16 percent of heritage structures are heritage educational institutions. 11 percent of the heritage structures are residential properties.8 percent of Mixed properties refer to mixed functionality.

4.2 Proposed Metro Line and Aligned Heritage



Proposed metro line



Marked MIZ

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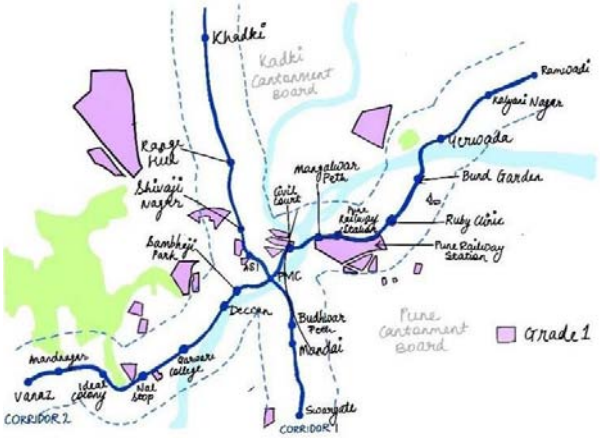
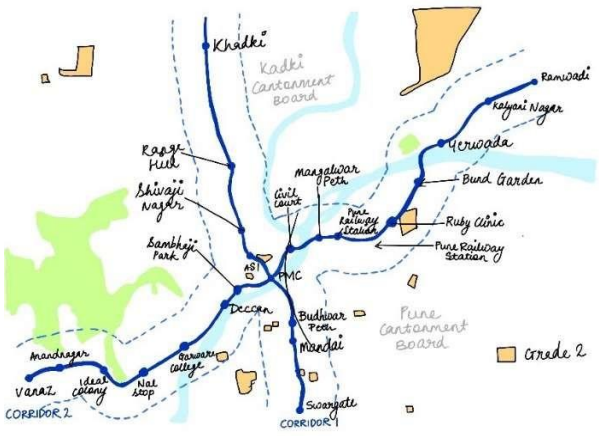
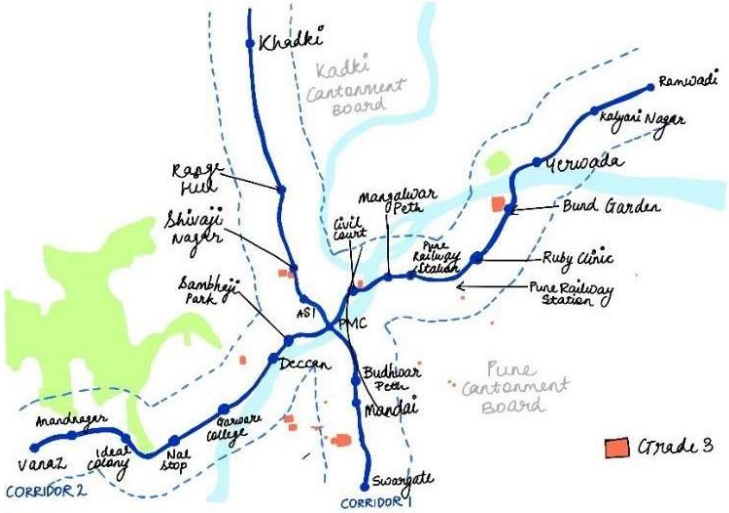
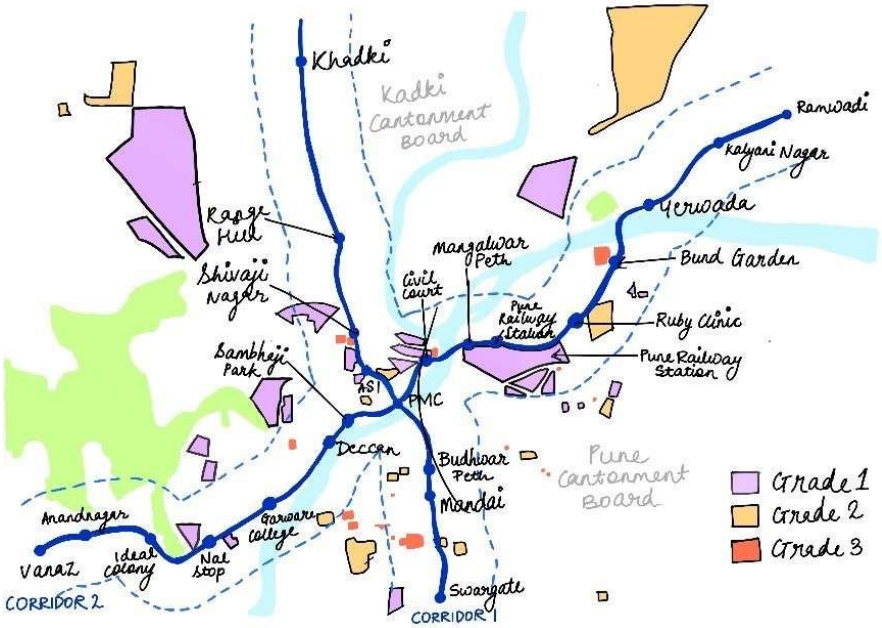


Grade 1 heritage



Grade 2 heritage





Grade 3 Heritage

Figure 3: Final Map with Marked Heritage

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4.3 Bifurcation of Structures According to its Grade

CORRIDOR 1 PCMC-SWARGATE	GRADE	CORRIDOR 2	GRADE
Vishrambaug wada	1	Fergusson College	1
Nana Wada	1	Kesari Wada	1
Tulsibaug Mandir Complex	1	OmkareshwarTemple	1
Someshwar Mandir	1	Jangli Maharaj Complex	1
Lal Mahal	1	Pataleshwar Caves	1
Nageshwar Temple Complex	1	Shaniwar wada	1
Simla Office	1	College of Engineering Pune	1
Kasba Ganpati Mandir	1	Sasson Hospital	1
Mandai Complex	1	SNDT College	2
Vetal Temple	2	New English school	2
Commonwealth Building	2	Wadia College	2
Laxmi Narayan temple	3	B J Medical College	2
Huzurpaga School Complex	2	Deccan Gymkhana Police Station	3
Kedareshwar Mandir	2	Panchaleshwar Mandir	3
Bank of Maharashtra	3	Deccan Gymkhana Post Office	3
N M Wadia Hospital	3	Savarkar Smarak	3
LIC Building	3	Shivaji Bridge	2
Tambat Ali Road	2	SSPMS Highschool complex	2
Ram Mandir Complex	2	Nanasaheb Peshwe Samadhi	3
Naik Wada	2	Natu Wada	2
City Post	1	Ranade Institute	2

Figure 5: Bifurcation of Structures According to Its Grade

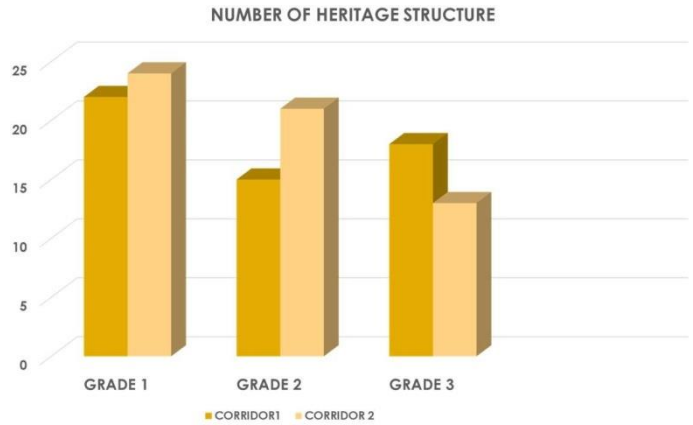

Figure 6: Number of Graded Heritage in Corridor 1, 2

4.4 Site Visit and Observations of the Mandai Metro

Mandai Metro Station

Excavation is done and construction is under process:

- Effects on surroundings
- Extreme congestion of vehicles
- Loss of business of those whose shops have beenDisrupted
- Extreme discomfort to pedestrians
- Emission of dust in neighbouring areas

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Figure 7: Mandai

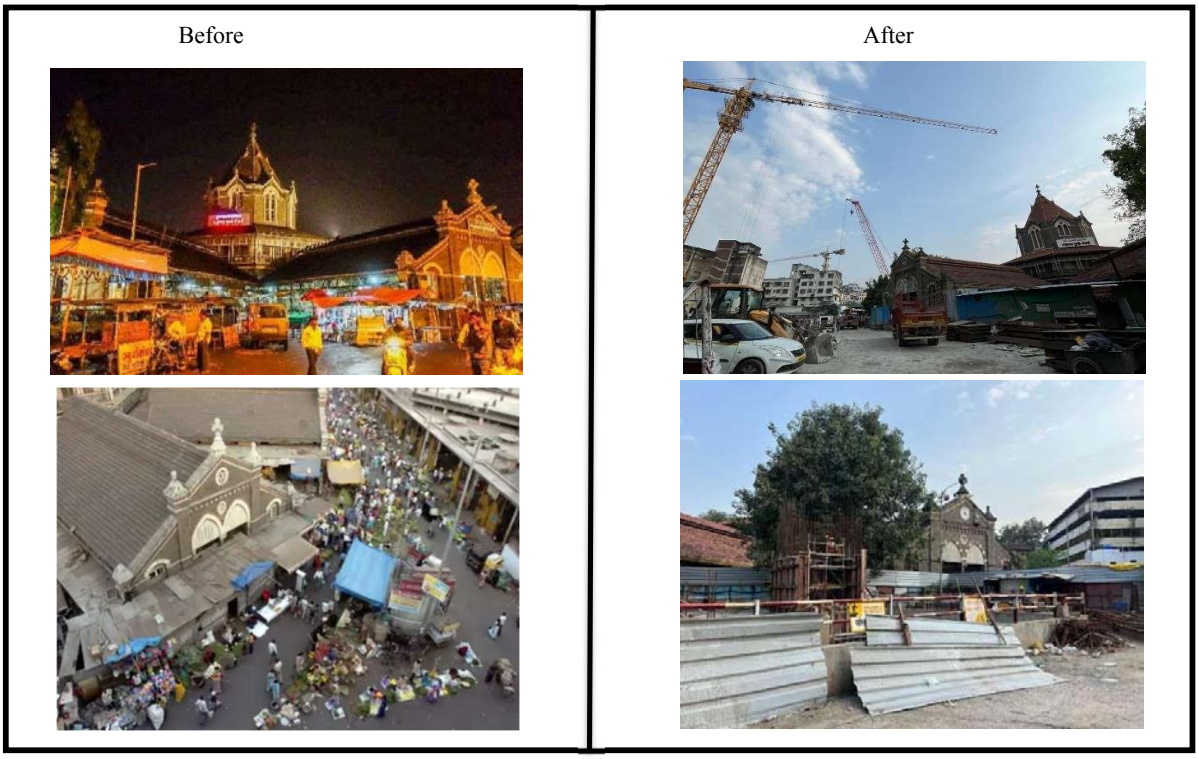

Figure 8: Effects on Mandai Metro

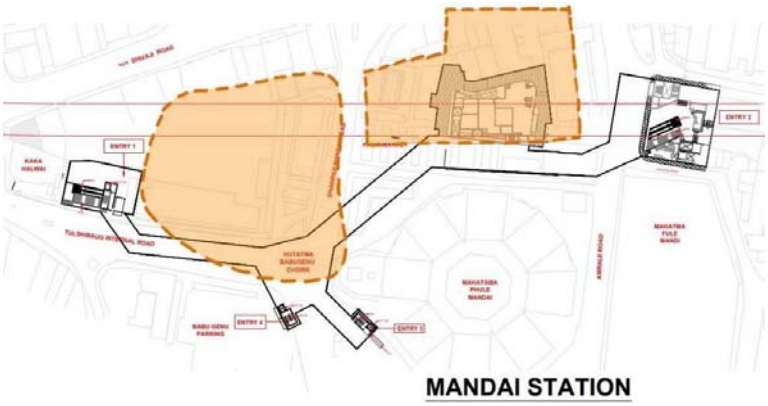

Figure 9: Impacted Zone in the Mandai Market Area Due to Metro

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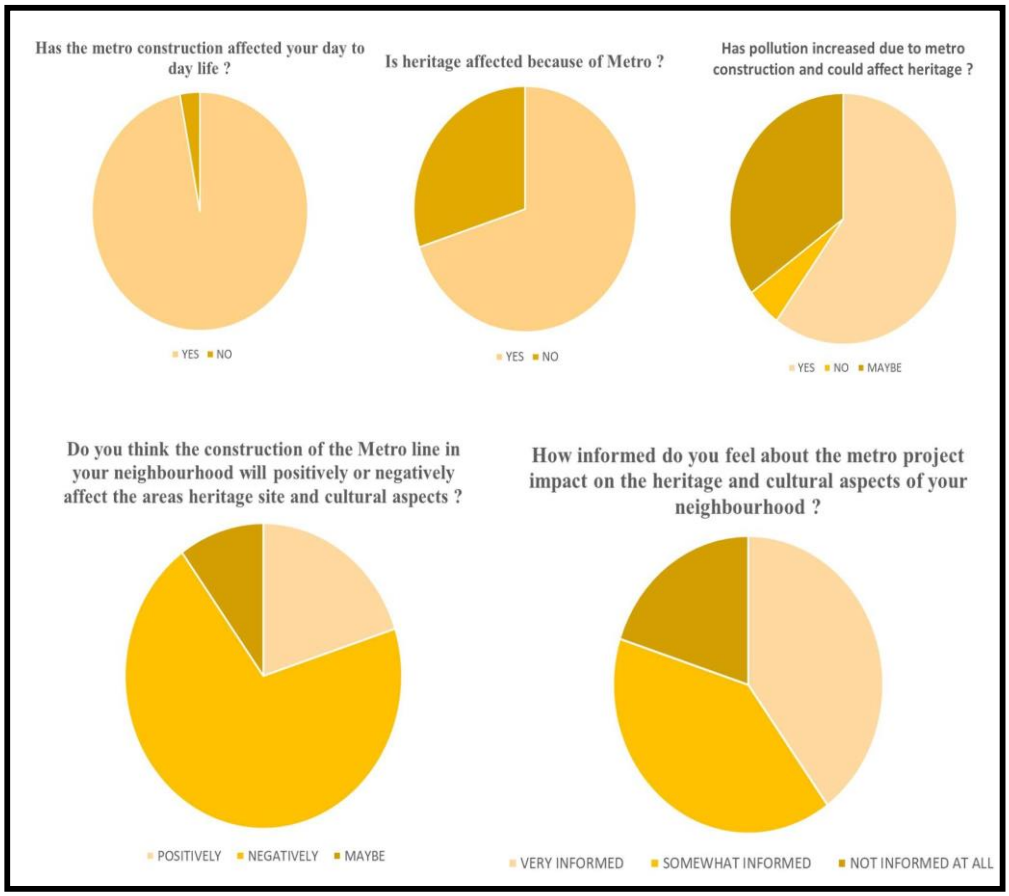
Question asked to the local shop vendors and the residents:



5. RESULTS AND DISCUSSION

The introduction of a metro line in Pune, an expanding metropolis with a rich historical core, has raised significant implications for the city's heritage and urban development. This study aimed to investigate the impact of the metro line on Pune's historic core, considering both the positive and negative consequences.

Positive Impacts:

- **Improved Connectivity:** The metro has enhanced connectivity within the city, making heritage sites more accessible to tourists and commuters. This has the potential to boost tourism and local businesses within the historic core.
- **Reduced Congestion:** The metro has the potential to reduce traffic congestion, minimizing vehicular pollution and preserving heritage structures from environmental degradation.
- **Economic Growth:** The development of metro stations and related infrastructure has led to increased economic activity, providing employment opportunities and potential for the rehabilitation of heritage buildings.

Negative Impacts

- **Problems due to construction:** Traffic has increased due to the construction of Metro. During the case study of Mandai metro which is under construction from last one year and traffic in that area has increased immensely (Buddhivant & Narkhede, 2023b).
- **Effects of Cultural Landscape:** The landscape in front of may heritage structures has been removed for construction of new structures.
- **Distruption of the Sea Bed:** The Sambhaji metro station is build in the sea bed itself, this is a huge threat to the heritage.

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- **Reduction of FSI:** The properties that come above the metro tunnel have a restriction that they can not to large scale development and the have a restrictionthat they have very less fsi now considered to earlier.

The introduction of the metro line in Pune has indeed brought about several positive changes. Enhanced connectivity and reduced congestion have made heritage sites more reachable, increasing their potential as tourist attractions. Moreover, economic growth in the form of new jobs and business opportunities can contribute to the conservation and rehabilitation of heritage structures.

However, the negative impacts are significant. The proximity of metro construction to heritage sites is a cause for concern, as it can result in structural damage and aesthetic alterations. The potential commercialization of the historic core may compromise its cultural value, shifting its character to accommodate businesses rather than preserving its heritage.

6. CONCLUSIONS

In conclusion, while the Pune metro brings potential benefits, its implications on the historic core are multifaceted. To effectively manage these impacts, a comprehensive approach that involves heritage conservation, urban planning, and community engagement is essential to ensure that Pune's rich historical core retains its cultural significance and character while benefiting from modern development. The metro, a new train system in Pune, has had both good and not-so-good effects on the old part of the city. The good things are that it makes it easier to get to historical places, lessens traffic jams, and creates jobs. It can also bring moretourists and help local businesses.

However, there are problems too. The building of the metro close to old buildings and historical spots can damage them. It may also lead to changes that harm the city's culture. People living there might have to move away because of the changes. To solve these issues, the city needs to carefully plan how the metro fits in with its old places. They should also involve the local community and make sure thattourism and business growth are done in a way that respects the city's history and traditions. It's a tough balancing act between keeping the old while bringing in the new, and the decisions made now will affect Pune's identity and future.

ACKNOWLEDGEMENT

The completion of this research paper could not have been possible without the guidance of: Ar. Ramiya Gopalakrishnan, and research coordinators Dr. Vaidehi Lavand, Ar. Ramiya Gopalakrishnan. Their guidance carried me through all the stagesof writing my research. A debt of gratitude is also owed to all the people, places, and management of heritage and metro study without whose corporation, the study would not have been a success. Last but not the least, I would like to thank SMEF's Brick School of Architecture for enabling my study.

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Rejuvenation of Mutha Nadi Bank Canal in Pune: Janta Vasahat

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ABSTRACT: Canals are considered one of the important factors of sustainable development economically, socially and environmentally. As cities expand and evolve their infrastructure undergoes drastic change including development and alertration of canal system. Also as urban areas expands, they encroach upon natural habitat surrounding canals. Urbanization often introduce pollutants into canals through stormwater runoff, sewage discharge and industrial effluents which can alter physical structure of canals system. This can affect the water quality in canals, making them less suitable for purposes like irrigation or drinking water supply.

This research paper aim to provide a comprehensive understanding of canal's current status its potential for rejuvenation and benefit it could bring to city of Pune in term of environmental, economic and social aspect..

Keywords: *Sustainable, Urbanization, Pollutant, Alertration, Rejuvenate.*

Aim

The aim of the research paper is to rejuvenation of canal considering issues.

1. INTRODUCTION

Canals are artificial waterway, used to connect waterfalls into intention of shortening routes. It is also constructed to convey water for irrigation, land drainage, urban water supply, hydroelectric power generation.

Even canals often enhance aesthetic appeal of urban areas and provide green corridors for wildlife and plant habitats. They can contribute to a healthier urban environment and promote biodiversity.

2. MUTHA NADI BANK CANAL, JANTA VASAHAT, PUNE

2.1 History

Mutha right canal developed in 1960. as it is long stretch of 200 km originates from khadakwasla dam, flows upto indapur. the major purpose of developing this canal was for irrigation and at the time of colonial periods goods were transported from this root of canal canal reaches dhayari, nanded,janta vasahat, cantonment area, hadapsar,fursurgi, lonikalbhor, dhaund and indapur. it boosted the economy of pune. and now the patch of canal in janta vasahat become source of irrigation for 10 month.

Janta vasahat, Pune' s largest slum at foothill of Parvati hill a residential area located in southern part of Pune, Maharashtra, India it is also commonly known as Parvati pytha or Parvati. The area around Janata vasahat have residential community, shops and its proximity to Parvati hill, which is popular tourist and religious destination in Pune. Janta vasahat comprises multiple slums that total population of around 60000 situated above mutha Nadi bank canal.

The mutha canal, which carries water to rural areas starts from from khadakwasla dam, covers about 24 km distance up to phursungi. It flows via via sinhagad road, dhayari, Janta vasahat, Parvati, swargate, sopanbaug and Hadapsar.

The 400 meter long stretch of mutha canal in Janata vasahat, begin from Khadakwasla dam and flows across the city – covering a distance of above 25 km. The Janata vasahat area is among the most exposed stretches of canal because a significant no. of people resides on both side of canal there. Water is flowing into canal at 1005 cu secs from khadakwasla. The canal carries water to rural areas for 10 months in a year to meet agriculture needs. The total length of mutha canal is around 200 km crossing rural areas till indapur.

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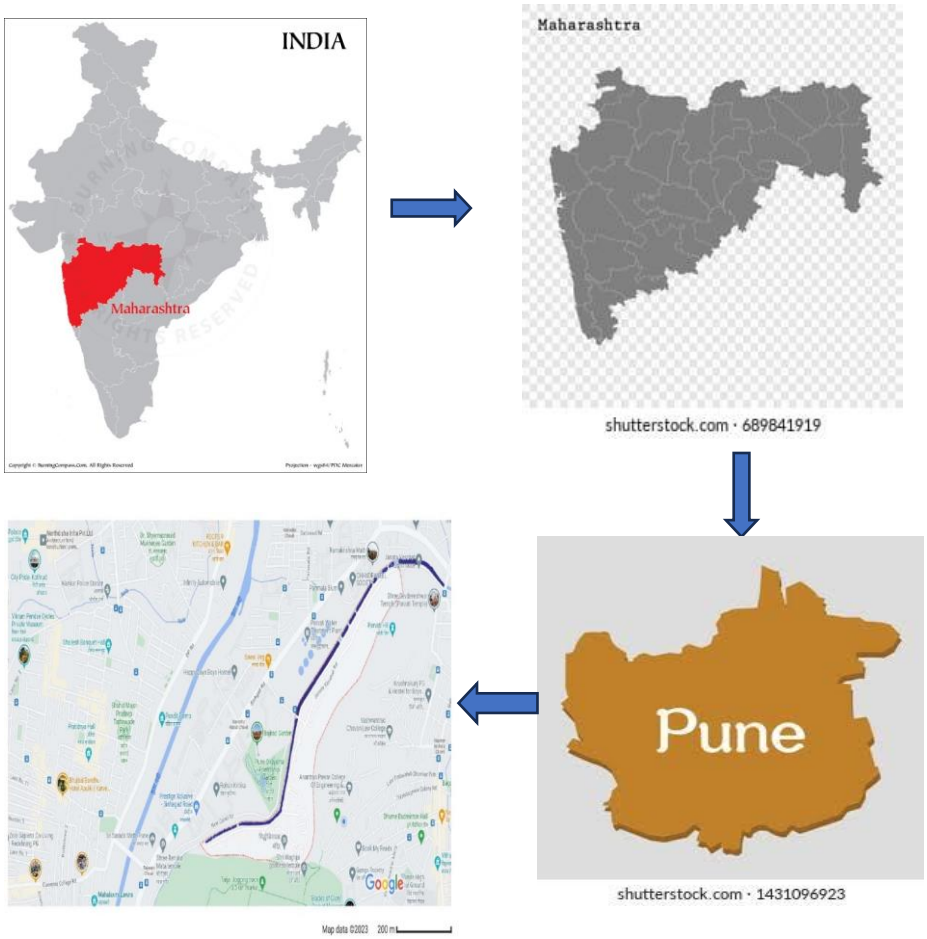
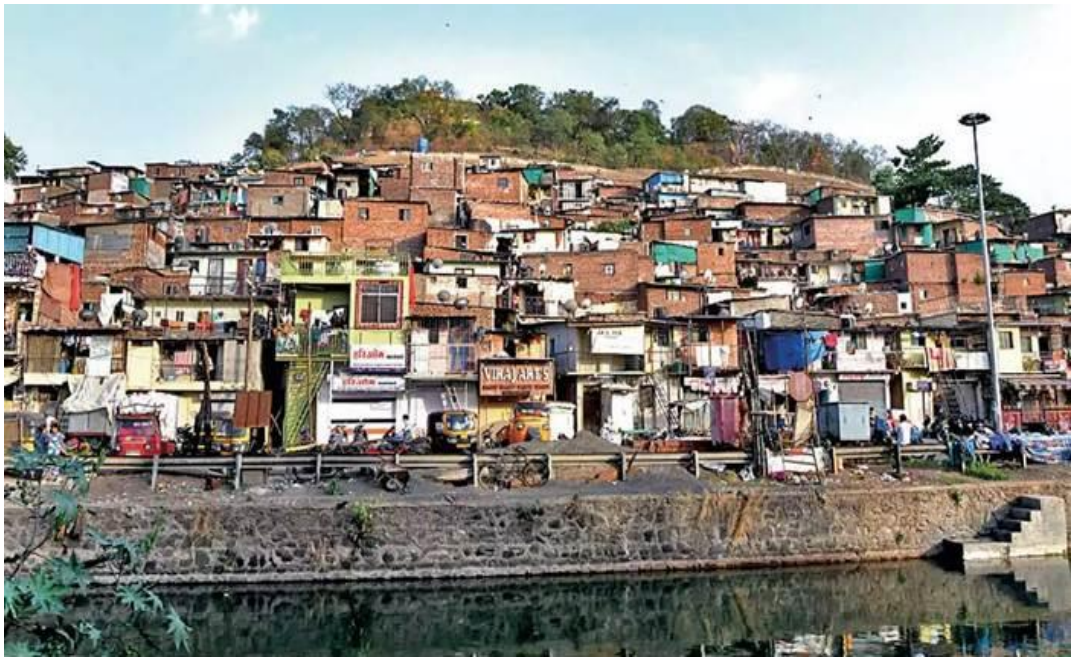


Mutha Nadi Bank Canal, Janta Vasahat, Pune



Janta Vasahat, Pun

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2.2 Identifying the Timeline

The timeline is a graphical representation of events or activities organized in chronological order. Timelines representing a canal's history or development including significant event related to canal over a specific period. Timeline of mutha nala bank canal, Janata vasahat, Pune from 2011 to 2023 (present) with yearly time lag between 3 year: 2011 to 2014, 2014 to 2017, 2017 to 2020, 2020 to 2023).

Timeline: 2011 (canal reaches its halfway point in term of construction)
Timeline: 2011 (canal reaches its halfway point in term of construction)

Mutha Nadi Bank Canal At Present, Janta Vasahat, Pune

Timeline: 2011
(canal reaches its halfway point in term of construction)

Timeline: 2014
(completion of canals ' mains structure)

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Timeline: 2017
(canal officially inaugurated for water flow and recreation)

Timeline: 2020
(plantation of greenery along canal's banks)

Timeline: 2023
(continued efforts to maintain water quality and prevent encroachment)

2.3 Identifying Issues and Values

With the settlement of people around mutha canal in Janata vasahat, Pune, some of the issues are arises near canal:

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Area around canal have become garbage dump , people living around there , dump the garbage near the canal making canal polluted.

Seepage are visible, while iron mesh installed along canal is broken at many location, unsafe for children

Drainage lines located in area are getting impacted because of water seeping out.

Objective

1. To identify and analysis issues with respect to mutha nadi bank canal near Janata Vasahat.
2. To give solution to rejuvenate the existing canal.

Scope

The rejuvenation of canal in Pune presents various scopes and opportunities tht can benefit the city in multiple ways:

1. Environmental restoration.
2. Implementing measures to improve the water quality of canals responses positive effect on local ecological and aquatic life.
3. Urban planning and development.

Developing parks, walking paths and recreational areas along the canal can enhance the city's green infrastructure.

Limitations

This paper is limited only to patch which flows through Janata vasahat area.

2.4 Methods

1. Literature review
2. Site visit
3. Site analysis

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3. METHODOLOGY

3.1 Literature Review

Urbanization with rapid population growth and increasing industrialization has significantly transformed the landscape of cities worldwide. Poorly planned urbanization can disrupt natural drainage patterns, leading to increased flood risk for both canal and surrounding areas. Urban development can pave over permeable surfaces causing rainwater to run into canals during heavy storm.

As urban canals are integrated into urban infrastructure, they require regular maintenance to prevent silt builtup, erosion etc. To mitigate the effects of urbanization on canals, cities need to engaged in comprehensive urban planning that takes into account the preservation and sustainable management of canal system.

Mutha Nadi Bank Canal, Janta Vasahat: Site Visit

After reading all literature review, a site visit was conducted and following points are analyzed.

The area around canal have become garbage dump, people living there dump the garbage near canal making them polluted. Garbage dumping near canal lead to water pollution harming aquatic ecosystem and also affecting water quality makes water unsafe for agriculture and recreation use.

Also it was observed that iron mesh installed along canal is broken at many location broken barricades near canal is an increased risk of flooding as it leads to risk of water entering adjacent residential areas during heavy rain or flooding. Drainage lines located in area are getting impacted because of water seepage, increases the risk of accumulation of water in low lying areas.

4. NEED OF REJUVENATING MUTHA NADI BANK CANAL

1. Regaining the real identity: Rejuvenating the canal can help it to regain its real identity as it can be use more beneficially for more purposes.
2. Boosting the employment opportunities: while rejuvenating the canal, workers are needed so it lead to boost the employment opportunities for people.
3. Developing the flora and fauna: when a canal is rejuvenated with a focus on environmental enhancement, it can create or restore habitats that support a wide range of plant and animal species.
4. Enhancing ecosystem: Implementing measures to improve the water quality of canal responses positive effect on local ecological and aquatic.

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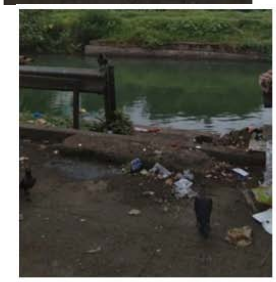
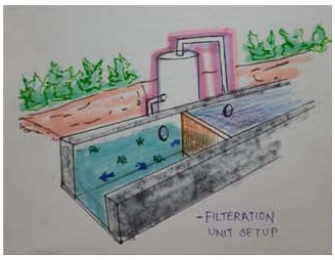
5. REJUVENATION OPPORTUNITIES

Rejuvenating opportunities for canals can provide numerous benefits to a region, including improved transportation, tourism, and environmental sustainability.

Rejuvenating canals can have positive economic, social, and environmental impacts. It can breathe new life into historically significant waterways and create vibrant, sustainable urban environments. Here are some solution and rejuvenating opportunities for patch of mutha nadi bank canal, janta vasahat with respect to issue arises there. Rejuvenation opportunities we can adopt are:

ISSUES		SOLUTIONS	
	Area around canal become dumping yard →		Conducting awareness campaign for not polluting canal
	Barricates are broken around canal.		Using natural fencing such as throny plants like cactus as a barricates
	Water is polluted in canal		
	Water is polluted in canal →		Installation of water filtration tank for filtration of water
	Barricades are broken around canal →		Using natural fencing such as thorny plants like cactus as a barricades

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6. DISCUSSION AND FINDING

There is need of rejuvenating the patch of canal in janta vasahat as the that patch faces so much issues like garbage dumping in nearby area of canal that pollutes the water of canal, broken barricades around canal that is unsafe for people living there, seepage are visible that affect drainage line. As the water of canal used for irrigation, so for the filtration of canal water filtration tank are installated in specific distance and with that aqua culture can be done with the fishes who eats debris in water like crab fishes, flatfish. Natural fencing like thorny plants can be provided as a barricades for safety purpose.

7. CONCLUSION

With analysis the factors affecting the mutha Nadi bank canal, I conclude here that there is a need of rejuvenating canal as it involves automation of irrigation systems to improve water efficiency and crop productivity. Also rejuvenating efforts also include water quality improvement measures like sediment removal, pollutant control, and implementation of sustainable water management practices.

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Contemporary Relevance of Artistic Elements from Traditional Wada Architecture

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ABSTRACT: The research relates to the loss of cultural importance in today's era among the youth. It is mainly focused on making the younger generation realise that the culture is not just related to celebrating festivals and functions on large scale but it's related to live it in our day-to-day lives. Living in a space in not just related to amenities and community spaces but its also related to getting in relation with the structure and going all along with it. *Vastushastra* is just what this concept talks about. Therefore, the aim for the study talks about going ahead with the world but along with the roots of our culture and tradition intact. The objectives talk about going about the various elements of the traditional architecture which eventually talk about our culture and heritage. Hence during the process of the study, the author comes across various elements being used by the traditional architects which had a very significant value in the structures of the earlier period but they have lost that importance by time. But these elements also comeup as carriers of tradition and culture throughout. Here the author comes up with carrying further this tradition by using these elements not as structural or design elements but as artistic elements in interior design, façade design, etc. Hence the author concludes by describing the use of these elements effectively in contemporary style thus achieving the purpose of the research.

Keywords: *Artistic Elements, Culture, Heritage, Tradition.*

1. INTRODUCTION

Aim: To study the various artistic elements of traditional Wada Architecture and its implications in contemporary style.

1.1 Objective

1. Various types artistic elements in Wada style architecture.
2. Their significance in traditional architecture.
3. Relevance in use of these elements in contemporary architecture

The Wada as a residential structure was accepted wide and loud across the areas of the Deccan Plateau (Mainly in and around the Sahyadri ranges).

One of the reasons behind this wide spread acceptance was seen to be the wada as a whole was designed according to one of the first Hindu treatise, The Vastushastra. It as a structure was wholly an introvert arrangement of rooms and verandahs placed around the courtyards. Thick walls with few and small openings in the outside provided strong security against intruders. Provision of courtyards ensured plenty of light and ventilation without sacrificing privacy. As a neighbourhood, this type of module having verandahs and rooms around one or many courtyards could be very closely placed with similar adjoining structures.

The designing of a wada can be divided into various features such as:

1. Plinth (Ota)
2. Verandah (Sopa)
3. Terrace (Gacchi)
4. Staircase (Jina)
5. Built tank or pond (Pushkarni or Haud)
6. Well (Vihir)
7. Fountain (Karanje)
8. Basil plant structure (Tulsi Vrindavan)

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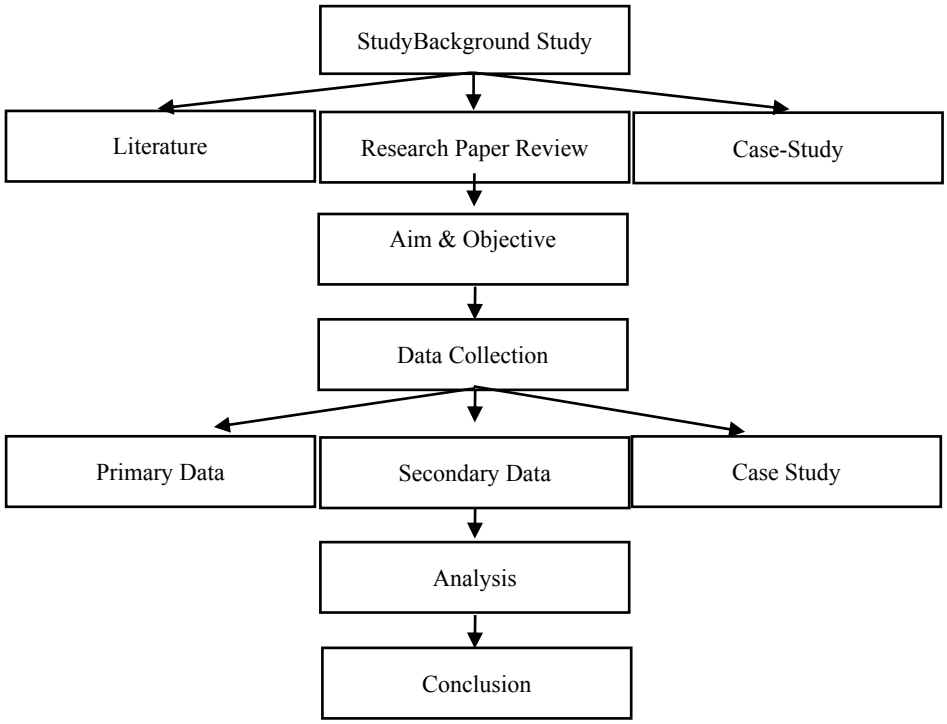
These features in the Wada style architecture comprise of various decorative and space creating elements that have their own feed and function. Some of these spaces creating or zonal elements which make-up as a part of a Wada are:

1. Osari : A verandah or a transition space
2. Dewadi : Verandah or rest area for guards
3. Sadrecha Sopa : Common verandah which leads to courtyard
4. Khalbhatkhana : Known as the negotiation room. This was specifically a semi-public area where discussions and negotiations take place
5. Diwankhana : This can be said to be the living room as it used to be a large hall mostly used for formal and informal gatherings
6. Majghar : This was a middle chamber, a completely private area which was mostly used by the women and children of the house
7. Devghar : The prayer hall
8. Tijory : The treasury
9. Gotha : Place for the cattle of the house
10. Swayampak Ghar : The kitchen
11. Kothar : Storeroom

All these spaces have some artistic architectural elements which do not have much significance as structural members but are:

1. Different types of Doors
2. Different types of Windows
3. Various types of Brackets
4. Beam Covers
5. Arches
6. Devlis'
7. Window Brackets
8. Wall niches

2. METHODOLOGY



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3. LITERATURE REVIEW

The literature being referred for this research is mostly related to traditional and cultural construction style of buildings, mainly relating to the construction techniques in Wada architecture. The papers and articles being referred to the topic are:

1. ***Energizing the Future with Memories of the Past:*** *The Wadas of Pune City By, Shilpa Nagapurkar, Parag Narkhede, Vaseem Anjum Sheriff*

   The author describes the context of Pune city during the Peshwa period and the significance of Wada evolving as a characteristic built-form. The author discusses about the characteristic spatial organization harmonizing form and space with distinct architectural features. The wadas once being the seat of power, intrigue and grandeur, now are just standing as a surviving witness of battle plans and palace intrigues at the glory of the Maratha Empire.

   The authors have particularly focused on the areas in and around Pune city. They have described the city of Pune as the Queen of Deccan and a major historic city associated with the Maratha Empire. The city eventually went ahead and became one of the major cantonments.
2. *The Architecture of Wadas of Maharashtra by, Samanata Kumar*

   This article desbribes Wadas as rich and cherished architectural heritage in Maharashtra, reflecting the pride, religion, culture traditions and turbulent history of Marathas. The author describes a wada as a form of housing in the past which are being re-used and preserved as a cultural and architectural heritage.
3. *Wadas by, Maharashtra Film, Stage & Cultural Development Corporation Limited*

   This paper documents various wadas and heritage sites in Maharashtra which are rich in culture and design. This document has been published by the government of Maharashta as a guide of the heritage structures being used for commercial puposes like filming and shooting. These sites are very rich in artistic elements and designs and are preserved by the government.
4. *The Introvert and the Extrovert Aspects of the Marathi House by, Narendra Dengle*

   The author describes the historic significance of wada and details of its design. The author runs through the design development of a wada according to the Vastushastra. The author describes the artistic elements, zonal distribution of spaces, etc. of a wada. He also talks about the design extent of the Wada style architecture in various parts of the country like, Andhra Pradesh, Karnataka, Telangana, etc.
5. *Decoding Wadas of Maharashtra by, Neha Bhamburdekar*

   The author describes the wada architecture throught the point of a traveller or tourist. She describes the user experience of the various parts of a wada like Ota, Sopa, Gacchi, Jina, Pushkarni or Haud, Vihir, Karanje, Tulsi Vrindavan, etc. She also talks about the liveabitly experience as an owner and as a visitor.

4. DATA COLLECTION

4.1 Primary Data

The primary data collected by the author is done by visiting various sites of traditional wadas and identifying the various artistic elements being used in the structures. The sites visited by the author are:

- Vishrambaug wada, Pune
- Sarkar Wada, Nashik

The data collection is as follows:

Sr. No.	***Element***	***Details***
1.		Name: Khan Location: Vishrambaug Wada, Pune Carving details: Material: Timber Significance: artistic elements between two columns

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Sr. No.	***Element***	***Details***
2.		Name: Fresco (Gilava) Location: Vishrambaug Wada, Pune Carving details: Material: Chuna Plaster Significance: Artistic element in facade design
3.		Name: Wooden timber opening Location: Vishrambaug Wada, Pune Carving details: Timber carvings Material: Timber Significance: Acts as an opening that serves as an connection between the upper floors and the courtyard
4.		Name: Wall brackets Location: Vishrambaug Wada, Pune Carving details: Timber logs carved to minute details Material: Timber Significance: Artistic element
5.		Name: Beam covers Location: Vishrambaug Wada, Pune Carving details: Carved timber blocks Material: Timber Significance: To save the beam from decay due to rain and termites. Also act as artistic element to the building facade
6.		Name: Wooden decorative columns Location: Sarkar Wada, Nashik Carving details: Timber carvings added to wooden columns Material: Timber Significance: Enhance the beauty of the column

4.2 Secondary Data

The secondary data collected by the author is done by taking reference from various research papers and articles published refering to the topic. The articles and papers refered by the author are:

- Decoding Wadas of Maharashtra
- (*Source:* https://www.busnumbergyaarah.com/home/decodingmarathiwada)
- The Architecture of Wadas of Maharashtra by Samanata Kumar.
- The Introvert and the Extrovert Aspects of the Marathi House by Narendra Dengle.
- Energizing the Future with Memories of the Past: The Wadas of Pune City by Shilpa Nagapurkar, Parag Narkhede, Vaseem Anjum Sheriff.

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The data collection is as follows:

The elements have been described as per their name, source, material, significance etc.

1. Name: Main entrance door
   Source of Picture: The Architecture of Wadas of Maharashtra
   Materials: Timber
   Significance: Acts as the main entrance to the Wada
2. Name: Doors for rooms and other internal areas
   Source of Picture: The Architecture of Wadas of Maharashtra
   Materials: Timber
   Significance: Acts as access to rooms and other internal spaces in a wada
3. Name: Entrance gate
   Source of Picture: The Architecture of Wadas of Maharashtra
   Materials: Timber
   Significance: Acts as the entrance gate to the wada campus
4. Name: *Devli*
   Source of Picture: The Architecture of Wadas of Maharashtra
   Materials: Brick (*Pustak Vit*)
   Significance: Area for lighting lamps
5. Name: *Devli*
   Source of Picture: The Architecture of Wadas of Maharashtra
   Materials: *Chuna* plaster
   Significance: Area for lighting lamps
6. Name: *Devli*
   Source of Picture: The Architecture of Wadas of Maharashtra
   Materials: Sand plaster
   Significance: Area for lighting lamps

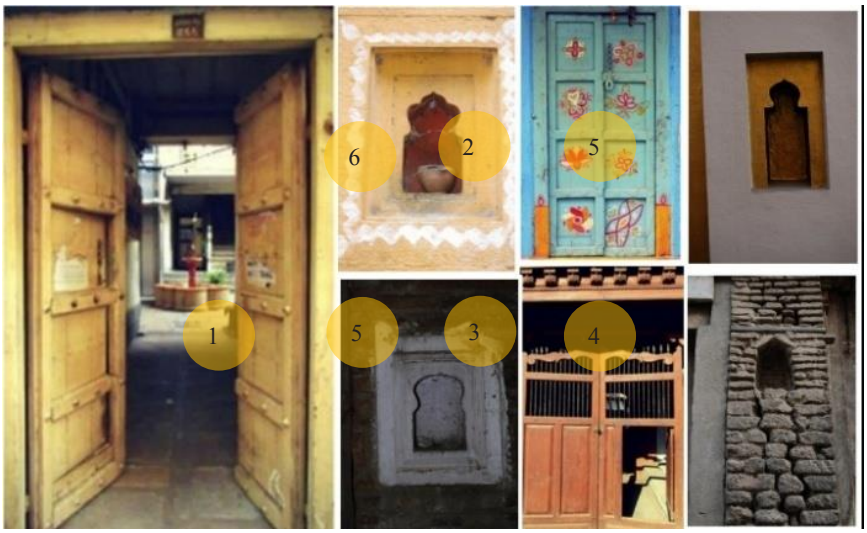

Figure 1: Signifies Secondary Data

4.3 Analysis

During the study the author has come through many instances where these beautiful elements being used in these structures could be used in contemporary construction techniques. The purpose or relevance of these elements could be seen to be

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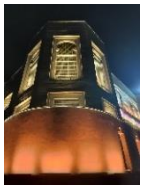
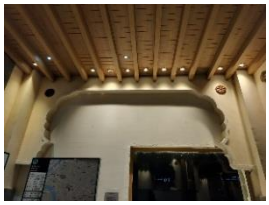
negligible in the contemporary style but can be used as decorative elements and help in carrying forward the rich culture and tradition to the next generation. To support this statement, the author has conducted some case studies as follows:

- Shivajinagar Metro Station, Pune
- Ruby Hall Metro Station, Pune

The analysis done comprises of following observations:

Sr. No.	***Element***	***Details***
1.		Name: Window (Khidki) Location: Shivajinagar Metro Station, Pune Carving details: Material: Plaster Significance: Used as a artistic element in the facade design
2.		Name: Wall nitch(Devli) Location: Shivajinagar Metro Station, Pune Carving details: Basalt rock carvings Material: Basalt rock Significance: Basalt rock carvings used as wall cladding as a artistic elements
3.		Name: Vrindavan Location: Shivajinagar Metro Station, Pune Carving details: Basalt rock carvings Material: Basalt rock Significance: Basalt rock carving structures placed at compound wall as an artistic element.
4.		Name: Wall nitch (Devli) Location: Shivajinagar Metro Station, Pune Carving details: Basalt rock carvings Material: Basalt rock Significance: Basalt rock carvings used as wall cladding as a artistic elements
5.		Name: Ornamental wooden dummy column Location: Shivajinagar Metro Station, Pune Carving details: Single wooden Material: Timber Significance: Artistic element
6.		Name: Palita holder Location: Shivajinagar Metro Station, Pune Carving details: Basalt stone carving Material: Basalt rock Significance: Used as an artistic element on a wall
7.		Name: Ceiling (Kadipat/Patai) Location: Shivajinagar Metro Station, Pune Carving details: Wooden Material: Timber Significance: The Kadipat ceiling being used to enhance the dignity of the wada architecture

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Sr. No.	Element	Details
8.		Name: Khan Location: Shivajinagar Metro Station, Pune Carving details: Wooden carvings Material: Timber Significance: Used as a facade design to enhance the richness of the corridor
9.		Name: Wooden Windows (Khidki) Location: Shivajinagar Metro Station, Pune Carving details: Wall cladding Material: Timber Significance: used as an artistic element to enhance the wall surface
14.		Name: Gilava Location: Ruby Hall Clinic Metro Station, Pune Carving details: Printed glass Material: Glass Significance: The design of Gilava as a facade element being used here at the ticket counter
16.		Name: Door (Darwaja) Location: Ruby Hall Clinic Metro Station, Pune Carving details: Wall cladding Material: Timber Significance: The timber door being used as a wall hanging

5. CONCLUSION

The modern construction techniques are used to have all the modern facilities and designs. These techniques use new and modern styles of designs and create an impression on the users. These structures take part in raising up the user standards but fail to nurture the rich culture and tradition this land beholds. The elements being used in the traditional architecture were of some or the other significal importance of that era. Along with the significal importance these elements also carried the ahead the cultural and tradional values.

These elements may not have the same significal importance in the structures being built in today's date with the contemporary style but these elements carry great importance in today's date for the carrying the culture and tradition. These may not be used as structural or design elements but can be surely used as artistic elements fulfilling the purpose of tradition and culture.

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[1] Decoding Wadas of Maharashtra.
(*Source:* https://www.busnumbergyaarah.com/home/decodingmarathiwada)
[2] The Architecture of Wadas of Maharashtra by Samanata Kumar.
[3] The Introvert and the Extrovert Aspects of the Marathi House by Narendra Dengle.
[4] Energizing the Future with Memories of the Past: The Wadas of Pune City by Shilpa Nagapurkar, Parag Narkhede, Vaseem Anjum Sheriff.

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The Influence of Vastu Shastra on Living Style in Residential Structures, Pune

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ABSTRACT: Vastu is an ancient Indian architectural system that is based on the principles of Hindu cosmology and the belief that the built environment can affect the well-being of the people who inhabit it. The system is believed to have originated around 3,000 BCE, and it is still widely used in India today. The meaning of following and applying Vastu principles is somewhat propagated as religious or spiritual repercussions and benefits, so that individuals may be unable to violate the regulations and be compelled to make genuine decisions regarding the design of their home. Vastu Shastra as a science is applicable to all types of buildings irrespective of their functions, size, scale, and type. This research paper would be showcasing studies and the impact of such spaces on the people's living style.

Keywords: *Vastu Shastra, Science of Vastu Shastra, Impact, Living Style.*

1. INTRODUCTION

Vastu is an ancient Indian architectural system that is based on the principles of Hindu cosmology and the belief that the built environment can affect the well-being of the people who inhabit it. The system is believed to have originated around 3,000 BCE, and it is still widely used in India today. Vastu Shastra as a science is applicable to all types of buildings irrespective of their functions, size, scale, and type. Vastu principles are applicable at the design stage of spaces and areas. Vastu Shastra is an ancient Indiansystem of architecture and design that emphasizes the balance and harmony of the natural and built environment. Based on the knowledge of the Sun Rays, the Earth's Magnetic Poles and the Geopathic Zones, many rules have been legislated in ancient Indian architecture dealing with environmental criteria that are now considered superstitions; however, applying them may be useful in designing buildings in complete harmony with the surrounding nature.

2. AIM

To study and analyse the Influence of Vastu Shastra on Living Style with respect to circulation, light andventilation of the residential structures in Pune.

3. OBJECTIVE

- To understand concept of Vastu Shastra.
- To study and document the Influence of Vastu Shastra on human Life Style.
- To find out the Influence of Vastu Shastra on Living Style through literature study and live case studies.

4. HYPOTHESIS

Even when the space is organized according to Vastu Shastra, we can still observe different observations due to space area not allowing the furniture to work as per the Vastu Shastra layout due to availability ofspace.

5. SCOPE AND LIMITATION

1. To study the impact of Vastu Shastra on living style.
2. To study the comparative analysis of live case studies.
3. To understand the aftermath after following Vastu Shastra.

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4. To study the before and after impact of Vastu Shastra on living style of people.

6. METHODOLOGY

An empirical study of impact of Vastu Shastra on living style through live case studies of residential structure. The research paper is a quantitative research type. Therefore the primary data collection consists of live case study, interviews of the residentants and observations. The secondary data collectionconsists of literature study, books and articles. The study of all the case studies is done in Pune itself. There were total three case studies which explains the comparison of before and after using houses according to Vastu Shastra. These houses are residential structures located in Bhandarkar Road, Pune, Anandnagar, Pune and Sinhgad Road, Pune. The house located in Bhandarkar road had two generations living together while the houses in Anandnagar and Sinhgad Road had three generations living together.This research paper gives an insight of impact on living style of different age groups living in the houses. An expert in Vastu Shastra helped in studying the factors that are involved in Vastu Shastra.

7. LITERATURE REVIEW

(Ar. Priyanka Rastogi, April, 2023) Over a longer period of time, architectural styles have developed in response to shifting necessities, shifting lifestyles, shifting building materials, and, most significantly, rising land prices (Vastu Shastra in Indian Architecture - Home Loan Stories - Kotak Bank, n.d.) that are now out of reach for middle-class families. Not only have land prices but also construction costs increased dramatically. With major developments in construction technology (An Architectural Interpretation of Vastu Shastra | Habitus Living, n.d.) and urban services, as well as a need for improved health and hygiene, the concept, designs, and objectives have shifted substantially. In today's fast-paced world, time and money have become the most important factors in metropolises, megalopolises, and tyrannopolises. Consequently, the design of urban houses has also evolved. This is one of the reasons people prefer modification of the present house according to Vastu Shastra instead of approaching a new home with spaces aligned according to Vastu Shastra.

(Goodarzi, 2010) Vastu as a traditional guide to architecture aims to design buildings in harmony with the natural laws of the universe. "As Einstein Proved, everything in existence, sentient and non-sentient, is a field of energy." In this case 'Vastu' is referred to pure subtle energy that underlies everything while 'Vaastu' is the manifestation or expression of that energy as matter. In fact, Vastu is a science of working with energy fields which used to guide the architects to design buildings in a way that their underlying energy fields arebeneficially manipulated due to proportion and direction.

8. CASE STUDY/DOCUMENTATION

There are total three case studies which help in studying parameters which affect on living style on peopleliving in the house. Parameters like impact of Vastu Shastra on activities of the kids, psychological impacton everyone in the house while being productive and relaxing after the work. The purpose of choosing these case studies was to study the before and after impact of Vastu Shastra on the people's living style after they modified according to Vastu Shastra.

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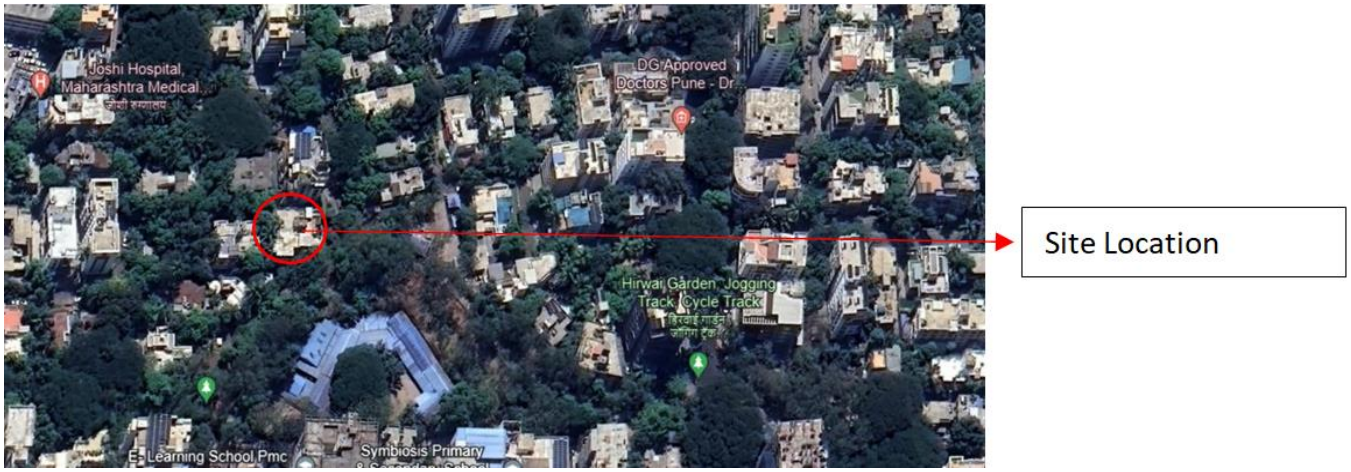
8.1 Live Case Study 1



Location: Bhandarkar Road, Pune.
Year of Building Construction: 2009
Year of Modified House: 2014
Activity of the Building: Residential Structure of G+4 in a gated community

The house is a duplex flat and is in a gated community and is a residential structure of G+4. The house which was opt for the case study was on 4th floor. The following images show proportionate plans of the constructed and modified flat.

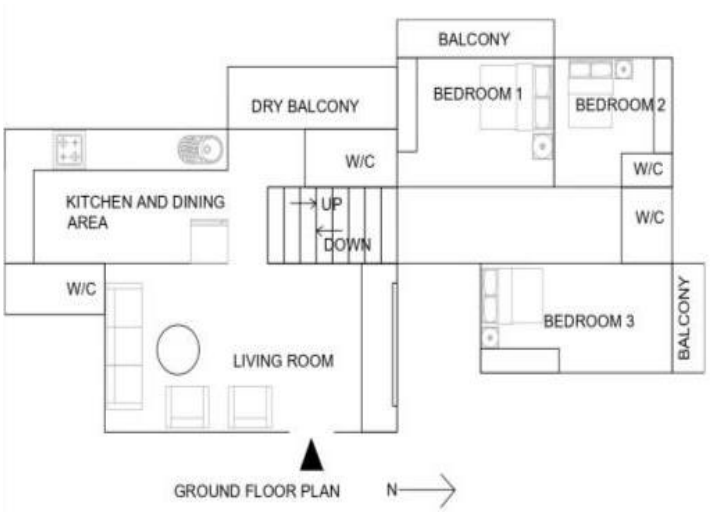


Image 1: Constructed House

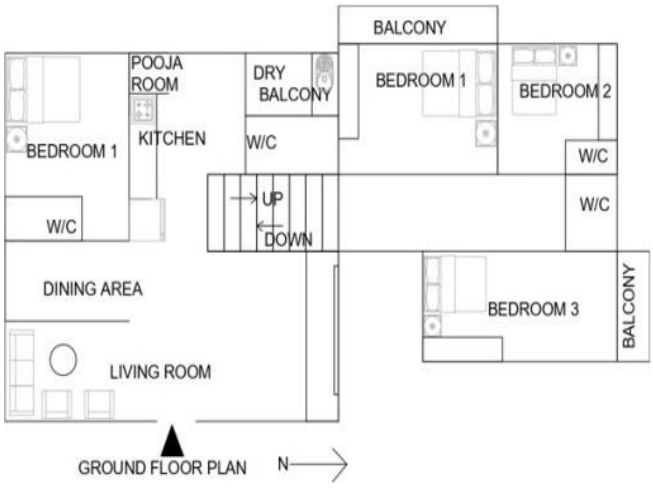


Image 2: Modified House

The owner of the flat was an IT professional and two generations were living together; the owner and their parents. After asking some of the research questions and interview questions, the owner mentioned about their depriving growth in both personal and professional life as the flat was not according to Vastu Shastra. They faced many challenges like financial crises, less professional growth, unstable sleep schedules, etc. hence, to overcome these issues, they decided to approach a Vastu Shastra expert who helped them to re-design the flat. Image-2 shows the modified house. After this modification of the house according to Vastu Shastra, the owner mentioned about the growth phase of their life and abundance they experienced.

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8.2 Live Case Study 2

Location: Anandnagar, Pune.

Year of Building Construction: 2018

Year of Modified House: 2020 (Before Pandemic Lockdown in Pune)

Activity of the Building: Residential Structure of G+10 in a society

This is a flat in a society of residential zone. This structure is a G+10 structure. The flat opt for the case study was on the 10th floor. Here, three generations live together; the owner, their daughter and their mother.

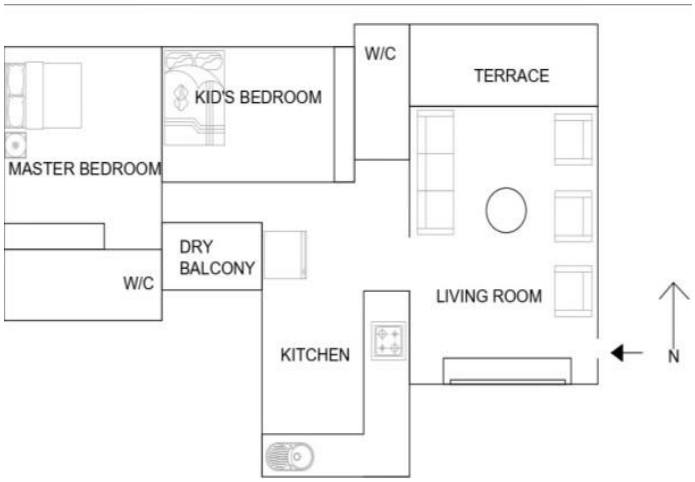

Image 3: Furniture Layout before Changing

Image 4: Furniture Layout after Modification

The image-1 shows the flat's plan when handed to the owner. The plan clearly shows the layout of furniture is not according to Vastu Shastra which made the owner to modify spaces according to Vastu Shastra, the owner mentioned about the circulation being clogged due to furniture placement. Even though the flat had good amount of ventilation there was certainly problem of light and circulation insidethe flat. The owner also mentioned the lack of light impacting their day-to-day activities. The rate of productiveness was less due to lack of light which helps in rejuvenate energy after every interval of timeso to work fresh every time. Also, their daughter experienced lack of study interest due to furniture placement in her room which affected her academics. So, to overcome such challenges, the owner modified the flat according to Vastu Shastra after consulting a Vastu Shastra expert. After modifying theflat accordingly, the owner mentioned the amount of light they could take in as the furniture layout changed which helped in overcoming the procrastination phase of their daughter.

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8.3 Live Case Study 3

Location: Sinhgad Road, Pune.

Year of Building Construction: 2009

Year of Modified House: 2016

Activity of the Building: Residential Structure of G+3 in a society.

The house is a bungalow of G+3 structure in a society. There are three generations living in thebungalow; the owner, their son and daughter-in law and their six year old grandson.

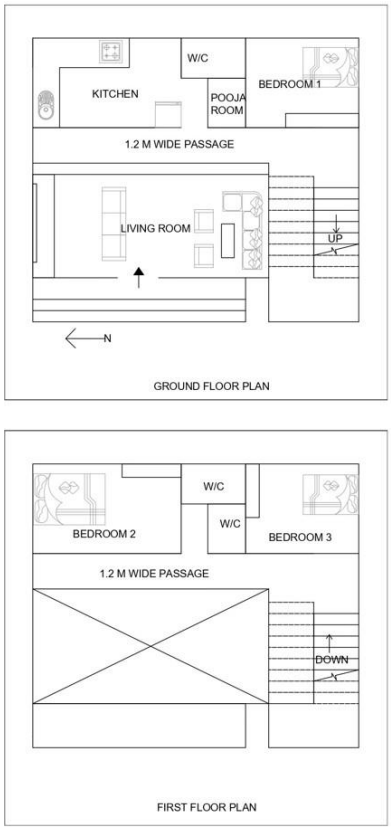

Image 5: Constructed House

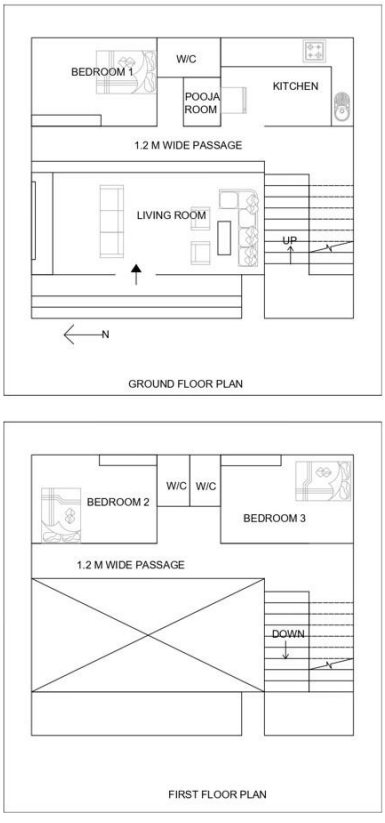

Image 6: Modified House

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Image 1 is the constructed structure which was not according to Vastu Shastra. The owner themselves being a believer in Vastu Shastra tried to modify the structure accordingly. But before modifying the structure, the owner mentioned about how they experienced the challenges like severe illness caused due to lack of light and ventilation, lack of personal and professional growth, financial crises. After facing such phases of life they decided to re-design the internal space only as shown in Image 2.

After such modification, within 6-7 months they were blessed with the news of their grandson. Also the owner's son is a doctor who mentioned his growth after this change in house according to Vastu Shastra.

9. CONCLUSION

After studying these three case studies, the common factors that are into consideration are namely- light, ventilation, circulation, psychological impact, impact on productivity rate and health. Keeping these factors in mind, re-designing a space or structure might be approached. As Vastu Shastra is a science of living, hence, the above mentioned factors lead to science itself. A gist of geographical factors like light and ventilation are to be primarily considered while designing any space. Hence, by applying basic principles of Vastu Shastra, one can design a space which overcomes factors like procrastination, illness, lack of personal and or professional growth, etc. Although the technological advancements of today make it possible to warm and cool any area regardless of its climate, the proper use of architectural forms and patterns may lead to sustainable design which decreases the rate of energy consumption as well as making a proper micro climate compatible with human needs which can also stand in complete harmony with the surrounding environment.

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Effectiveness of Reservoir in Rural Context

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ABSTRACT: India lives in and survives on its villages. It is agriculture which serves the entire population, and this is mainly carried out by the huge rural population existing in different parts of the country. The role of rural areas in development of India is unparalleled, yet it is the farmers and their infrastructure, who have largely remained untouched from the seeds of development. It suffers innumerable challenges and problems ranging from basic needs like clean water, water harvesting, unemployment (during floods and drought). The reasons to be sought for this are lack of implementation of governmental programs and yajnas, political interference, self-interest of leaders this is due to people's poor understanding and awareness. As a result, the rural areas have been lingering in backwardness for a long time.

It is rural India which makes our life and existence possible; and unfortunately; it is rural India which are struggling for their own life and existence.

During rainy season the ponds are filled up. After filling up the water gets flooded into the village and destroy the crops which leads to huge loss and inflation with increase in price of food. But during dry seasons or in the time of drought there is no proper storage of water which leads to again huge loss and inflation with increase in price of food. Now the focus on what extent the reservoirs can mitigate the risk of flooding through climatic change hydrological extremes from the perspective of historical climatic change.

Keywords: *Reservoir, Ponds, Drought, Rainfall, Household Industries.*

Research Question

How to cater the water logging issues, flood issues and drought issues in rural areas with the help of reservoirs.

Objective

- The ideology is to cater the over flowing ponds and excess rain water during monsoon season with respect to hydological extremes and climatic change.
- To store the excess water in a particular place or reservoir and use the stored water during drought.
- Leveraging reservoir water diversely for economic growth in the village.

1. INTRODUCTION

Rural India forms the backbone of the country, sustaining the entire population through its agricultural endeavors. However, the rural population, particularly the farming community and their infrastructure, have largely remained untouched by the seeds of development. They face an array of challenges, including inadequate access to clean water, water harvesting facilities, and unemployment during periods of both floods and droughts. The primary causes of this plight can be attributed to the lack of effective implementation of governmental programs, political interference, and the self-interest of leaders, often stemming from a lack of awareness and understanding among the populace. Consequently, rural areas have long been mired in a state of underdevelopment and backwardness.

Often overlooked role of rural communities in supporting the country's development. Despite being the lifeline of the nation's economy through agriculture, rural areas grapple with various challenges that endanger their own well-being. Limited access to essentials like clean water, sanitation, and healthcare, along with insufficient infrastructure and education, adds to their struggles. Natural disasters like floods and droughts further compound their difficulties. While flooding destroys crops and homes due to inadequate water management, droughts lead to water scarcity, harming agricultural output and deepening rural struggles. This paradox underscores the need to prioritize the comprehensive development and support of rural India, ensuring a more balanced and sustainable future for the entire nation.

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This results in substantial losses and inflation, causing an increase in the price of food. On the other hand, during dry seasons or droughts, the lack of proper water storage exacerbates the situation, leading to similar losses and further inflation in food prices.

In this context, it is crucial to explore the extent to which the construction of reservoirs can mitigate the risks of flooding caused by climatic changes and hydrological extremes, considering the backdrop of historical climatic variations.

Reservoirs, with their potential for water storage, can serve as effective tools in managing these challenges. Through careful planning and strategic implementation, reservoirs can play a significant role in the following ways:

- **Flood Control:** Constructing reservoirs with adequate storage capacity to contain excess rainwater during the monsoon season, thereby preventing floods and protecting crops
- **Drought Mitigation:** Utilizing reservoirs for water storage during the rainy season to ensure a continuous water supply during dry periods, thereby reducing the impact of droughts on agricultural production.
- **Integrated Water Management:** Implementing integrated water management strategies that consider the historical rainfall patterns and anticipated climate changes, ensuring the effective utilization of reservoirs throughout the year.
- **Community Engagement and Awareness:** Involving local communities in the planning and maintenance of reservoirs, promoting awareness about the importance of water conservation, and encouraging participation in sustainable water management practices.
- **Technological Integration:** Incorporating advanced technologies for efficient water management, such as real-time monitoring systems and automated flood control mechanisms, to ensure the optimal utilization of reservoirs and water resources.

By incorporating these comprehensive strategies, India can harness the potential of reservoirs to mitigate the risks of flooding during climatic changes and hydrological extremes, thereby ensuring sustainable agricultural development and the overall well-being of rural communities.

- **Scope:** Study of Village profile and physical infrastructure i.e. water body (ponds) to cater flood and drought & social and economic factors of Village
- **Limitation:** social infrastructure i.e., development of village, education, hospitality and other amenities.

2. BACKGROUND STUDY

To assess the impact of reservoir regulation on hydrologic extremes, I compile a data set of natural and regulated catchment pairs upstream and downstream of reservoirs in a village.

Dams according to height and dam material.

2.1 Storage

The topography of dams and reservoirs varies considerably from narrow gorges and steep valleys to very flat areas and very long low embankments; reservoir volume may differ from 1 to 100 for two dams of same height.

A rough splitting of total storage according to unit storage of dams is presented below:

Table 1: Storage of Dam

Height	Number of dams		
	Earthfill or Rockfill	Concrete or Masonry	Total
60-300 m	800	1 200	2 000
30-60 m	5 000	2 500	7 500
15-30 m	27 000	3 500	30 500
	32 800	7 200	40 000

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Unit Storage (in millions of m^3)	Number of dams	Total Storage (in billions of m^3)	Total area (in thousands of km^2)
Over 1000	700	5 000	250
10-1000	10 000	1 000	80
0.1-10	150 000	150	40
Less than 0.1	Millions	50	30
		6 200	400

Source: District Census Handbook (2001 & 2011).

This total storage is sometimes compared with the yearly level of water utilization, which is in the range of 1 to 10 millions m^3, and mainly put to use for agriculture and other uses for small scale industries.

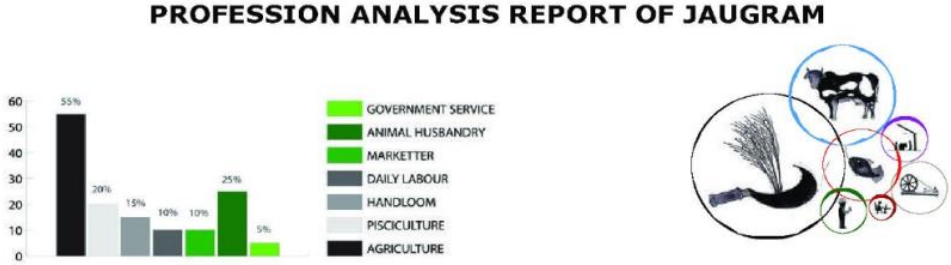
Small-scale factories in villages often require water for various production processes and industrial activities. These factories, while operating on a smaller scale, are integral to the local economy and contribute significantly to employment generation and economic development in rural areas. Some examples of small-scale factories that require water include:

- **Argo-based Industries:** Small-scale food processing units such as flour mills, rice mills, and oil extraction units require water for cleaning, processing, and production purposes.
- **Textile and Garment Workshops:** Handloom weaving, textile dyeing, and garment manufacturing units often rely on water for fabric treatment, dyeing, washing, and finishing processes.
- **Cottage Industries:** Various cottage industries, including pottery, handicrafts, and small-scale manufacturing units, utilize water for crafting, shaping, and finishing products.
- **Food and Beverage Processing Units:** Small-scale food and beverage processing plants, such as fruit juice production units, dairy processing units, and confectionery units, require water for cleaning, sterilization, and production processes.
- **Cottage Chemical and Pharmaceutical Units:** Small-scale chemical and pharmaceutical manufacturing units often require water for equipment cooling, product formulation, and cleaning purposes.

As these small-scale factories play a significant role in generating employment and enhancing economic activities in rural areas, providing access to reliable and sustainable water sources is crucial for their continued operation and growth. Implementing efficient water management practices, promoting water conservation, and ensuring proper wastewater treatment can contribute to the sustainable development of these small-scale industries, fostering economic resilience and livelihood opportunities in rural communities.

three most important commodities manufactured	Total workers	Main workers	Cultivators	Agricultural labourers	Household industry workers	Other workers	Marginal Workers	Non Workers
1. Vegetable								
2. Mustard Oil								
3. Rice								
	3953	3049	526	1058	176	1289	904	5702

2.2 About the Village



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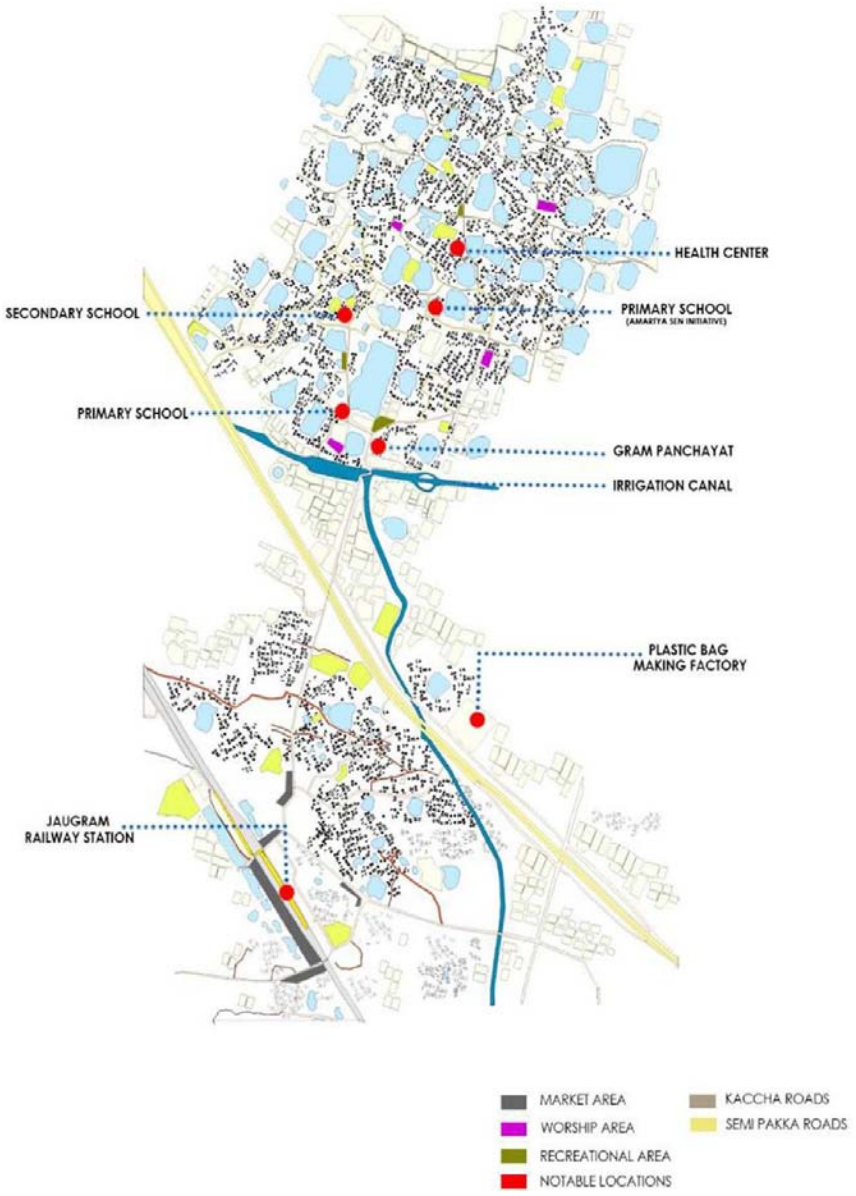

Source: District Census Handbook (2001 & 2011).

2.3 Proximity to Town

Nearest Town: Memari

Distance to Memari: Approximately 10 km

This concise presentation summarizes the key demographic, geographic, and socio-economic aspects of Jaugram village in West Bengal based on the Census 2011 data.

2.4 Why Jaugram? A brief site study...

Jaugram has been known for holding a niche population of 11500 people approximately engaged in agricultural activities. After a thorough analysis it was seen that this area has an immense potential to attract the main agricultural cultivation, fishing cultivation (which can be a international market for them) and some small sclae factories in the eastern zone of our country within its abode. Around 152 numbers of ponds were identified in each household and a main Damodar Canal of West Bengal state was seen to be running beside this place.

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Neighbour village:		Amenities	Population	Number of Households
722 Amra	2011	RS	6038	1430
633 Dattapur			2361	588
634 Dhuluk			2906	693
715 Dogacchia		B	3191	821
723 Gopalpur		S	2590	603
726 Ilsara		M, Dispensary, S, Primary Health Care	1382	322
725 Jajanpur			749	173
728 Kolingram		S,M	7730	1770
727 Mayna			2000	448

HIGH SCHOOL / INTER COLLEGE . S
TECHNICAL INSTITUTIONS . . . . . T
BANK . . . . . B
DISPENSARY. . . . . D
PRIMARY HEALTH CENTRE . . . . . A
OTHER MEDICAL SERVICES . . . . ▲

Source: District Census Handbook (2001 & 2011).

three most important commodities manufactured	Total workers	Main workers	Cultivators	Agricultural labourers	Household industry workers	Other workers	Marginal Workers	Non Workers
Mustard oil, Vegetable, Wheat	1849	1720	138	614	24	944	129	3150
	704	655	251	309	12	83	49	1067
	1340	1102	281	591	2	228	238	1287
Vegetable, Rice, Mustard Oil	1195	1082	224	597	8	322	113	1176
	924	679	93	393	13	180	245	1398
Vegetabble, Mustard Oil, Rice	508	499	86	348	5	60	9	797
Vegetabble, Mustard Oil, Rice	397	397	164	202		31		314
	3034	2830	536	1781	82	431	204	4117
Vegetabble, Mustard Oil, Rice	621	576	13	300	19	119	45	1085

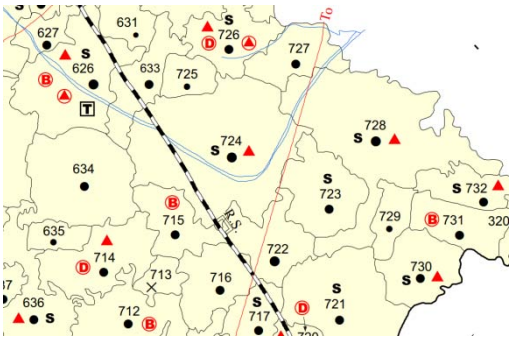
Source: District Census Handbook (2001 & 2011).

2.5 SWOT Analysis of the Village, Jaugram

This SWOT analysis highlights the village's potential for agricultural and industrial development but underscores the need to address limitations such as water storage capacity, skill shortages, and infrastructure challenges. Strategic planning of reservoir can maximize opportunities and mitigate threats for sustainable growth.

2.6 About the Neighboring Villages

Collaboration with neighboring villages to address the workforce shortage involves establishing strategic partnerships and leveraging the skills and expertise available in adjacent communities. This collaborative approach offers several advantages and opportunities for overcoming the shortage of skilled labor and also constructing reservoirs on their village too.



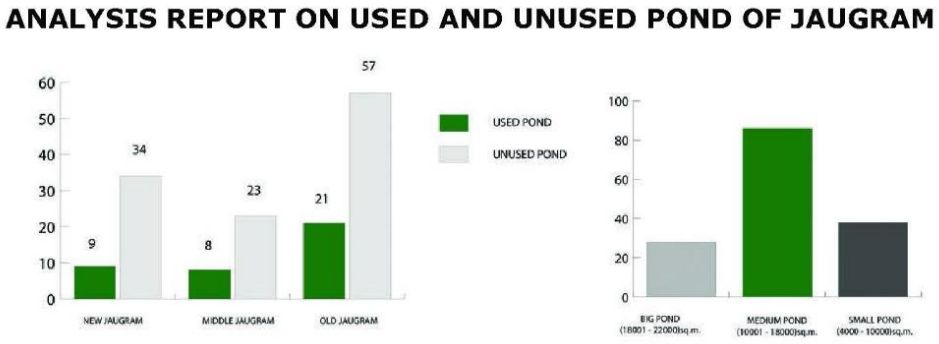


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Table 1: Neighbour Village and Their Population, Households & Workers

Strength	Weakness	Oppurtunities	Threats
Abundance of Ponds: Village with 152 ponds and hold a damodar canal which provides sufficient water to the villagers for agriculture Favorable for agriculture, offering irrigation opportunities and enhancing crop productivity	**Limited Space:**Inadequate space for future water storage and expansion of small-scale industries.	The presence of ponds in the village can significantly contribute to the advancement of fishing cultivation and household industries	**Environmental Extremes (Floods and Droughts):** Risks associated with floods (excessive rainfall) and droughts (scarcity of rainfall) can impact agricultural and industrial activities.
Skilled Labor for Small Scale Industries: Availability of skilled workforce supports the development of small-scale industries	**Insufficient Skilled Labor:** Shortage of skilled labor, requiring efforts to enhance the local workforce's skill set.	**Ponds for pisciculture:** Exploiting ponds for pisciculture opens opportunities in the international market.	**Inflationary Pressures:** Due to this Inflation poses challenges, affecting the overall economic stability of the village and the cost of living.
Sufficient Space for Reservoirs to built: Enough space for constructing reservoirs, enabling water storage for agricultural and industrial needs.	**Poor Infrastructure for Industries:** Lack of robust infrastructure poses challenges for the growth of small-scale industries.	**Skilled Labor from Neighboring Villages:** Collaboration with neighboring villages for skilled labor addresses the workforce shortage.	
	Non working population: About 50 percentage of people are non working population	**Economic Growth Potential:** Anticipated economic growth in the village presents opportunities for development.	
		Space for Industrial Expansion: Sufficient space allows for the establishment and expansion of more industries.	
		Dual Use of Reservoirs: Reservoirs can serve dual purposes, supporting pisciculture throughout the year, even during floods and droughts.	
		Non-working population: The non-working population in the village presents a unique opportunity for fostering growth in household industries. By harnessing the skills and potential of individuals who are currently not employed.	
		also, **Empowering Women and Marginalized Groups**	

Source: District Census Handbook (2001 & 2011).

To assess the current status, utilization patterns, and potential impact of used and unused ponds in a specific region.

2.7 Used Ponds

Positive Aspects

Actively utilized for agricultural irrigation, contributing to increased crop yield.

Support for fish farming, providing a source of income for local communities.

Some used ponds serve as communal spaces for social and cultural activities.

2.8 Concerns

Instances of water over-extraction leading to decreased water levels.

Potential pollution from agricultural runoff affecting water quality.

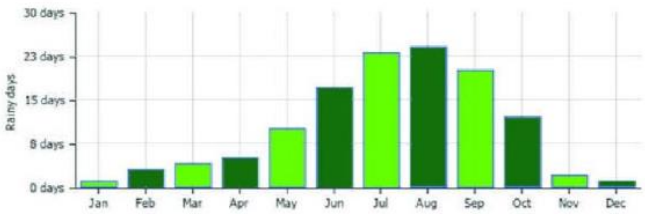
2.9 Unused Ponds

Potential for Restoration:

Opportunities for environmental conservation and biodiversity enhancement.

Unused ponds could serve as water reservoirs for emergency situations.

Challenges



Rainfall graph

Neglect and lack of maintenance, leading to siltation and reduced water quality.

Limited community awareness regarding the potential benefits of restoring unused ponds.

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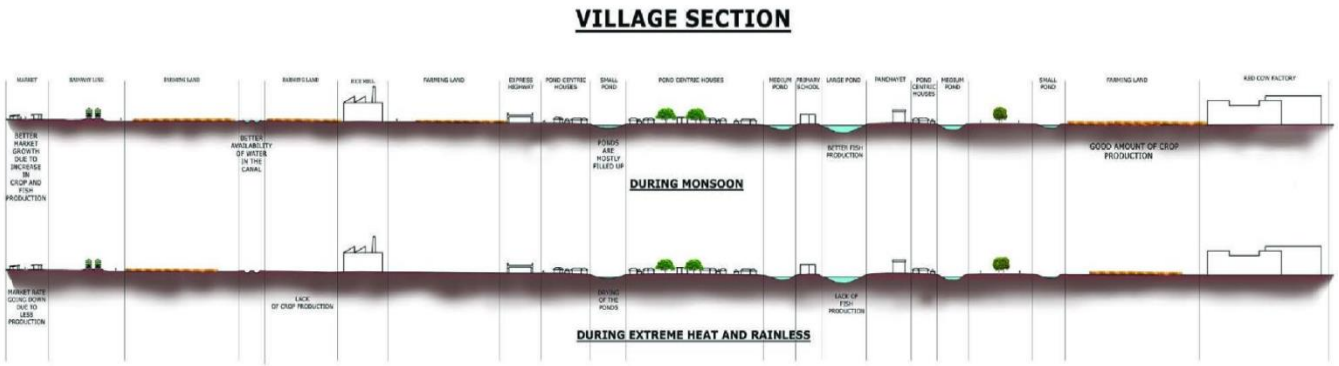

Source: District Census Handbook (2001 & 2011).

2.10 Section Analysis

Different use of pond: Fishing, Bathing, Daily uses (like cleaning of utensils and clothes)

Different use of open land: Potato farming, Rice farming, Seseme farming, people's recreation

2.11 Section during Monsoon Season

In the monsoon season, crops flourish with abundant water, but excessive rainfall can lead to pond overflow, causing widespread water accumulation. While beneficial initially, too much water poses challenges like flooding and waterlogged fields, impacting agriculture and infrastructure.

- Depth is about 2.8M
- As its depth is less, it is much safer for the household activities.
- Water lilies act here as a dirt absorbent which is produced during house hold activities in the pond
- Cattle feeding and cattle bathing is safe here

- Depth is about 4M
- Volume is large hence the water web current is high
- Fishing is much easier and is in a large scale
- Water lilies planted inside the pond controls temperature of the water, making it comfortable for the fish during summer
- The chicken manure poured in the pond acts as the food for the fishes, also creating nitrous oxide in the water
- The nitrous oxide water can be helpful for farming during scarcity of water

- Depth is about 1.5M
- Much easier for maintenance and cleaning.
- Less natural water current, hence easier for fish hatching

2.12 Section during Rainless Season

In dry seasons, water scarcity not only impacts agriculture but also disrupts daily activities and small-scale industries, creating a dual crisis for both essential tasks and the local economy. This underscores the urgent need for sustainable water management strategies to address immediate and long-term challenges across various sectors.

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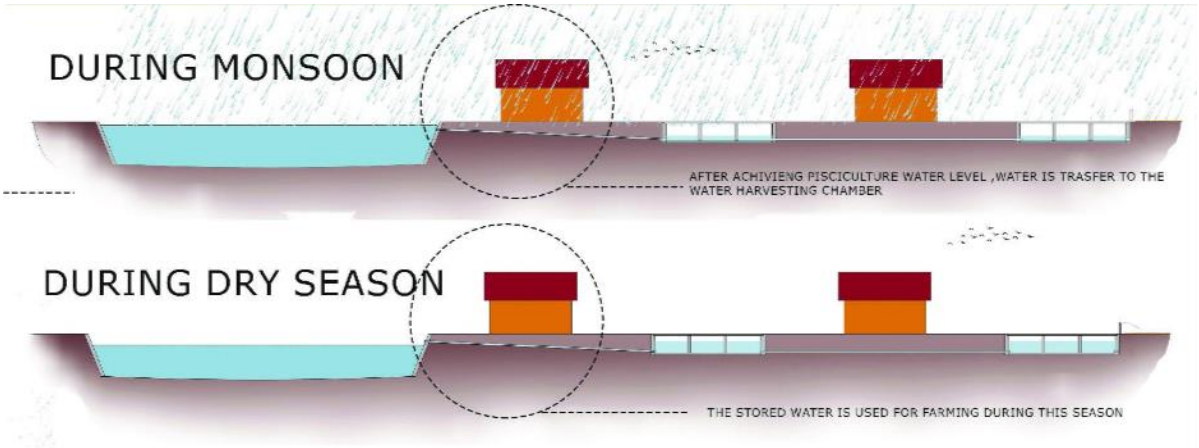
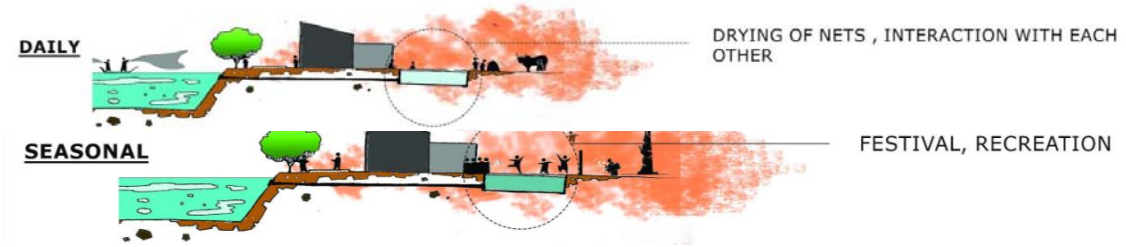
3. METHODOLOGY

3.1 Details of Rainwater Harvesting in the Reservoir



3.2 Activity on the Reservoir as the Common Courtyard



3.3 How Water Harvesting Under Common Courtyard Helps in Social Production of Habitat Process

In the bountiful season of rainfall, ponds brim with water. Once reaching the optimal level for fishing, any surplus water is judiciously and evenly diverted into community reservoirs. This surplus resource serves as a lifeline during periods of scarcity, strategically allocated to both farmlands and small-scale industries. This foresighted approach ensures a seamless continuum in agriculture and sustains the operational momentum of small-scale industries, preventing any disruptive halts.

4. CONCLUSION

Situated amid the embrace of West Bengal, the chosen locale stands witness to a profound dance with the monsoon winds, orchestrating the seamless transfer of surplus rainwater to subterranean reservoirs. This carefully curated water, harvested from the chambers, assumes a pivotal role in the daily lives of the locals, extending its influence to essential activities like drinking, bathing, and various household chores. Across the expanse, myriad ponds weave a tapestry of pisciculture, not merely as water bodies but as sustenance for livelihoods.

In times of water scarcity, the reservoir's yield becomes a lifeline, coursing directly into farmlands and the tapestry of small-scale industries. The ponds, replete with fish cultivating nitrogen-rich substances, establish a symbiotic alliance with agriculture, nurturing growth. This agricultural prosperity, in a cyclical dance, upholds not only human sustenance but also the indispensable realm of cattle farming.

Cattle, as pillars of the local economy and agriculture, rely on the ponds for hydration and graze upon the nourishing straw. Beyond mere sustenance, the byproducts of these cattle, notably cow dung, emerge as catalysts for the generation of biogas, contributing dynamically to the economic landscape. The bovines, as prolific producers of milk, add another layer to the economic tapestry, enriching the financial ecosystem.

Water, the orchestrator of this intricate symphony, extends its influence beyond agriculture and livestock, nurturing the budding ambitions of small-scale industries. Villagers, artisans in their own right, showcase their skills, becoming architects

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of economic vibrancy within the community. This holistic water management paradigm not only preserves time-honored traditions but also catapults the village into a modern, forward-looking epoch. It illustrates how the judicious utilization of a singular elemental resource can metamorphose the very essence of a community, seamlessly blending tradition with progress.

ACKNOWLEDGEMENT

We would like to extend our sincere appreciation and acknowledgment to all the onsite workers who contribute their time, effort, and dedication to ensuring the success of our projects. Your commitment to excellence and your unwavering determination have been invaluable to our organization.

We recognize the significant sacrifices you make as onsite workers, leaving the comforts of your homes and families to be present at the project site. Your presence and expertise are crucial in achieving our collective goals.

Furthermore, we would like to express our gratitude for your efforts in maintaining and enhancing the living spaces provided to you during your time onsite. We understand that these living spaces serve as your temporary homes, and we are committed to ensuring your comfort and well-being.

We assure you that your well-being remains a top priority for us. We will continue to prioritize the improvement and maintenance of your living spaces, ensuring they meet the highest standards of comfort, cleanliness, and safety.

I would also like to thank the management of DYPSOA, Charoli, for their kind supporting course of research.

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Architects as Entrepreneurs: Bridging the Gap between Design and Business

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ABSTRACT: Everyone in this world wishes to be financially rich, recognized with brand value. We choose our profession accordingly which will help create our future and gain us some value. Is architecture that profession in today's scenario? In contemporary India, architects find themselves challenging to establish a practice that can help them earn more money. A person's future is greatly influenced by the career they choose, especially in the modern chase of financial success and brand recognition. In the current Indian architectural landscape, however, practitioners face obstacles to building profitable practices, leading some to pursue other avenues of employment. According to this study, entrepreneurship presents itself as an innovative and timely way out of this situation. This study examines the unexplored possibility for architects to become essential participants in the booming entrepreneurial wave that is sweeping India. Architects are in a unique position to spearhead progress in architectural materials and open up previously unexplored revenue opportunities by leveraging their unique skill set and creative abilities. Architects have the ability to transform the built environment by initiating innovative material creation and conception through their business initiatives. The two main goals of this project are to provide architects with a healthy income and to establish a well-known brand name in the market. This study tries to clarify the mutually beneficial relationship between architecture and entrepreneurship, bringing up the idea that architects can fill the gap between design and business by pursuing their entrepreneurial endeavors. Architects have the ability to handle financial difficulties by promoting an innovative and entrepreneurial culture. They may also initiate a new era in the building materials market and leave a lasting legacy on the global architectural environment.

Keywords*: Entrepreneurial Wave, Architects, Innovative Materials, Finance.*

1. INTRODUCTION

For a very long time, the discipline of architecture has been distinguished by its constant dedication to creativity, artistic expression, and forward-thinking design. As stewards of the built environment, architects are essential in creating the environments we live in. Still, given their vital role, one of the main concerns expressed by architects in modern-day India is the disparity between their artistic ability and their pay. Because of this disagreement, there has been a paradigm shift in the architectural community, with more architects now looking to entrepreneurship as a way to close the gap and realise unrealized potential. India has seen an extraordinary upsurge in entrepreneurial enthusiasm in a number of sectors in recent years. This wave of innovation-driven businesses has not only revived the economy but also created an atmosphere that welcomes risk-taking and innovative thinking. This combination of circumstances offers architects a rare chance to evolve from being merely practitioners of design to innovative entrepreneurs, collectively called as **Archipreneurs**, revolutionising the materials that form the basis of our built environment. Architects are in a unique position to use their inherent creativity, ability to think outside the box, and multidisciplinary approach to design by taking this entrepreneurial route. This in turn has the potential to provide ground-breaking materials that will not only improve a building's sustainability and structural integrity but also mark a new era of architectural beauty. Additionally, when architects become entrepreneurs, they are given the freedom to create their own brands and position themselves as industry leaders who are valued for their creativity and accomplishments. This study aims to investigate the reasons for and possible advantages for architects who choose to become entrepreneurs in order to increase their income and make a lasting impact on the field of architecture. By means of an extensive examination of case studies, interviews, and market trends, our objective is to clarify the revolutionary capacity that exists at the intersection of architectural expertise and entrepreneurial energy. By doing this, we hope to encourage architects to take this step and advance the field towards a time when innovation, creativity, and commercial expertise will come together to redefine what constitutes architectural brilliance.

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2. BACKGROUND STUDY

While studying other research papers I found that some architects have started to look to other industries for cues on how to compete. By 2030, India's real estate and architectural business are predicted to have grown from **$200 billion** in 2021 to **$1 trillion** in 2030, accounting for almost 13% of the country's GDP, yet we find it a struggling profession due to various reasons. The COA is also trying its best but is not in power that much that it can stop architects from quieting the profession and provide opportunities or supporting financially. In pune the number of architects were 3417 as of 2013, in 2023 the number is 6350. In 10 year's there is no such growth in the number which is disappointing. There are people who have created identity in the profession like Zaha Hadid, Normen Foster, B.V. Doshi who have become a brand through their principles and innovations. Rather than pursuing the profession for 5 years and then finding other job opportunities is not the right choice. We have to evolve with time and do what the market demands. Right now, the entrepreneurship wave is going on and we should be part of that wave where we design and innovate products, materials not for magazines but for society where we launch them. The designs may be sustainable, economical, more functional catering the needs of people and at same time responsive to nature. Architectural mindset and skills is a key element which can help grow such ideas and bring them to reality. Through articles, research papers I came to know that we have to change the old system of practising and shake the architectural profession again to make it active to utilise the maximum of what the field can give to us. "Necessity is the mother of invention", there is need for inventions, innovations and architecture is all about that. We can give society so much through our designs rather than just limiting ourselves to setting up offices, working 24 hours on projects.

2.1 Research Questions

1. What are the examples of architects who have successfully transitioned into entrepreneurial roles, and what strategies did they employ to achieve financial success.
2. What are the potential challenges and barriers architects may face when attempting to adopt entrepreneurial practices within the profession?
3. How does the adoption of an entrepreneurial mindset affect the overall professional satisfaction and career trajectory of architects?
4. How can professional organisations and institutions better prepare architects for entrepreneurship, equipping them with the necessary skills and knowledge to navigate the business landscape?

2.2 AIm

To investigate the potential for architects to transition into entrepreneurs, thereby bridging the gap between design and business in the contemporary Indian architectural landscape, generating more income.

2.3 Objectives

1. Explore the specific areas within architecture where innovation and entrepreneurship can be effectively integrated, with a particular emphasis on material development and production.
2. Assess the potential benefits and drawbacks of architects becoming entrepreneurs, both at an individual level (financial gains, job satisfaction) and at a broader industry level (innovation, market disruption).
3. Evaluate the lasting influence of Archipreneurs on the architectural industry, considering factors such as innovation diffusion, market transformation, and professional recognition.
4. Develop recommendations and frameworks for creating an enabling environment that facilitates architects' transition into entrepreneurship, including policy initiatives, educational programs, and industry collaborations.

2.4 Limitations

The research focuses on suitable furniture, product, innovative technology, solutions and material designs when we say bridging the gap between design and business and not architectural plans or renders.

3. LITERATURE REVIEW

The growing realization that there is a big divide in the architectural profession between design and business has led to a greater focus on the mutually beneficial link between architecture and entrepreneurship. While design concepts, aesthetics,

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and technical expertise are frequently prioritized in traditional architecture training, commercial knowledge and entrepreneurial abilities are not routinely incorporated into curricula. This gap has led to a revaluation of architects' roles in today's professional environments.

The traditional architect education primarily emphasizes artistic and technical qualities, leaving a gap in financial literacy and strategic thinking. As a result, architects could discover that they lack the necessary skills to handle the intricacies of the commercial sector. The transformative potential of entrepreneurship for architects has been explored in recent literature as a solution to this gap. The inclusion of entrepreneurship education in architecture programs, highlighting the necessity for architects to be skilled business executives in addition to imaginative designers. This change is thought to be crucial for architects who want to actively control their career paths and use their creative abilities to spur innovation and financial success. In conclusion, the literature study shows that there is increasing agreement that there is a divide in the architectural profession between design and business. The talk places a strong emphasis on the necessity for architects to embrace entrepreneurship, acting as a link between these two historically distinct fields and enabling architects to prosper in a fast-paced, cutthroat industry.

4. METHODOLOGY

(a) **Literature Review:** Conducted an extensive review of existing literature on the architectural profession, entrepreneurship in architecture, and the challenges associated with the integration of design and business.
Analysed academic journals, industry reports, and case studies to identify gaps and opportunities for architects to play a more entrepreneurial role.

(b) **Surveys and Interviews:** Created and distributed surveys to active architects in order to gather their opinions about the current divide in their field between design and business. Conducted in-depth interviews with seasoned architects, in the architectural sector, and experts from associated fields to acquire qualitative information on difficulties and possible solutions.

(c) **Case Studies:** Examined case studies of architects who have successfully ventured into entrepreneurship, identifying key factors contributing to their success. Investigated instances where architects faced challenges in integrating business aspects into their practices, aiming to extract lessons learned.

5. RESULTS AND DISCUSSION

An analysis of case studies revealed important elements that architects' successful business ventures possessed. Proactive business education, smart partnerships with industry specialists, and a sharp grasp of market dynamics were among the commonalities. On the other hand, difficult situations highlighted the value of flexibility and a readiness to absorb failures. These case studies provided valuable insights that shaped the creation of practical plans for architects who want to start their own businesses. Comprehensive interviews produced detailed qualitative information that explored the complexities of problems encountered and possible solutions suggested by seasoned architects and business leaders in the industry. A lack of resources, a lack of business acumen, and risk aversion were common themes that highlighted areas that needed attention.

6. ARCHITECTS WHO BECAME ENTREPRENEURS

(a) **Vijayadurga Koppisetti, Architude:** Vijayadurga Koppisetti, an architect from Hyderabad believes greener solutions are not only important to safeguard the environment but also the health and wellbeing of occupants. In 2018, she founded Architude, an infra-tech start-up to provide green buildings with solutions that are adoptable, and affordable. By leveraging new age technologies, Architude is developing products and services to help foster sustainability and reduce the construction industry's carbon footprint by providing green solutions. The Hyderabad-based startup has built an AI (artificial intelligence) product called KNOWYOURBUILD that suggests lists of suitable and sustainable materials tagged with time, cost, energy efficiency and maintenance information. The virtual prototype models built using Architude products behave exactly like real buildings. The cost of the construction, time schedules, energy efficiency of the building and the data needed to maintain the building can all be extracted from these model.

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Figure 1: Vijayadurga Koppisetti, Architude

(b) **Tithi Tewari, SmartVizX:** Working in the industry for close to two decades, Tithi Tewari had witnessed several problems and situations while communicating design intent to clients through traditional tools and mediums that did little to aid their overall understanding. Despite the extensive use of 3D renders and walkthroughs, she realised that clients had trouble visualising the end-product. Tithi and her husband Gautam Tewari's startup SmartVizX launched Trezi, a fully-immersive VR product for the construction industry in 2018. The startup claims it is India's first such product for this industry. Trezi is a SaaS product, which transforms design communication in the building construction industry. It allows users to step into the virtual world with co-designers and clients to interact with their design, and each other, in real-time, within immersive environments and over desktop systems alike. It allows users to explore, review, and modify their designs at full scale and colour.

Figure 2: Tithi Tewari, SmartVizX

Figure 3: SmartVizX

(c) Bjarke Ingels

- Bjarke Ingels is a Danish architect known for his innovative and ambitious designs.
- Bjarke Ingels, the founder of Bjarke Ingels Group (BIG), has demonstrated a keen interest in pushing the boundaries of traditional architectural services through his subsidiary called BIG Ideas.
- BIG Ideas serves as a platform for experimentation and forward-thinking initiatives. Ingels and his team within BIG Ideas engage in projects that address broader challenges and opportunities, ranging from urban planning concepts to technological innovations.

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- By establishing BIG Ideas, Bjarke Ingels showcases a commitment to using design thinking and architectural innovation to tackle complex problems and explore new possibilities. This approach reflects a broader entrepreneurial mindset that goes beyond the traditional scope of architectural practice, emphasizing the potential for architects to play a pivotal role in shaping solutions for a variety of challenges.

Figure 4: Bjarke Ingels

7. EFFECT OF ENTREPRENEURIAL MINDSET OVER PROFESSION

The adoption of an entrepreneurial mindset can significantly impact the overall professional satisfaction and career trajectory of architects. Embracing entrepreneurial practices often opens avenues for architects to take control of their projects and business initiatives. This increased autonomy and ownership can contribute to heightened job satisfaction as architects see the direct results of their efforts. Entrepreneurial thinking encourages architects to seek innovative solutions, fostering creativity and adaptability. This can lead to more diverse and fulfilling projects, ultimately enhancing professional satisfaction. Moreover, the ability to identify and seize business opportunities may result in increased financial rewards, further boosting job contentment. In terms of career trajectory, architects with an entrepreneurial mindset are often better positioned for leadership roles. They may progress from traditional design roles to managing their own firms or spearheading innovative projects. The versatility gained through entrepreneurial thinking equips architects to navigate the dynamic demands of the industry, potentially accelerating their career progression. However, it's important to note that with increased autonomy and entrepreneurship comes a heightened level of responsibility and risk. Not all architects may find this path suitable, as it requires a diverse skill set beyond design expertise. For those willing to embrace the challenges, adopting an entrepreneurial mindset can lead to a more rewarding and impactful career trajectory in the field of architecture.

8. POTENTIAL CHALLENGES

Architects venturing into entrepreneurship within their profession encounter a myriad of challenges. Regulatory complexities, including navigating stringent licensing requirements, pose initial hurdles and government policies. Acquiring clients in a competitive market demands effective marketing strategies and networking, skills not traditionally emphasised in architectural education. Financial risks are inherent in starting a business, with architects often grappling to secure funding and manage cash flow effectively. Balancing artistic vision with commercial viability becomes a delicate act, requiring a mindset shift from pure design focus. Project management skills are paramount for timely and budget-conscious project delivery. Staying technologically current is imperative for competitiveness, demanding architects' adaptation to evolving digital tools. Market differentiation presents another challenge, necessitating a unique value proposition. Team building and leadership skills are often uncharted territories for architects accustomed to solo or small team projects. Overcoming these barriers requires a holistic approach, combining education, mentorship, and a proactive embrace of both architectural and entrepreneurial skill sets.

9. ROLE OF INSTITUTION, ORGANISATIONS TO PREPARE ARCHITECTS

Professional organisations and institutions play a crucial role in preparing architects for entrepreneurship by implementing comprehensive strategies. To begin, integrating business-oriented modules into the architectural curriculum ensures that students acquire essential skills in financial management, marketing, and strategic business planning alongside their design

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education. Collaborative initiatives with industry partners can provide students with real-world insights and opportunities for mentorship, bridging the gap between academic theory and practical entrepreneurship. Additionally, hosting specialised workshops and seminars focusing on entrepreneurial aspects within architectural programs helps students develop a nuanced understanding of project management, client relations, and legal considerations specific to their field. Internship programs that expose students to the business side of architecture foster practical experience and mentorship, preparing them for the complexities of entrepreneurship. Establishing dedicated resource centres within institutions further supports aspiring entrepreneurial architects by providing access to tools and information essential for navigating the dynamic landscape of the architectural profession. Through these initiatives, professional organisations and institutions can empower architects with the diverse skill set needed to thrive in entrepreneurial endeavours.

10. CONCLUSION

In conclusion, this research paper advocates for a holistic transformation in the architectural mindset, urging architects to embrace entrepreneurship as a means to secure financial success and to reshape the future of architecture. Through a symbiotic relationship between design and business, architects have the potential to usher in a new era of innovation, creativity, and commercial expertise, marking a paradigm shift in the architectural profession. The paper also explores the transformative potential of architects embracing entrepreneurship as a means to bridge the gap between design and business in the contemporary Indian architectural landscape. Recognizing the challenges architects face in establishing lucrative practices, the paper advocates for a shift towards entrepreneurship as a viable solution. Examining successful architect-entrepreneurs like Bjarke Ingels, Norman Foster, Neri Oxman, Tithi Tewari, Vijayadurga Koppisetti underscores the capacity of architects to pioneer advancements in materials and contribute to market innovation. The study reveals potential challenges, ranging from regulatory hurdles to the need for a balanced artistic-commercial mindset. Embracing an entrepreneurial mindset, however, can significantly impact professional satisfaction and career trajectories. Professional organizations and institutions are crucial in preparing architects for this transition, integrating business modules, facilitating industry collaborations, and offering practical experiences. Ultimately, the symbiotic relationship between architecture and entrepreneurship has the power to redefine the profession, catalysing a paradigm shift and leaving an enduring mark on the global architectural landscape.

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Culture Influencing Architectural Elements

"A unsaid story of tambat ali, Corelation of elements and space of Tambat Ali: How the culture is playing role in embarking the elements"

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ABSTRACT: Elements in architecture adapt to surrounding. These elements narrate the identity ofplace and sometimes became identity of place. These elements helps us to understand the space, characteristics, function and real sense of the space. Space is composition of existing elements tangible and intangible aspects that user experiences.

Tambat Ali of Pune Kasba Peth has rich culture and tradition. To understand the culture and tradition the architectural elements play vital role. Many time elements become sense of space and define the space becomes its inevitable identity. These elements imprint beautiful expression of tradition and culture the interaction of user with space elements give us the insight of the space in real, four enclosed walls will also say something everything and anything in a place has a primary function to do but moreover it plays a role in building a relation with space user the environment around. The well composition of these all create beautiful spaces a space with story, a space with culture. Tambat Ali a fusion of elongated streetscape, Small compact clusters is composition of different elements. The evolution of elements and narrative change as the space change. For instances a 'window' on street may say something different than window in cluster closely compacted, there prime function of light and ventilation may be constant but still narrate different story.

Through this research we'll understand the relation of elements and the activities of user affecting influencing the elements. Culture of place possess meaning to built environment, spaces are enriched by human activities daily traditions and all these plays a role in influencing elements which give sense to place.

Every city has its own story, which is narrated through the experience one take in different nichesand corner of the city.

Keywords: *Culture, Elements, Tradition, Tambat Ali.*

1. PREFACE

Pune, the cultural capital of India is flourished with rich culture and heritage. With different community living, art tradition and rich culture, Pune is blessed with strong historical background. A city residing on Mulamutha, composed of pethas each with unique identity, narrow lanes introverted clusters, ornamented facades all these tell us a story 'tambat ali' is one of the oldest lane of Pune established during peshwa period. Located in Kasba Peth is blessed with rich culture.

Tambats residing in tambat ali craft copper vessels. The rhythmic banging noise of vessel is poem it feels as if lane is reciting a story about its culture and tradition. The architectural elements of Ali have embarked their reflection. There is strong relation of these element and culture own by Tambat Ali Tambats have been practicing traditional art for more than 2 centuries. They have developed community living they are involved in social events gathering and celebrates festivals with great enthusiasm. There is sense of brotherhood in community. The unity and togetherness are evidently seen in the community.

In the growing era of modernisation, the traditional practice of crafting copper vessel is losing its value and passion. The streetscape of Pune is highly growing touching sky, in these changing periods the Tambat ali still holds its culture the narrow lanes of Ali clusters and karkhana yet have a beautiful story which is unsaid.

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Figure 1: Structure of Study: by Author

Aim: To study the influence of culture on architectural elements of Tambat ali.

Objectives

- To study interrelation of culture and elements, analyse cultural significance of their featuresand influence on local community living.
- Elements adapt themselves as per user or are acknowledged as per ones outlook. Architectural elements many times have external influence of culture tradition involve around, some elements play more than one function which are not directly visible, role ofelements and its narrative by individual may vary, primary function is the one that overpowers.
- To understand role of elements its identity and relation with surrounding and user.

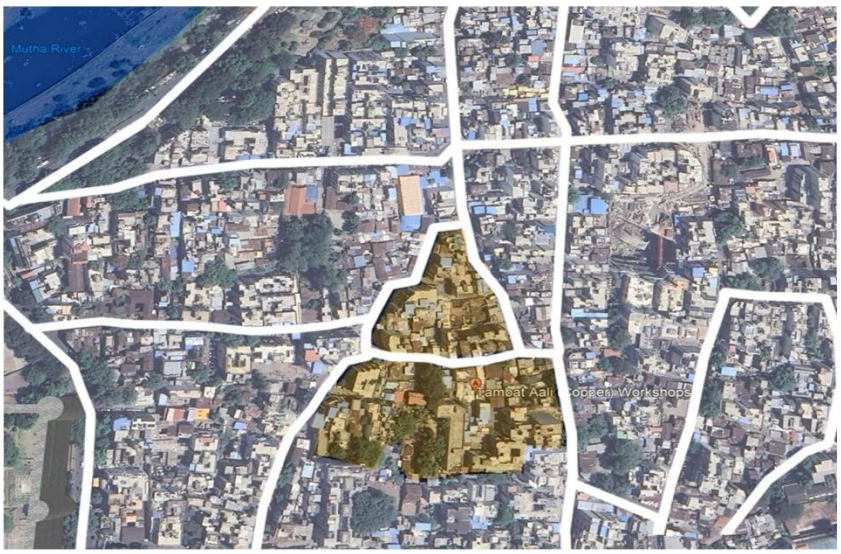

Figure 2

Source: Author, Google Map Loctaion OG Tambat Al.

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2. STUDY OF TAMBAT ALI

Tambat Ali residing in Kasba Peth Pune has a rich culture. The formation of peth during peshwa for systematic function of city it became the formal identity the extended city and suburban happened during the peshwa reign. Every suburban area was given a significant name after a purpose (Katdare, 2021). Thus **'TAMBAT ALI'** named after the art practice here. Tambat Ali (Copper Alley) is a street that is alive from dawn until dusk with the constant hypnotic rhythmic sound of the beating of metal objects. The narrow lane, karkhana, and the cluster close compacted houses have a story. the composition of ali is elongated narrow lane with windows openings extroverted, verandas, and small branching lanes taking into clusters. This street is characterized by banging noise which build a relation between the lane and karkhana inside creating curiosity. Located to the southwest part near riverside, surrounded by busy streets of Kasba, and Shanivarwada, Lal Mahal Ali still hold a peace in itself. With closeness, of build form narrow lane surrounded by semi open spaces where people hammering vessels metal sheets the street become lively. Old pune is reflected through the timber framework, door window overhang, in today times we feel like a flashback when one is in the lanes of Tambat Ali. Exposed bricks with timber pillar details of material are peculiarly observed through facades of buildings.

Though succumbing to the pressure of development and urbanization, it still today is a prominent landmark etched in memories of people in city. It marks a part of Kasba peth carrying on the legacy of over year and reflecting cultural practice within the city. (bangad)

Figure 3

Source: Himal South Asia (The artisan working)

Figure 4

Source: Pradnya Nesarikar, 'AND PLACES'

Figure 5

Source: Silver Talkies.

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2.1 History

Kasba Peth was formed during the reign of Sawai Madhavrao peshwa in 17th century. Nearly 300 migrants migrated from Konkan to Pune. Pune was divided in separated zones on basis of artisan's communities from potters to comb makers. The comb makers have disapper but coppersmiths (tambats) continue. Patriarchal rules over centuries have ensured that few women do work. The men are hard at work as they shape copper into pots and pans over the fire. Tambat Ali's focus on hand-beaten hammered copper work or '*Mathar kaam'* remains a link to Pune's past and a must-see for visitors. (chakraborty). Cultural heritage of Tambats in Maharashtra is also as old as histrionic tradition and culture. Tambats known as 'Twastha Kasar' – 'Twastha' the other name of Vishwakarma, 'Kasar' – kansya the son of Vishwakarma Indian mythological architect. The community futher recognised as 'Twastha kasar'.

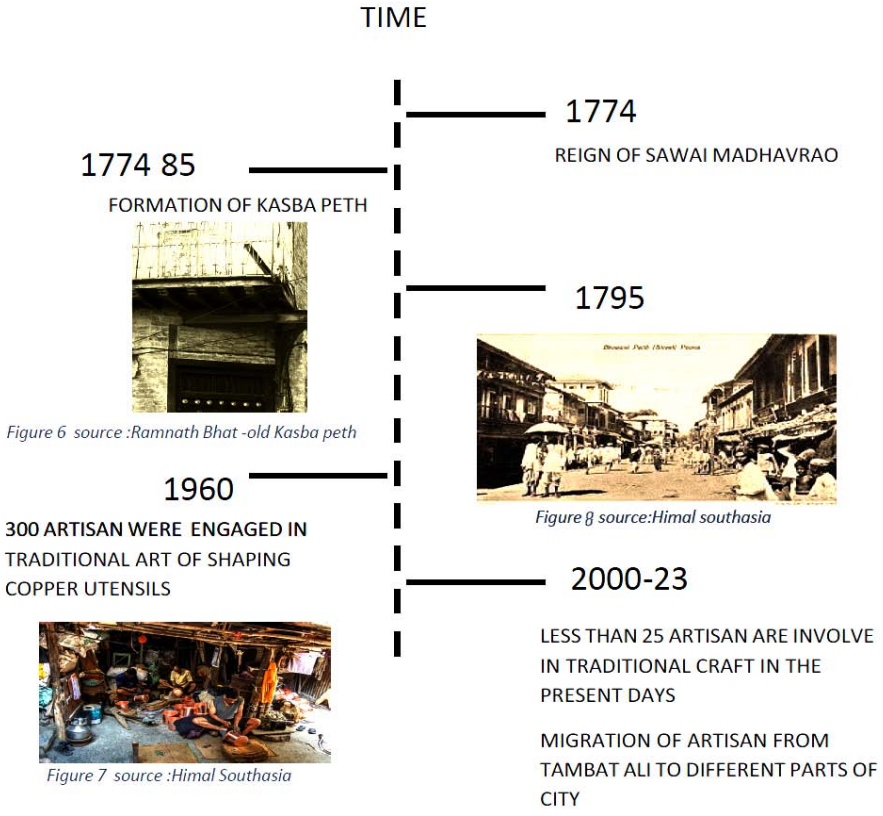

Figure 6 source :Ramnath Bhat -old Kasba peth

Figure 8 source:Himal southasia

Figure 7 source :Himal Southasia

2.2 Planning of Tambat Ali

Tambat Ali can be described as cluster evolved through the nature of occupation, requirements, culture and their domesticities. The narrow lanes with continuously hypnotic noise, small cluster all introverted creating branching with lane as the steam and cluster branching out, this huge network is hard to predict. Tambat have their home and workspace in small compacted closely stacked place, the outer courtyard or '*angan*' is utilised for working and other recreational activities. There are some cluster which are planned for work purposes only they are like small factory called as *'karkhana',* also known as *'Bakhal'*. Balkhal was echoed with banging of hammer and big utensils, workin this area start by morning ends at 6 in the evening with a lunch break, the banging poem receits continuously by workers. Balkhal, Karkhana are introvert planned with open spaces between, the tambat prefer to work in outer courtyard interacting with one another. These Karkhanas have small storage space, nearly 8-10 people have their working space in one cluster.

This craft cluster still retains the traditional planning of clusters—a dense interconnected maze of narrow access ways, compact residential and work clusters, and wider chowks. The Tambats of Pune specialize in 'mathar kaam' which is the art of beating copper to make it stronger. The traditional workshop-cum-living quarters of these artisans are called 'bakhal' where these artisans even today craft some of the best metalware known worldwide for its intricate hand-beaten work. (Kevinstandagehotography, 2022).

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Residential units have central open space cluster closely spaces around one another. They have main entrance to these cluster linking to main street.

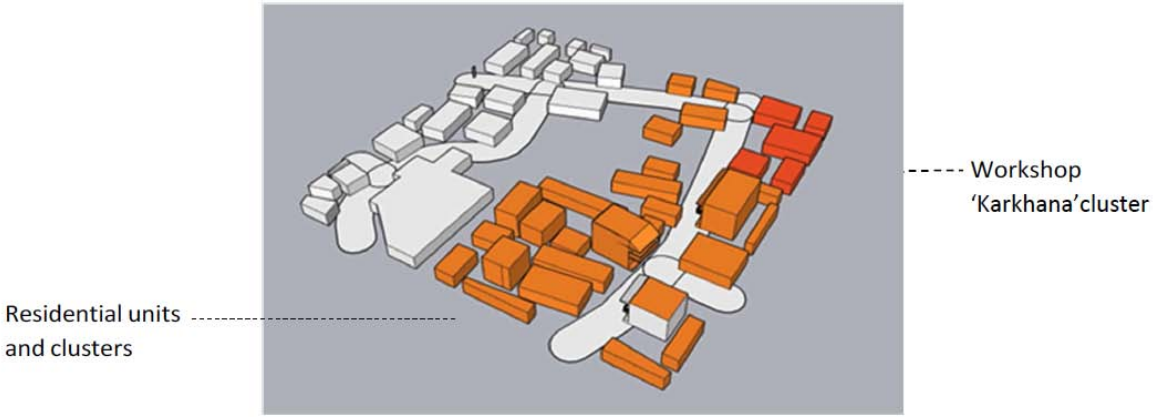

Figure 9

Source: Author View of Tambat Ali.

Figure 10

Source: Author, Plan of Tambat Ali.

The unit represent construction in teak wood column, mud walls, mud floorand the *"Khana"* system of planning. Balconies opening in central bays overlooking narrow lane building relation with outer environment (bangad). The three different components – *Karkhana, residential cluster and narrow lane together* shapes Tambat Ali. Each one have realtion with one another though not direct but coexists help building culture around. The culture is also developed in the similar pattern around them. The deep narrow lane opens into huge open chowk creating space for social gatherings, the façade of lane openings balconies bring the story together.

Figure 10

Source: Pradnya Nesarikar.

Figure 11

Source: Times of India.

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2.3 Culture a Thread between People and Element

The Tambat Ali today represent that intangible culture and essentially is part of the historicity. The significance of the same established through the practice and processes followed by craft, unique to it also for the identity of cultural practices. (bangad) Culture and tradition doesn't only include holy practices or custom. A tradition can be practice one follow, one develops with time span. Similarly culture can be art one practice one belief in. When we say culture of Tambat Ali we emphasis more on the practice they have been performing for many years its their culture tradition, the art of crafting moulding beautiful vessel is a culture in some sense develop over years.

2.4 Socio-Economical Condition

Twastha Kasar community have rich social life, The Tambat have actively taking part in social activity and responsibly played important role. Pune famous for Ganeshuthsov celebration of art culture tradition. The Tambats also celebrates Ganeshuthsov with great enthusiasm, the idol of lord Ganpati is made up of pure wood of shami tree. The community is sensible and aware about lot of social causes. They contribute in good sense to our society, there is community living with value of brotherhood, humanity and love for mankind. The social gatherings of community happen in 'Twastha kasar samaj mandir' near Pavale chowk. They are socially active and promote good value.

Figure 13

Source: Author, Mahakalika Mandir, Place Where Social Gathering Take Place.

3. ELEMENTS OF ARCHITECTURE

3.1 Elements of Space Making

We are surrounded by elements and we play with them in day to day life. Simiarly Architecture is abound with many elements. Floor, walls, roof, column, Window, are basic elements of architecture, some helps to build spaces, some exist to perform function while there are some elements that are formed during the process. Each and every element in architecture present physically plays a role, tangible intangible, their presence give sense to space. Its like the elements are alike the sensory organ of space which is body. A structure, place, space gets meaning a lot more because of elements, what they deliver what they project. In 'City of Images' the author 'Kelvin Lynch' has derived 5 parametric elements that classify the city on which city can be studied. Similarly, any built unbuilt structure is curator from small elements binded together. Tambat Ali is blessed with element which may look normal but has lot to convey. In this paper we have identified selective architectural elements from 3 different zones of Ali:

- Streetscape
- Karkhana
- Residential cluster

Same element in all these zone have some same and different story to narrate,all these zones are also binded together due to these elements, their role characteristic that bring harmony together and composed a well function Ali with peculiar culture.

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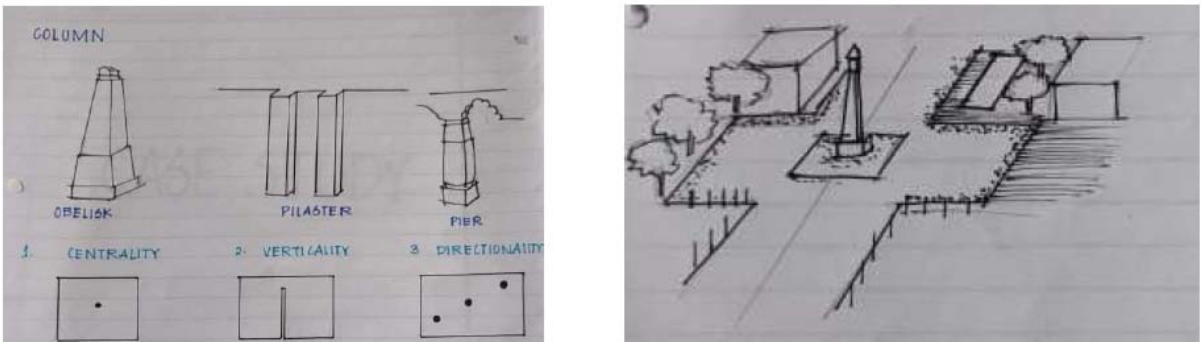

Figure 5

Source: Author reference from elements of space making.

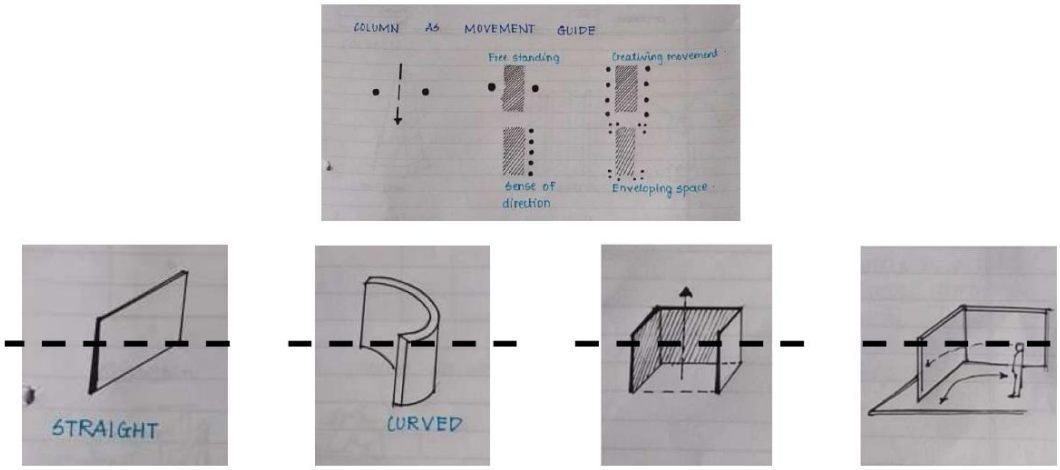

Figure 14

Source: 'Elements of Spacemaking'.

3.2 Unfolding the Architectural Elements

3.2.3.1 *Streetscape*

The façade of small Wada and house standing huge on either side of lane, a lane of 6 to 9 meter wide or maybe less than that take one to different places of Ali, narrow deep shaded lane with less human interaction in noon have veranda to sit, undulating skyline frequently changing as height of structure vary.

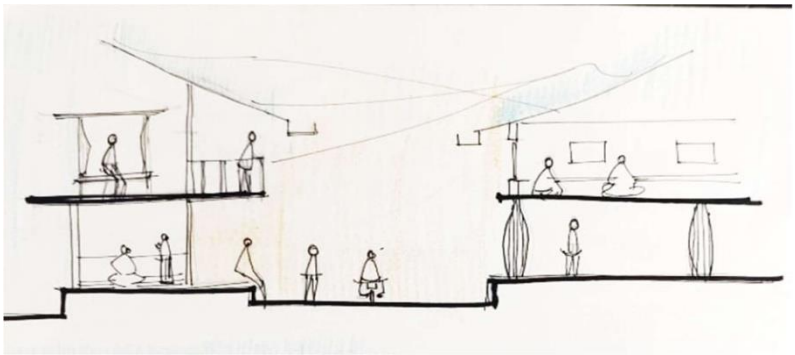

Figure 14

Source: Author Street View.

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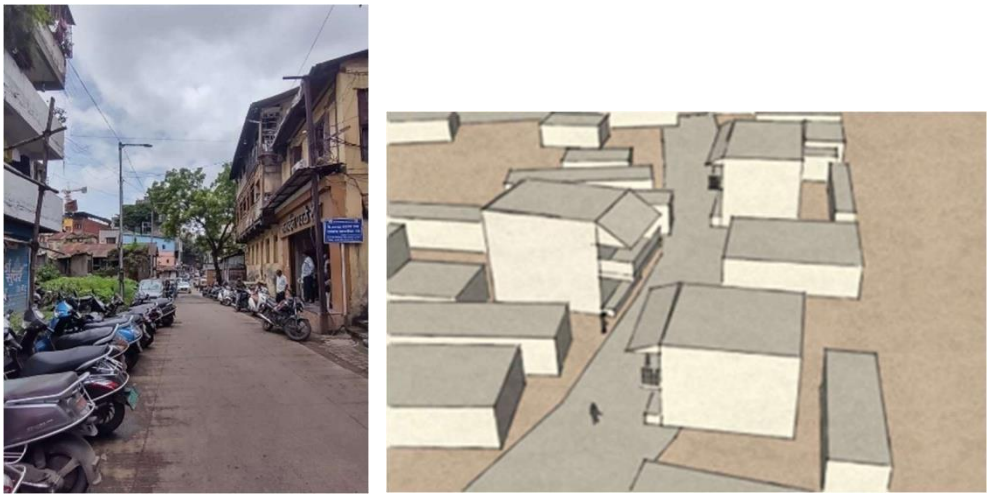

Figure 15

Source: Author Street View.

3.2.1.1 *Fenestration*

With overhang balconies projecting outward creating link between inside and outside, OPENING as ray of hope, aperture for light, to enter in the insides, the overhangs window projecting outward establishes vertical relation with people on the there side road and neighbourhood. This projection creates a play of mass on façade, adding depths and creative shadow pattern within the structure. With cross connection a relation is develop with Ali and insides indirectly. Window openings break the monotonous nature of dead façade and add play, it breaks surface continuity and subscale the mass. (pandey).

Timber chajjas overhangs carved timber with floral design takes visitor to 17 century, the simple design on window frame, grills of cast iron having unique floral pattern creating jaali for privacy and fresh air.

The niches in wall scoop out in different shapes to store small lamps dilas in olden times now these niches are used as easy accessibility to keep things required quickly.

The niches adding to pattern again breaking monotonous mass of plain wall. As time changes user adapted the niches for their purpose as required changed. The big window in balcony provide visual connection and openness on upper floor, the height to width ratio is considerable large to provide direct light and ventilation at same time link the vertical relation.

The door – short narrow on raised platform with ornamented timber frame with bright colour creating entrance to small cluster, always deliver welcomeness. Door being access to other realm bring transition from one space to other from public to private.

Figure 16

Source: Author.

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Figure 17

Source: Author.

Figure 18

Source: Author Orange Frame Marks Window.

3.2.2 *Floor Level*

Floor level or veranda, plinth level is considerably high with platform to sit which is hardly 1-2 m wide

Stone veranda, where older people sit and kids play, some sort of work of crafting utensil while interacting with people is observed during evening. These raised platforms were place to rest for visitor during 17th–18th century as guest were not directly taken to main khana (house). This makes a point in delivering a culture which may not be practice in today's time. Now this veranda are multifunctional but, communication interaction still holds its identity which is shaped by culture.

Floor line differentiate in function of space the lane and veranda are distinguish different due to raise plinth level and divide them in individual area. Still develop a relation with one another. These raise undulating plinth line on 2 sides of lane cretes guiding movement for visitor through the lane. these floor line holds the façade taking composition together creating platform and dignifying other elements. This is how one element can affect the other and on scale can be influence by human, user as they perform the prime function.

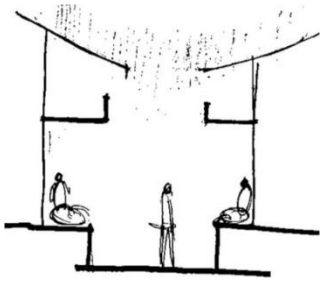

Figure 19

Source: Author Sketch Showing How Plinth Creates Platform for Interaction

Figure 20

Source: Wordpress Plinth Level.

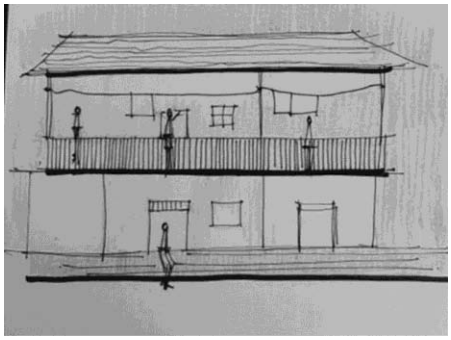

Figure 21

Source: Author, Elevational Sketch of House.

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3.2.2 *Bakhal, Karkhana*

The compact cluster where Tambat practice their traditional art of crafting utensils. The semi covered spaces often addressed as 'karkhana' are used as working area. the planning represents the order of process and space adjacency. (bangad) Cluster facing each other timber wood pillar holding a ai sheet covering 2 × 2 space open from 3 sides rested on raised plinth having adjoining covered place acting as storage to store raw material and tools. The artisan spend most of time working outside rarely used the storage place, the narrow pathway dividing two karkhana very narrow and deep, adjacent karkhana have partial wall as partition still visual connection is strong in the cluster, a central open space not planned but deliberately created or develop within time used as courtyard, some karkhana have hand pump, which denote centrality of the cluster. All artisan work together creating a rhythmic poem all day, this is place where they enjoy shaping artifacts from copper where hands create beauty.

Figure 22

Source: Kelvin Standage.

Figure 23

Source: Kelvin Standage.

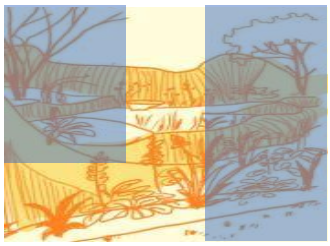

Figure 24

Source: Author.

3.2.2.1 *Walls and Fenestration*

The semi open spaces staggering each other establishing a network branch, forming cluster wall as element is primarily used to create partition between two working space. The nature of this partition is different from other, height of wall is less than a metre not covering the entire surface developing visual connection, creating openness giving sense of one space.

Though the partial wall demarcated space with its planarity features dividing space still holding unity is the prime narrative achieved by these elements.

These walls are used to sit sometimes used as beds to rest in noon by workers, raised platform to keep equipment's and also platform to exhibits artifacts. Hence one element can adapt itself as user and surrounding condition. If we think about origin of wall, it may be only for dividing space but now with tradition of space it has adapt itself to multifunction withstanding its prime role and identity.

The other wall divides inside and outside of karkhana act as complete barrier, enclosing a volume differently, niches on these to store creating masses breaking the linearity of plain. Openings and wall create a communication between spaces these elements are directly moulded by the culture of interacting with one another while working.

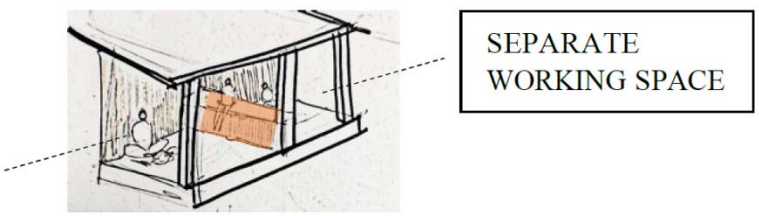

Figure 26

Source: Author Sketch of Wall

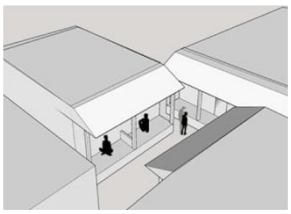

Figure 27

Source: Author Karkhana Cluste as Element Dividingspaces

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Floor

The floor level is elevated from ground line slightly. The raw line creates movement guide through karkhana as like in the ali some function of the element plinth remain same in these space karkhana but are associated with different activity. The raised platform define separate space foe working used most of time also develop a platform to sit for visitor, protect from water as elevated from ground level. The karkhana is supported and stabilized by this level all the plinth here are on same level delivering message of equality and unity among craftsmen developing relation among each other.

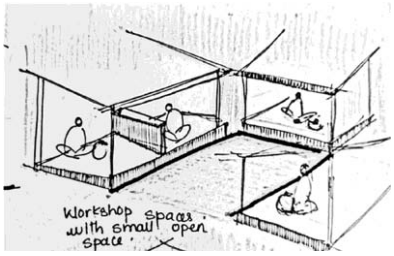

Figure 28

Source: Author marking floor line

Figure 29

Source: Author
(Demarking Floor Line Acting as Guide of Movement)

3.2.3 *Residential Clusters*

Short narrow lane taking to one to compact close cluster from the main street. The unit represent construction in teal wood column, mud wall, mud floor, and the "Khana" system of planning. Balconies open up in central bays, thereby overlooking workshops. Since the occupation demand certain process with metal, the areas and size reflect the same. (bangad) Residential cluster have some workshop depicting the evolution as in olden time people use to have workshop in front court and living and cooking areas inside the house.

The nature of life and tradition though fragmented can be witnessed through small open space in front and between the houses giving opportunities for social interaction, acting to accommodate domestic extension and recreational spaces for community living. (bangad) These cluster consisted of 5–6 families that reside here, some have their working space, two storey structure with long balconies, small open to sky courtyard and closely spaced unit all together formed a cluster.

Figure 30

Source: Author.

Figure 31

Source: Indian Express People Working in Courtyard

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Figure 32
Source: Author Entry Enclosed by Wall Plain Creating Curiosity.

Figure 33
Source: Silver Talkies

3.2.3.1 *Floorline*

The entrance of cluster have door, here the floor line distinguish in material, a huge stone mason wall on one side creating a gulley the difference in flooring material created a floor line which act as guiding line to inner, main cluster. The plinth of houses was not to high the break in monotous plinth line was seen in comparison to outer street. This make clear houses cluster lining in the vicinity of main street have high plinths, the cluster located inside away from main street where no direct relation of street was notice have considerably low plinth breaking in between. The breaking, uncontinous nature of plinth made the inner andouter spaces merge in itself, different unit were brought together due to this nature.

No huge veranda small step creating threshold of units narrating simplicity of nature denoting no Royality was done. Women used to sit on small steps doing house chores the front court was utilise for domestic purpose, low plinth tried to give ground to communicate for all residents residing here.

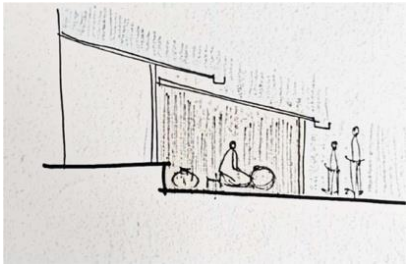

Figure 34
Source: Author Sketch Showing Hierarchy.

Figure 35
Source: Author Cluster, Open Space Partly Covered.

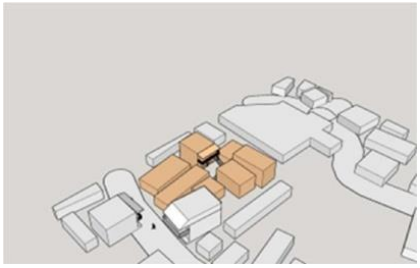

Figure 36
Source: Author Residential Cluster.

3.2.3.2 *A Staircase for Connecting Spaces and People*

Timber Staircase partially cover connecting the upper levels of cluster through balconies, The staircase in the central courtyard emphasis itself as element that divides planes and connects the structure vertically. The staircase is a construction designed to bridge large vertical distance by dividing it into small vertical distance called steps. Staircase maybe round or may consist two or more straight piece (pandey). The small covered staircase was place to sit interact play, sometimes to dry clothes on handrail, other than connecting two volumes to vertical planes staircase played varied role according to environment the presence of this divided the courtyard in two zones, added to geometry of space, gave sense to space, created a centrality, focus though it was element of communication it become element that emphasis that gave the cluster strong sense through its presence.

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Figure 37

Source: Author Volumes Connecting Through Staircase.

Figure 38

Source: Author View from Staircase

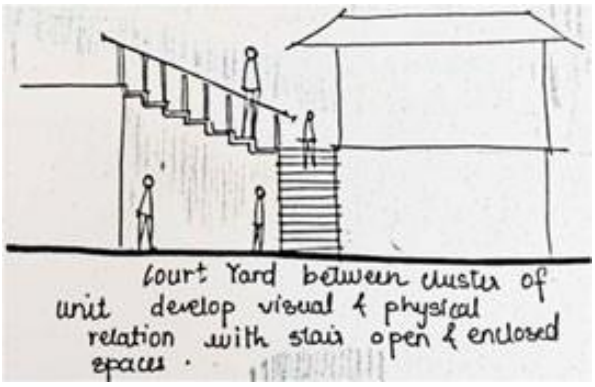

Figure 39

Source: Author Staircase from Central Open Space.

Figure 40

Source: Author.

3.3 A Story that Element Narrate

In this process we tried to observe analysis elements from different location, spaces of Tambat ali we tried to study the pattern that these element deliver. Elements parameter were same but as space around change, the element delivered a narrative related to space. These elements are identity of space due to role they play, they have became essence of space that have develop over years but they have culture inculcated in them in this time period, due to tradition of space, alike a human adapt oneself to the environment around, these element have adapted themselves to culture of these spaces and become a identity. Rich influence of culture and tradition have made this transition. Culture is not limited to rituals or customs its sense of space, as lanes of Tambat ali have adapted themselves to the hypnotic noise of banging like the people, the structural members have adapted themselves to the vibration just like that all elements have become integral part of the culture of Tambat Ali. The small compact cluster, dense network, small lane each one has something to say but is remained unsaid in the race of urbanisation. After spending many days on this topic visiting Tambat Ali for multiple time, I have question there is strong relation between the culture and elements which is reflected in Tambat ali, So are we creating such modern soace which will deliver its essence through elements?

ACKNOWLEDGEMENT

I would thank Ar. Sukhada Dixit Mam to guide me through the whole process.

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Formulating a Streamlined Digital Tool for Redevelopment of Housing Societies in Mumbai Metropolitan Region

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ABSTRACT: The land is a rare commodity in the city of Mumbai. In this context, the state government has adopted the 'enabling' approach to housing provision (Maharashtra State Housing Policy, 2006). The government has facilitated Housing Redevelopment schemes enabling private developers to reconstruct an existing multi-tenant co-operative housing society (C.H.S.) to rehouse the existing owner-occupier & use the additional F.S.I. to construct new apartments in the new construction to be sold in the free market.

The process of redevelopment is long & tedious process. Most of the time, the time taken is during the pre-construction process of selection of developers & building permits from authorities (IOD/CC).

The focus of this research is to examine the existing system and to find a **"One Stop Solution"** for the Society members that will help to educate the members and will be faster & less time-consuming for them to appoint a developer & further ensure that the whole process of Redevelopment goes smoothly.

Keywords: *Redevelopment, Floor space Index, Housing, Development Control Promotional Regulations, Pre-construction, Housing society.*

1. INTRODUCTION

As many of the Society bodies Lack the knowledge of Redevelopment and its Process, It might be difficult or time consuming to go through Redevelopment Process. There is need of educating the Societies about the Process. We can see that availability of legitimate Information is available, but is time consuming which can become a major hurdle in the process of Redevelopment.

Hence, an Application (App) is a need of an hour to facilitate the Information of Procedures and can Guide a person/Society throughout the entire redevelopment Procedure Step by Step. The application can be an educational tool to guide the Society members in the Preconstruction process of redevelopment.

1.1 Aim

The aim is to formulate an Application to facilitate "ONE STOP SOLUTION" for Redevelopment of Housing Societies in Mumbai Metropolitan region.

1.2 Objectives

1. To examine & identify flaws or drawbacks in the existing Redevelopment system.
2. To identify stakeholders in the process of Redevelopment.
3. To Educate the Society Members during the pre-construction stage.
4. To facilitate the availability of required documents/information at a single window.

1.3 Scope & Limitations

1. The study will include redevelopment process of a cooperative housing society & selection of developers for redeveloping the society building up to the pre-construction process only.

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2. The scope will be limited to considering small or medium size residential redevelopment projects with Plot areas up to 4,000 Square Meter.
3. Under residential, only private plot owners/societies Plots are to be studied which are developable under DCPR 2034 are to consider.
4. Only Residential Societies under Mumbai Metropolitan Region are considered.

2. LITERATURE REVIEW

Redevelopment of buildings in Mumbai city: risks and challenges by Vinod Vanvari, Dr. Sumedh Mhaske[1] in International Journal of Engineering & Technology.

2.1 Learnings from the Research Paper about the problems of Societies

- Process of building redevelopment is complex and challenging. This is further complex in case of projects of housing societies.
- There are multi-stakeholders with varied knowledge, wisdom, expertise and socio-economic status.
- Dilapidated condition of buildings, Changing development control rules by regulatory authorities, market conditions contribute major risks, while physical condition of plot, coherency among tenants, making them vacant to alternate accommodation, mobilizing finance are major challenges.
- If proper detailed feasibility study carried out at beginning, risks and challenges can be foreseen. Through proper discussion, transparency and communication same can be addressed during initiation phase itself.

Table 1: Challenges Faced by Different Stakeholders in Redevelopment

A	Challenges to both parties	Key Factor	Remark
1	Dilapidated condition of building or building in irreparable condition.	Structural audit and acting on its recommendation of its report.	MCGM guidelines to be followed for classification of buildings.
2	Sustaining coherency among tenants	Ensuring transparency and communication	
B	Challenges to Tenants	Key Factor	Remark
1	Project becomes non feasible due to one or other reason after selecting and appointing developer.	Getting detailed feasibility before or revisiting development agreement if such situation arises.	Feasibility need to be dynamic.
2	Developer less resourceful with respect to finance.	Due diligence or bringing other developer with proper settlement of previous developer.	
C	Challenges to Developer	Key Factor	Remark
1	Sudden shortage or unavailability of any construction material.	Adopt alternate material with consultation of Expert.	
2	Challenging local site conditions like low water table or surrounding buildings requiring silence like hospitals or educational institutes.	Pre-bid survey necessary or resolving such challenges with mutual discussions and meetings.	
D	Special challenges No conveyance, Earlier failure, Height restriction, Highway /Railway, MOEF, CRZ, Group Redevelopment and Self Redevelopment.		These are specific challenges they may be there or not, varies from project to project.

2.2 What are the Advantages of Redevelopment?

- There will be more spacious apartments with connected bathrooms in the bedrooms that are better planned and equipped for earthquake resistance.
- Each member will receive corpus funds, which will be used to cover increases in the premises' maintenance costs or for other objectives.
- A reimbursement of twenty-five to thirty percent will be collected from the developer. Furthermore, if more space becomes available, it may be bought from the developer for the greatest deal.
- There will be access to contemporary amenities and equipment such as elevators, cable TV, telephone, smoke detectors, firefighting alarm systems, disguised plumbing and hidden cabling for power and other utilities.
- Parking will be offered on stilts or below ground, freeing up ground area.
- There will be a clubhouse, pool, gym, community hall, and other amenities accessible.

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3. METHODOLOGY

- Identify the stakeholders in the pre-construction process of redevelopment & Discussion/Interview with them.
- Semi-structured Interviews with Experts in the field of cooperative housing society & redevelopment (redevelopment specific).
- Collecting government policies/manuals & deriving loopholes (redevelopment).
- Redevelopment Case studies of projects which are ongoing & projects which have completed the pre-construction stage of Redevelopment to be studied.
- To draw a flowchart showing the interdependency of different reasons & their effects, to understand the pre- construction phase in the lifecycle of the redevelopment project.

The primary agents in this research are the housing societies and the research situation in the market regarding the availability of required documents for redevelopment. The research restricts itself only to the Co-operative housing societies and does not examine the Slum rehabilitation.

4. RESULTS AND DISCUSSION, CASE STUDIES

Residents of an old building are now discovering that they have the opportunity to unlock substantial value from their property by offering it to a developer for redevelopment. The most effective, economical, and long-term solution in this situation is redevelopment, as it uses uneconomical or obsolete old structures for rehousing the old tenants/owners & building new housing stock.

Developers utilize the available Floor Space Index and Transferable Development Rights, Premium FSI, etc. allowing them to rebuild existing residential properties. In situations where land is scarce and costly, and there is no land available in a good location, it is a cost-effective way to invest in land. The developer does not have to invest a huge amount in buying the land.

1. ***Society:*** Trilochan CHS, GTB Nagar, Sion, Plot Area: 4000sq.mt Developer: Shikara Constructions Pvt. Ltd.

No of tenants: 112

Time Consumed in Pre-Construction Stage: 10 Years after Development Agreement Issues of society:

- After DA in 2012, Litigations started as a group of 8 members approached Court in opposition with the builder.
- Norms of MHADA changed in 2016, relaxation in Premiums.
- As per DCPR 2034, FSI Increased.
- CTS number of the Society was wrong in the records. It took 9 months to correct the records.

2. ***Society:*** Khimjibhai Chawl, Mulund (w), Plot Area: 1860 Sq. mt Developer: Tendering Stage

No of tenants: 68

Time Consumed in Pre-Construction Stage: 7 Years & counting after Passing Resolution for Redevelopment.

Points to Study:

- Location is Prime, but this is a Cessed Property. Land Owner wants to have maximum benefits.
- Few Tenants do not have Tax Certificate.
- Land Owner's PR Card shows Previous Land owner's name.
- PR Card shows that the Owner had taken a loan of 35,000 in 1982. According to owner he has repaid the loan, but it is not reflected in the documents, hence, there is no Bank NOC for Redevelopment.

Pre-construction

Pre-construction process in a redevelopment project involves several procedures including preparing a feasibility report, draft tender, comparative of bidders, having joint meetings with committee & society members on various agendas of redevelopment, drafting development agreement & checking the approval process for building permits from authorities by the developer.

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Different Problems that arise during the Pre-Construction stage in a Housing Society:

- Technical Know-how of the Entire Redevelopment Process.
- Lack of understanding about the potential of their own (Society's) Land.
- Lack of knowledge about the Documentation required for Initiating the Redevelopment Process.
- Litigations/Oppositions from some of the society members.
- Proper Consultation for the Process of Redevelopment

Primary data collection from society members in the form of Questionnaire, Meetings, Interviews, Discussions.

Table 2: Questionnaire

Sr.No	QUESTIONNAIRE	YES	NO
1	Does the society have 100% Availability of documents required for Redevelopment?		
2	Does the Society has enough knowledge to smoothly go for redevelopment?		
3	Are all the society members ready for Redevelopment?		
4	Is the committee aware of How much is the FSI potential of the Society?		
5	Does the Society have knowledge about different schemes for redevelopment?		
6	Are Members aware about their own Duties towards redevelopment?		
7	Are members aware about the 79A process for Redevelopment?		
8	Are members aware about Parking norms?		
9	Are People aware about whom to approach in case of lack of documents?		

5. CONCLUSION

Most of the times a lot of time is spent in the Pre-construction stage itself and eventually, the overall project timeline gets affected. Considerable amount of scattered data is available in the market and hence there is a need to compile it in a proper way. A concise availability of information related to Redevelopment is a big problem and it can be solved to an extent by developing an application for societies or by publishing a manual or a book stating the guidelines for redevelopment. An Application can be developed where the input will be the unite CTS No. and the Output Data will be gathered.

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Need for Development of Digital Tool for Tracking of Construction Labours Data

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ABSTRACT: In the growing and unorganized sector of construction in India, labour, site engineers and supervisors are the key elements of execution process. If the basic needs of labours taken care and expectations of engineers from the labours are conveyed to them, construction timeline can be easily improved.

Labour is one of the most important reason for the delay of works, due to their lack of presence on site because of money transactions and banking related activities, health issues, railway ticket booking queues, labor camp or staying issues, etc.

A digital tool/app based company can help labours to manage necessary activities, also understand expectations of engineers and try to bridge the gap between labours and engineers. Ultimately this will help for better scheduling and delivery of project.

Keywords: *Labor, Delay, Digital Tool, Labour Experience, Project Schedule.*

1. INTRODUCTION

1.1 Labour: Important Resource of Project

Construction industry is the largest growing industry in India and world. It's the second largest industry after Agriculture in India, contributed around 6 to 9% of India's GDP over the past five years while registering 8 to 10% growth per annum[1]. As per government data, the demand for construction manpower is projected to grow at a consistent pace of 8%–9%, thereby resulting in an annual addition of around 2.5 million jobs to the existing stock.

In Mumbai and surrounding region day by day development and infrastructure projects are increasing which drew migrants from all over India to these cities. These labours mostly having families doing some other works or doing farming in the native place. So these labours run to native places for activities in farming and marriages during the year, which hampers the construction activities and schedule of the project.

Also, **s**urveys of most of the working sites, finds less number of labour than the required ones on planned activities. And whatever numbers are there, retaining them is the biggest challenge.

1.2 Background Study

Analysis of delays in construction projects, states most of the times one of the prime reason for delay is labours. In whichever effective way scheduling of activities done by project managers, unexpected and at times non justifiable reasons are the cause of absentees of labors on scheduled activities. Even contractor himself finds difficult to track them on planned activities.

Existing apps in market: There are existing apps in the market like Powerplay, Quickso and Gem Traq which site team can use for labour and project management. But there is no app for labours for improvement. Even apps are not user friendly or with regional languages for labours who have limited education.

So this study states help of digital technology to track and improve labour attendance for construction projects.

[1] Analyzing factors affecting delays in Indian construction projects - https://www.sciencedirect.com/science/article/abs/pii/S0263786311001384

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1.3 Objectives of Study

1. To analyze the problems of labour which effectively cause absentees on the construction project.
2. To use of digital tools to analyze and motivate labour for better working conditions.
3. To improve the labour retention rate for builders and contractors.
4. To help site engineers for better scheduling and timely delivery of project.

1.4 Scope

1. The study will look at studying the overall well-being of the individual construction worker along with their socio-cultural relationships with each other.
2. It will track the living conditions, health and hygiene habits.
3. Labour in construction industry of residential project with requirement of about 250 nos will be considered for the research purpose.

1.5 Limitations

1. Only improvement in presence of labour at construction site will be measured.
2. However further study in app can be done for improvement of skill in labour work.

2. LITERATURE REVIEW

Table 1: Literature Reviews and Relevant Findings

Detail of the Journal/Book/Book Chapter	*Yearof Publication*	*Indexing of Journal*	*Main Findings or Conclusion Relevant to Proposed Research Work*
A study of construction workers' accommodations In Mumbai metropolitan region of India, Research paper by Ar. Himani Tawade parte[2]	2021	Journal of the Indian Institute of Architects referred journal of IIA ISSN-0019–4913 June 2021 Volume 86 - Issue 06	• Construction workers, migrants • BOCW act 1996, Accommodations below standards, No basic parameters for safe and healthy environment. • 5 crores of workers which form around 10% of the total employed workforce in India (BOCW 2020 P.10; Sutradhar book 2016 P. 16), around 65% unskilled with no training/skills • Maharashtra – around 23 lakhs workers estimated to be present (BOCW record 2020 P. 29) • Welfare cess approx. Rs. 38000 crores still left in India (BOCW 2020 P. 11) and in Maharashtra around Rs. 6652 crores
Occupational health problems of construction workers in India, article by Jaykrishnan Thayyil, Bhaskar Rao and Biju George[3]	2013	International Journal of Medicine and Public health, October 2013	• Occupational diseases like tuberculosis (1%), malaria (13.7%) and jaundice (10.6%), typhoid (3.4%) were present when data was collected from 387 (94.4%) workers. • Most of them belonged to the young age group (26.8 years). • Prevalence of injury was higher among civil work group (17.2% and 6.6%.) and Current fever, respiratory infections, eye disease were higher among building workers.

[2] https://indianinstituteofarchitects.com/pdf/jiia/2021/June_2021.pdf

[3] https://www.researchgate.net/publication/307703848_Occupational_health_problems_of_construction_workers_in_India

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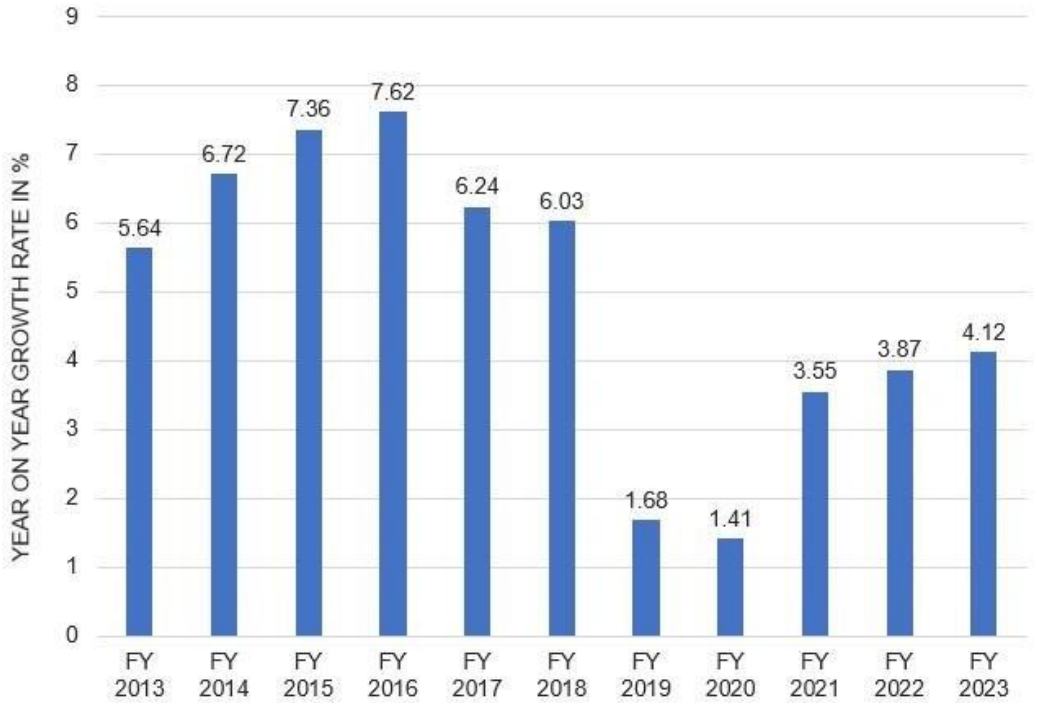
Detail of the Journal/Book/Book Chapter	*Yearof Publication*	*Indexing of Journal*	*Main Findings or Conclusion Relevant to Proposed Research Work*
Studies on Labour Safety in Construction Sites, research article by S. Kanchana[4]	2015	The Scientific World Journal - 2015 - Article	• As per the case studies—data collected from 32 residential building sites, 16 commercial building sites, 2 educational building sites, and 2 religious buildings sites. • Found that the average age of the workers was 32 years, with 37% of sample being younger than 39 years. • In small industrial sites 96 migrant workers and 337 Kerala workers are included. In large industrial sites 196 migrant workers and 489 Kerala workers are included. • More numbers of migrant laborers are from Bengal. • The migrant laborers are ready to work for low wages and contractors are happy with that.

As per the graph 1, the growth in productivity is decreasing year by year. There is a sudden drop in that in covid pandemic situation and slowly now it's improving. But still the average growth is 4.93% that requires more motivation to increase the growth rate which can help the growing construction industry.



Graph 1: Showing Year on Year Labour Productivity Growth in India from Financial Year 2013 to 2023[5]

[4] https://www.hindawi.com/journals/tswj/2015/590810/Research Article -Volume 2015 | Article ID 590810 | https://doi.org/10.1155/2015/590810

[5] *Source:* https://www.ceicdata.com/en/indicator/india/labour-productivity-growth#:~:text

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As per the literature reviews, reasons for labour shortage on-site can be classified as below:

Table 2: Classification of Reasons for On-Site Labour Shortage

Working Environment	***Health and Behavioral***
• Work is more difficult compared to wages. • Outskirts work—No market available nearby. • Fear of local people/contractors for migrant workers. • Labour is not satisfied with the atmosphere (labor camp) • Fear of getting theft or already theft.	• No common facilities for health and safety. • Behavior of construction engineer, Supervisors, etc. • Communication gap with supervisors/engineers. • Health and hygiene issues. • Facilities like Canteen, drinking water, toilets, medical store not available. • Migration back to villages during farming and marriage seasons. • Labour retention and Labour Acquisition on other sites.

3. MATERIAL AND METHODOLOGY

Methodology for the research consists of deciding Aim and Objectives with the help of background study, Identifying and listing down the gaps with experience and observations. Further there are two components to this study. The first section will provide a comparative analysis of the norms for a safe and healthy environment based on primary data gathered from in-person observations and interviews with labours, contractors, and supervisors in the Mumbai region.

Through case studies and site visits, the second phase of this research attempted to explore the factors contributing to the poor health conditions and other reasons for shortage of labours. Ultimately, approaches were suggested for resolving the problems and enhancing the labour system's working circumstances based on the analysis of the results and other pertinent information.

3.1 Primary Data—Views of an Experts

Table 3: Opinions of Industry Experts

Er. Amol Koujalgi Worked on many construction and repairing sites, Township projects like Mohak city and Rustomjee Infra in Virar.	Labour need to be shown some care from the contractor/builder side, to motivate them to work efficiently on construction sites. If the basic facilities required to them are given, efficiency and performance can be enhanced.
Er. Kiran Kamble An engineer in SD Corp Pvt. Ltd. And currently working on High rise residential building project Sarova Sienna in Kandivali east.	Engineers waste so much time in tracking labours and going behind the contractor to follow schedule of the project. If we can change the labour's approach towards the work, work can be done in schedule with better quality.

3.2 Secondary Data—Case Studies

Table 4: Case Studies o on Going Sites in Mumbai

Project: Sarova Sienna, at Samta Nagar, Kandivali High-rise residential building Permanent Labours – 1400 nos 	Project: Shikara Heights, at GTB Nagar, Mumbai High-rise residential building Permanent Labours – 250 nos 	• In both case studies skilled labours of around 100 nos and 50 nos of unskilled labours are taken as sampling. • Schedule and timeline of the project affected in both cases. • Labours retention and activity planning was the major task.

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4. DISCUSSION AND RESULTS

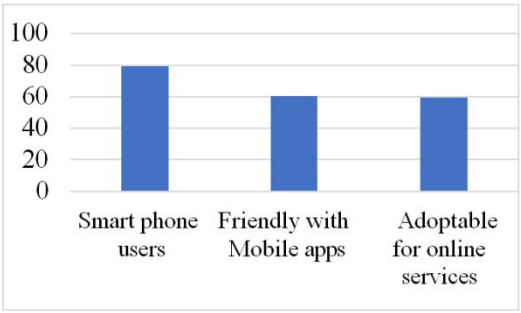
4.1 Discussion

Questionnaire is shared and answered by sampling labours. Also the food consumption, daily habits, health status of them is observed (Medical checkup was not part of study).

From primary data collection and data from case studies shows following results:

As per Graph 2 findings from case studies shows that around 78% labours are using smart phones out of which 63% are very much familiar with using various mobile applications.

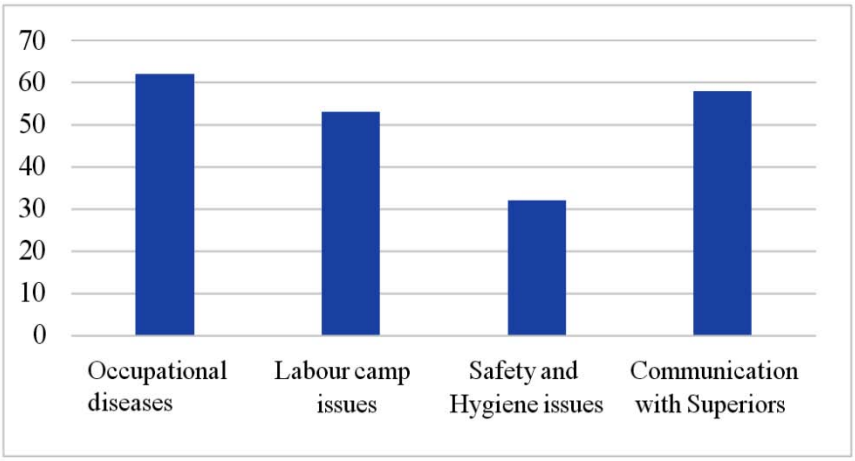
Even around 56% of construction workers find it useful that online services will surely help them and they are ready to adopt them.



Graph 2: Showing Percentage of Construction Workers with Mobile Easiness and Online Use

As per Graph 3 which tries to reflect the challenges faced by construction workers, 62% of labours are having short or long term occupational diseases. Labour camp issues and theft issues faced by around 53% workers.

32% labours are facing health, safety and hygiene issues at site and around 58% believe that there is a communication gap with superiors which affects their productivity.



Graph 3: Showing Percentage of Construction Workers having Challenges and Health Concerns

4.2 Results

Digital help/tool in terms of mobile app helping construction workers to:

- Basic Banking requirements, Money transfers to added accounts.
- Railways bookings can be easily done and tracked.
- Health and hygiene videos to improve daily habits.

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- Regular medical checkups can be arranged.
- Hardware tools—Order/Maintenance can be done online.
- Booking of Parcel facility for native places can be done online.

Digital help/tool in terms of mobile app helping site engineers to:

- Tracking of health issues faced by individual or group of labours.
- *Project scheduling*—This app will help to know schedules of the workers going to native place, engineers can consult to contractor to plan the activities accordingly.
- *Labour Attendance and Safety*—An app based technology will have RFID with GPS installed in helmets can be connected to same app for their attendance as well as location of working—which help engineers also to track activities happening on site.
- With the help of same RFID, location of injured worker can be tracked in remote site area and necessary medical help can be provided.
- *Labour Retention*—To avoid churn/turnover situation, with the data available on app one can try to understand reasons for leaving, Better services and offers to be given, Timely payments, Event initiations, etc. for labour.

5. CONCLUSIONS

The continuance of existing situation of present accommodations, health issues with labours, their negligence and lack of motivation for work will result in delay of every construction project even though it is planned properly.

Even the need to improve the work environment of construction workers by ensuring availability of protective gears, sanitation facilities at the sites along with an accessible, accountable occupational health services is necessary.

Cost of the application can be bear by the Customer i.e. Builder/Contractor and app will be used by Consumer i.e. labours. Also time of application and cost, can be controlled and negligible to the project cost, which is the added benefit for the builder/contractor.

Contractors can be rated as per the labour performance and to improve ratings suggestions can be given. So, overall this digital tool/app will have following benefits for project:

- High chances of conversion of labour.
- No shortage of labour with better scheduling and timely completion of project.
- Word of mouth marketing for project.

ACKNOWLEDGEMENT

This study is based on real-world events and ongoing labour practices in Mumbai's working conditions system. And it was made feasible by the sites and information that select system employees had access to. For giving the pertinent information, I would like to thank Mr. Amol Koujalgi, Ar. Prathamesh Khot, Mr. Dharmesh Sharma, my colleagues, and the construction workers from both the on- and off-site.

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Comparative Study of Alternate Substrate Materials for Live Moss Panels

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ABSTRACT: The selection of a suitable substrate material plays a crucial role in supporting the growth and maintenance of live moss, influencing the overall performance and viability of the panels. This research paper presents an experimental analysis of indoor live moss panels with alternate substrate materials, specifically clay & aerated concrete.

The aim of this study is to compare the performance and suitability of clay & aerated concrete as substrate materials for indoor live moss panels. A quantitative experiment-based research methodology is employed, involving the development of prototype panels using each substrate material. The panels are designed to accommodate the growth of live moss, ensuring optimal conditions for its survival and aesthetic quality. Through controlled environmental conditions, data collection encompasses quantitative measurements of moss retention, weight changes, and cost of substrate material.

The comparative analysis of the collected data will evaluate the performance, practicality, and economic feasibility of the clay & aerated concrete substrate materials. The findings will shed light on their ability to support live moss growth, weight, and cost for indoor environments. The findings will also aid in selecting the preferred material for future indoor live moss installations, advancing the field of sustainable interior design. This research aims to address the practical considerations of weight, cost, and growth support, providing valuable insights for designers, architects, and environmental enthusiasts in making informed decisions for indoor live moss installations.

Keywords: *Moss Panels, Moss, Indoor Plants, Workplace Productivity, Sustainable Interior Design.*

1. INTRODUCTION

The integration of live moss in interior design presents a unique opportunity to bring nature indoors, creating a visually captivating and environmentally friendly ambience. Unlike traditional potted plants or larger-scale green installations, live moss panels offer a compact and versatile solution that can be easily incorporated into various indoor settings, such as offices, residential spaces, and commercial establishments. With their ability to thrive in low light conditions and require minimal maintenance, mosses provide an attractive option for introducing greenery into spaces where natural light is limited, or regular care is challenging.[1]

However, despite the potential benefits, the widespread adoption of live plants in interior spaces has been hindered by practical considerations, primarily related to practicality, availability, weight, and cost. Traditional approaches to constructing green walls or vertical gardens often involve complex structural frameworks and substantial weight, necessitating additional support and extensive modifications to existing buildings. Moreover, the cost of materials and maintenance associated with live moss panels has also been a deterrent to their widespread use. For live moss panels to become a practical and economically viable choice for interior design, it is essential to explore lightweight and cost-effective materials that can provide the necessary support, durability, and visual appeal, while minimizing installation and maintenance expenses.

This research aims to fill this gap by exploring the viability of an indoor live moss panel using lightweight and cost-effective materials, thereby paving the way for a more sustainable and visually appealing approach to indoor green installations.

Aim: This research aims to assess the performance and cost-effectiveness of indoor live moss panel substrate materials.

Objective: The objective of this research is to find a lightweight and economically feasible moss panel substrate material.

[1] https://mossandstonegardens.com

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2. LITERATURE REVIEW

1. Interior Plants May Improve Worker Productivity and Reduce Stress in A Windowless Environment[2] (Lohr, V.I., C.H. Pearson-Mims, and G.K. Goodwin. 1996, J. of Environmental Horticulture 14(2):97-100)
   (a) This study was conducted in a computer lab at Washington State University. Subjects were asked to participate in an experiment to measure stress levels in people using computers. Subjects were randomly assigned to be tested in the computer lab when plants were absent or when they were present. Interior plants, when present, were placed around the sides of the room. Subjects' blood pressure and emotions were monitored while they performed a slightly stressful computer task that measured reaction times in response to seeing and decoding the shape of a simple object on the screen.
   (b) When plants were added to the lab, the subjects were more productive (12% quicker reactions on the computer task) and less stressed (systolic blood pressure lower). They also reported feeling more attentive when the plants were present.
2. **ReSpyre**[3] (a startup from the Netherlands) has developed an innovative –patent pending– bio-receptive concrete solution.
   (a) After hardening, the bio-receptive concrete's surface accommodates the growth of moss. However, the intended purpose for this technology is mainly for external use and is proprietary in nature.

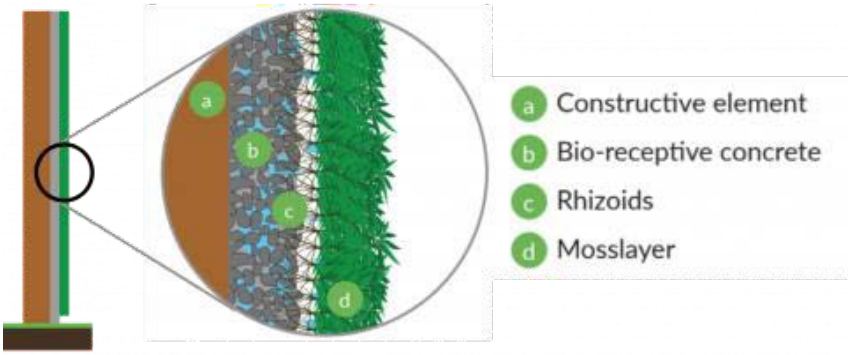

Figure 1: ReSpyre's Bioreceptive Concrete Components

Figure 2: ReSpyre's Bioreceptive Concrete Material

Figure 3: ReSpyre's Bioreceptive Concrete Showing Moss Growth

3. **Artificial Ecosystems**[4] has invented **BryoSYSTEM** which is a self-greening ventilated curtain wall. Behind the component, which can be attached to facades, there is a hidden irrigation circuit that is controlled by an algorithm, so that mosses settle on the surface all by themselves. Behind this is an IoT technology that uses sensors to detect the actual state of the wall. Meteorological data are determined and evaluated. On this basis, the plants can be watered and fertilized as needed.
   (a) This system is very capital-intensive and impractical, and the irrigation system cannot be easily installed everywhere thus not modular.

[2] http://hrijournal.org/doi/pdf/10.24266/0738-2898-14.2.97
[3] https://gorespyre.com/
[4] https://www.5-ht.com/en/media/blog/we-want-to-design-buildings-close-to-nature-in-a-completely-new-way

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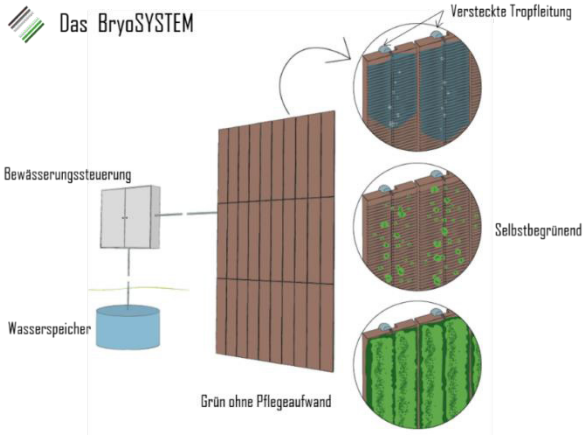

Figure 4: BryoSYSTEM's Components

Figure 5: BryoSYSTEM Live Sample

4. **Mosspure**[5] is an American startup that makes live moss panels with proprietary materials which doesn't require watering or maintenance. This is unproven and needs further clarification.
   (a) A study by Mosspure states that "Certified analytical results for air quality testing show that our 11" × 14" frames captured 42% of carbon dioxide and 1.5 million particulate matter debris in 1–2 minutes. Other air filters on the market can do this in 1–2 hours."[6]

Figure 6: Mosspure Moss Panel Front View

[5] https://www.mosspure.com
[6] https://www.mosspure.com/science-of-live-moss/

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Figure 7: Mosspure Moss Panel Side View

3. MATERIAL AND METHODOLOGY

This research adopts a quantitative experiment-based research methodology to assess the viability of the proposed indoor live moss panel using different substrate materials, specifically clay & aerated concrete. The methodology involves several key steps, including the selection of materials, prototype development, data collection, and data analysis.

1. **Selection of Substrate Materials:** The initial phase of the research involves the careful selection of two different substrate materials: clay & aerated concrete. These materials are chosen based on their distinct characteristics and potential suitability for supporting live moss growth. Clay is known for its porous nature and moisture retention properties, while aerated concrete offers lightweight and insulating properties.
2. **Selection of Moss variety:** Following the selection of substrate materials, the moss variety *Hypnum curvifolium* 'Sheet/Carpet Moss' is selected for the study.
3. **Experimental Setup:**
   (a) Samples of clay and AAC brick.
   (b) Samples placed vertically, perpendicular to the ground.
   (c) Samples placed on the planted surface facing north.
   (d) Samples watered in intervals of 96 hours (4 days)
4. **Data Collection:** The data collection parameters are as follows:
   (a) Dry weight (in kg)
   (b) Wet weight (in kg)
   (c) Moss retention (in days)
   (d) Cost (in Rs)

3.1 Scope and Limitations

(a) The experiment is only conducted on two samples, namely Clay and Autoclaved aerated concrete (AAC).
(b) The experiment is only conducted on 1 moss variety, namely *Hypnum curvifolium* 'Sheet/Carpet Moss'.
(c) The water used for the experiment is civic supply tap water.
(d) The findings of the study only apply to the regions of India with a coastal climate.

4. RESULTS AND DISCUSSION

Experiment findings:

1. A Sample of *Hypnum curvifolium* 'Sheet/Carpet Moss' was ordered from an online retailer.
2. The hypnum moss sample was applied on an AAC and clay brick on 01.10.2023.
3. On the AAC block, initial growth was observed but the moss sample became dormant after 9 days. Sample has shown some indications of revival after 20.11.2023 but not significant enough to be considered as live.
4. On the Clay brick, the sample is thriving 80 days from date of application.

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Figure 8: Author's Experiment on AAC Block

Figure 9: Author's Experiment on Clay Brick

5. Data Collection

Parameters	*Aerated Concrete Block*	*Clay Brick*
1. Dry weight (in kg)	0.87	1.14
2. Wet weight (in kg)	1.48	1.76
3. Moss retention (in days)	9	80
4. Cost (in Rs)	45	12

6. CONCLUSION

From the conducted experiment of 80 days (1.10.2023–20.12.2023), following are the observations and conclusions:

1. The dry weight (i.e. weight of sample before moss planting and watering) of AAC block is lesser due to it being more porous than clay sample, however the same reason increases its wet weight (i.e. weight of sample after moss planting and watering) as the absorption is higher.
2. The moss retention of clay is found to be much higher than AAC sample in this experiment.
3. The cost of AAC sample is much higher due to a higher manufacturing cost.
4. So from this experiment we can conclude that even though the clay sample is heavier than the AAC sample, the moss retention and cost advantage of the clay sample make it an objectively better material for use in a live moss panel.
5. However, more detailed study needs to be done as the number of samples and duration of experiment are not large enough to reach a definite conclusion.
6. Future scope of study may involve different samples of mosses and substrate materials to be able to gather more data.

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Enhancing New Employee Engagement and Productivity in Construction Industry

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ABSTRACT: This research paper aims to investigate the factors that contribute to the success and performance of new employees in organizations. The onboarding and integration of new employees are critical stages. This study synthesizes existing literature on various aspects of new employee success and performance management, including recruitment and selection, onboarding, training and performance evaluation processes.

The research methodology employed in this study is a comprehensive review and analysis of academic articles, and case studies. The findings of this study shed light on the strategies and interventions that can enhance the effectiveness of organizations in managing new employees and fostering their productivity and engagement.

The results reveal that effective recruitment and selection processes play a crucial role in identifying individuals who possess the necessary skills, knowledge, and cultural fit. A structured orientation program significantly impacts new employees' socialization, job satisfaction.

Performance management systems that provide clear performance expectations, regular feedback, and opportunities for growth and development are instrumental in driving new employees' success and performance. Additionally, the role of organizational culture, leadership, and peer support in facilitating new employee integration and engagement is highlighted.

Keywords: *New Employee, Success, Performance Management, Onboarding.*

1. INTRODUCTION

In the demanding construction industry, productivity and employee engagement are vital for success and growth. A motivated workforce improves outcomes, cuts costs, and increased customer base. However, challenges like skill gap, physical strains hinder engagement. To overcome these, companies must adopt a comprehensive approach focusing on training, rewards, and inclusivity.

2. BACKGROUND STUDY

Performance management: A system to measure, monitor, and improve employee performance.

It aligns individual goals with organizational objectives, boosts employee productivity and job satisfaction and helps to drive business success.

Key components include Goal setting: Clear, specific goals for employees. Performance evaluation: Regular assessment against criteria.

Feedback and coaching: Ongoing guidance and support.

Development and training: Opportunities to learn and grow. Enhances employee performance, engagement, and organizational success. By fostering a productive and engaged workforce, results in improved outcomes, lower costs, and happier customers.

Aim: The key aim of this research is to investigate and analyze the factors that contribute to the productivity and retention of new employees within the organization of construction industry.

Objectives: To analyze the impact of onboarding and orientation programs on new employee integration, job satisfaction, and retention.

- To evaluate the effectiveness of performance evaluation processes in managing and improving new employee performance.

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Scope: This research focuses on the management of new employees' success and performance within organizations. It encompasses the onboarding, training and the retention process

Limitations: Generalizability: The findings of this research may not be universally applicable.

Time Constraints: The research is conducted within a specific timeframe, and the dynamics of new employee success and performance management may continue to evolve.

3. LITERATURE REVIEW

Table 1: Highlights Key Takeaway from Various Existing Research Papers

Sr. No.	Title	Author	Year	Key Takeaway
1	Bauer, T. N., & Erdogan, B. (2011). Organizational socialization(2011)	Bauer, T. N., & Erdogan, B.	2011	The authors highlight the significance of structured onboarding programs that provide clear expectations, social support, and opportunities for skill development in facilitating new employee success and integration into the organization.
2	Srivastava, P., & Bhatnagar, J. (2010). Performance management practices in Indian companies: An empirical exploration. Indian Journal of Industrial Relations, 45(3), 450-466.	Srivastava, P., & Bhatnagar, J.	2010	Data was collected through a survey from a sample of companies across different industries in India. The research highlights the potential impact of **effective performance management** on organizational performance, productivity

Table 1 by author.

The table highlights the importance of a structured onboarding process that comprises of clear expectations and proper training results in employee and organizational success. There is a positive impact of effective development and training facilities. It depicts that effective performance management techniques impact the organization as a whole.

Table 2: Review of Various Existing Literature Research Papers

Sr. No.	Title	Author	Year	Key Takeaway
3.	Saks, A. M., & Gruman, J. A. (2014). What do we really know about onboarding programs? It's time to take a closer look.	Saks, A. M., & Gruman, J.	2014	Research on onboarding programs, aiming to understand their effectiveness. The authors discuss different components and practices commonly included in onboarding programs, such as orientation, **training, and mentoring**.
4.	The widening skills gap in construction and the road toward improvement by Star Building Systems	Star Building Systems	2021	The organization notes, "Firms are boosting pay, adding new benefits and taking other steps to make construction careers even more rewarding. They are launching new training programs and expanding existing ones. They are adopting new technologies and new techniques to increase productivity."

Table 2 by author.

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The table highlights the practices commonly included in onboarding programs, such as orientation, training, and mentoring. Effective onboarding leads to effective organizational outcomes. There is a skill gap in the fresh graduates. Firms are boosting the training and development programs for better productivity.

4. RESEARCH METHODOLOGY

1. **Problem Identification:** Observed low engagement and productivity among new employees in construction industry. Negative impacts on project efficiency, retention, and talent attraction.
2. **Research Questions:** What factors influence new employee engagement and productivity in construction? What interventions are effective in enhancing engagement and productivity?
3. **Mixed-Methods Approach:**

   Quantitative Surveys: Gather data from existing literature of construction firms and new employees on: Engagement levels (e.g., job satisfaction, motivation).

   Perceptions of key influencing factors (e.g., training, communication, leadership).

   Case Studies: Analyze successful employee engagement initiatives implemented by construction companies. Identify best practices and practical interventions
4. *Data Analysis:* Quantitative data: Statistical analysis to identify correlations and trends

5. RESULTS AND CONCLUSION:

Synthesize the findings of the research.

5.1 Need for Performance Management

The performance of new employee architects and civil engineers in India is a serious issue for the construction industry.

Survey Methodology: A questionnaire was developed to collect data on the performance of new employee architects in India. The questionnaire was distributed to a sample of 100 architecture firms in India.

5.1.1 *Survey Findings*

The survey findings indicate that new employee architects in India are underperforming. The following are some of the key findings:

- New employee architects are not meeting expectations. 80% said that new employee architects are not meeting expectations.
- New employee architects are not producing high-quality work.
- 70% said that new employee architects are not producing high-quality work. New employee architects are not meeting deadlines.
- 60% said that new employee architects are not meeting deadlines. Factors Contributing to Underperformance:
- Lack of training and development. 50% said that their firms do not provide adequate training and development for new employee architects.
- Lack of mentorship. 40% said that their firms do not provide mentorship programs. Unrealistic expectations. 70% said that expectations for new employee are unrealistic.

5.1.2 *Recommendations*

- Architecture firms should provide more training and development for new employee architects.
- Architecture firms should provide mentorship programs for new employee architects.
- Architecture firms should set realistic expectations for new employee architects. This will help to reduce stress and improve performance.
- Retaining and Developing Talent.

Overall, performance management of new employees training is necessary to set expectations, monitor progress, identify strengths and weaknesses, provide feedback and coaching, motivate and engage new employees, and retain and develop talent.

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5.1.3 *Case Study*

Larsen & Toubro (L&T) uses a performance management system called "L&T People Excellence Model" (LPEM). LPEM is a comprehensive system that covers all aspects of employee performance, including goal setting, performance reviews, development planning, and compensation and benefits.

Shapoorji Pallonji Group uses a performance management system. SPG PMS is a system that is based on the Balanced Scorecard framework. It focuses on measuring employee performance against four key perspectives: financial, customer, internal processes, and learning and growth.

DLF Limited uses a performance management system called "DLF Performance Management System" (DPMS). DPMS is a system that is based on the 360-degree feedback framework. It involves collecting feedback from the employee's manager, peers, and customers.

Results: The research on enhancing new employee engagement and productivity in the construction industry yields low engagement levels.

They struggle with engagement, leading to decreased productivity, satisfaction, and retention. This can be attributed to factors like:

- ***Lack of training and development:*** New employees often feel unprepared for the demands of the job and lack the necessary skills and knowledge.
- ***Poor communication and leadership:*** Unclear expectations and lack of feedback ***Demanding work environment:*** Long hours, physical labor, and unpredictable schedules
- ***Limited career advancement opportunities:*** Perceived lack of career growth can demotivate new employees and lead them to seek opportunities elsewhere.
- ***Positive impact of engagement strategies:*** Increased development and training: Providing relevant training and development programs can equip new employees with the skills they need to succeed, boosting their confidence and performance.
- ***Effective communication and leadership:*** Open communication, clear expectations, and supportive leadership foster a positive work environment that encourages engagement and collaboration.
- ***Improved work-life balance:*** Implementing flexible work arrangements and promoting healthy work-life balance can reduce stress and improve employee well-being, leading to increased engagement.
- ***Career development opportunities:*** Providing clear career paths and opportunities for advancement can motivate new employees and encourage them to stay with the company.

6. CONCLUSION

The construction industry faces a challenge in winning and retaining new employees. By understanding the factors hindering engagement and implementing targeted strategies, companies can foster a more positive and productive work environment for new hires. This can lead to numerous benefits, including:

Improved productivity and project efficiency: Engaged employees are more productive, leading to faster project completion and improved cost-effectiveness.

Reduced employee turnover: Better engagement leads to higher employee satisfaction and retention, reducing the costs associated with recruiting and training new employees.

Improved innovation and problem-solving: Engaged employees are more creative and innovative, contributing to better problem-solving and improved project outcomes.

Attract and retain top talent: A optimistic and engaging work environment makes the construction industry more attractive to potential employees, enabling companies to attract and retain top talent.

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Analysis of Existing Walling Material with Respect to Embodied Carbon Footprint

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ABSTRACT: The Construction sector is a major contributor to the emissions of pollutant gases, which are responsible for the health damage and effects of climate change where Concrete is the most utilized construction material as compared to the other materials. Concrete in construction is widely used because of its simple availability of ingredients, durability, and cost-effectiveness. However, construction contains cement, which emits a significant amount of carbon dioxide (CO_2) during its production. The concrete industry and its construction impact the global environment quite badly. India is a country with a rapidly growing construction sector and significant cement production. As the second-largest cement producer globally, India's concrete industry contributes to embodied carbon emissions. Thus, to overcome these serious issues, sustainable and alternate material solutions are very necessary.

The resolution defines embodied energy as the total energy used in the production, transportation, construction, and maintenance of a building material. Calculating embodied energy is a comprehensive approach to measuring the environmental sustainability factor, as reducing embodied energy contributes to reducing environmental pollution.

Hence, the research will be done on the basis of various existing wall materials, and their embodied carbon emissions.

Keywords: *Construction, Cement, Embodied Energy, Carbon Dioxide.*

1. INTRODUCTION

The analysis of embodied carbon footprint in existing walling materials is a crucial aspect of sustainable construction practices. Understanding and minimizing embodied carbon is essential for mitigating the environmental impact of construction projects and achieving sustainable development goals. In the context of walling materials, which form a significant part of a building's structure, analyzing their embodied carbon footprint becomes particularly important.

The total carbon emissions in buildings are classified into embodied and operational carbon emissions. This embodied carbon emission is represented as emission by the material used in construction; In embodied carbon, the role of emission is huge and should be controlled before the construction of the building, because, once used, the materials in the building may not be easy to replace with low carbon materials. Construction and building generate around 40% of carbon footprint.

Hence, analyzing the carbon footprint of existing wall materials is an important step towards more economical and environmentally friendly construction practices. It empowers Architects, and builders to make informed decisions that promote a low-carbon future.

2. BACKGROUND STUDY

2.1 Net Zero Target—India Heads Up for Cut Down Its Emission to Net Zero. How can We Help?

The issue of rising carbon footprint is global in nature, a meeting was convened in Glasgow in which India participated and presented its **'Panchamrit'** scheme to achieve five major climate targets.

India presented its **'Panchamrit'** to achieve five major climate targets.

- Net zero emissions by 2070.
- Up to 2030, India wants to fulfill its 50% energy requirements from renewable energy.
- By 2030, Up to 1 billion tons of total projected carbon emissions should be reduced.
- 45% reduction of carbon intensity by 2030.
- To reach the target by 2030 of 500GW of non-fossil energy capacity.

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The Indian Climate Assessment Report (ICAR), released by the Ministry of Earth Sciences (MoES), provides a comprehensive assessment of climate change in India.

According to the India Climate Assessment Report, India's average annual temperature has increased by about 0.7°C since 1901. This warming trend is projected to continue, with an average annual temperature rise of 2.5°C to 4°C by the end of the 21st century.

The data indicates a growing trend in global average surface temperatures (global warming) caused by human- caused greenhouse gas emissions. Based on numerous independently produced datasets, the global average and combined land and ocean surface temperature show a rising of 1.09°C (range: 0.95 to 1.20°C) from 1850–1900 to 2011–2020. The trend has been faster since the 1970s than in any other 50-year period over at least the last 2000 years.

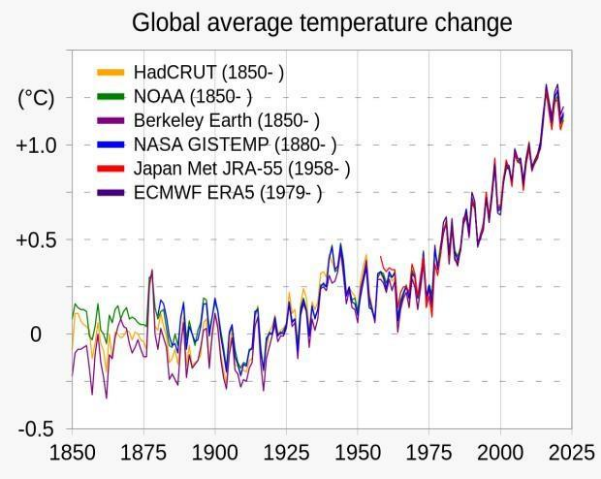

Figure 1: Shows Global Average Temperature Change

Source: https://web.archive.org/web/20230526033427/https://climate.metoffice.cloud/temperature.html

Graphs from many scientific organizations illustrating the connection of recorded world average temperature.

Here are some of the key findings of the ICAR report:

- India's average annual temperature has increased by about 0.7°C since 1901.
- This warming trend is likely to continue, with average temperatures projected to rise by an additional 1.5°C to 2.5°C by the end of the 21st century.
- India is already experiencing the impacts of climate change, such as more extreme weather events, rising sea levels, and changes in precipitation patterns.
- These impacts are expected to become more severe in the future.
- India is a significant contributor to global greenhouse gas emissions.
- The country's emissions have been growing rapidly in recent years, and are projected to continue to grow in the future.
- India needs to take urgent action to address climate change.

The ICAR report also found that India is a significant contributor to global greenhouse gas emissions. The country's emissions have been growing rapidly in recent years, and are projected to continue to grow in the future.

The report concludes that India needs to take urgent action to address climate change. This involves lowering greenhouse gas emissions, investing in renewable energy, and adjusting to climate change effects.

- As stated by the **Intergovernmental Panel on Climate Change (IPCC),** the largest contributor to global warming is the increase in atmospheric carbon dioxide (CO_2) since 1750, particularly from fossil fuel consumption, cement manufacture, and land use changes such as deforestation.

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Table 1: News Articles

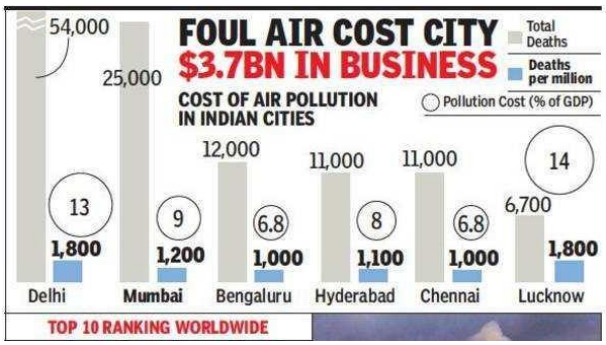

Figure 2

In all six big cities: New Delhi, Bengaluru, Hyderabad, Chennai & Lucknow, an estimated 1.2 lakh deaths were seen to have been caused by air pollution.

Figure 3: The lack of checks at the construction site kicks up dust, making Mumbai ill.

Source: http://timesofindia.indiatimes.com/articleshow/81099733.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

Source: http://timesofindia.indiatimes.com/articleshow/97410281.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

Aim: Analysis of Existing Walling Material with respect to Embodied Carbon footprint.

Objectives:

- To quantify the embodied carbon footprint of walling materials.
- To compare the embodied carbon footprint released from different walling materials—This will allow for the identification of materials with low carbon footprints.

Scope

- This research will focus on the immersion of the embodied carbon footprint of existing walling materials.
- This research will consider the carbon footprint of various materials from cradle to factory gate phase only.

2.2 Limitation

- This research will not consider the carbon footprint of other building elements such as foundations, roofs, and slabs.
- The research will also not consider the operational carbon of buildings which is the carbon dioxide emissions associated with the energy used to heat, cool, and light buildings, and transportation of materials.

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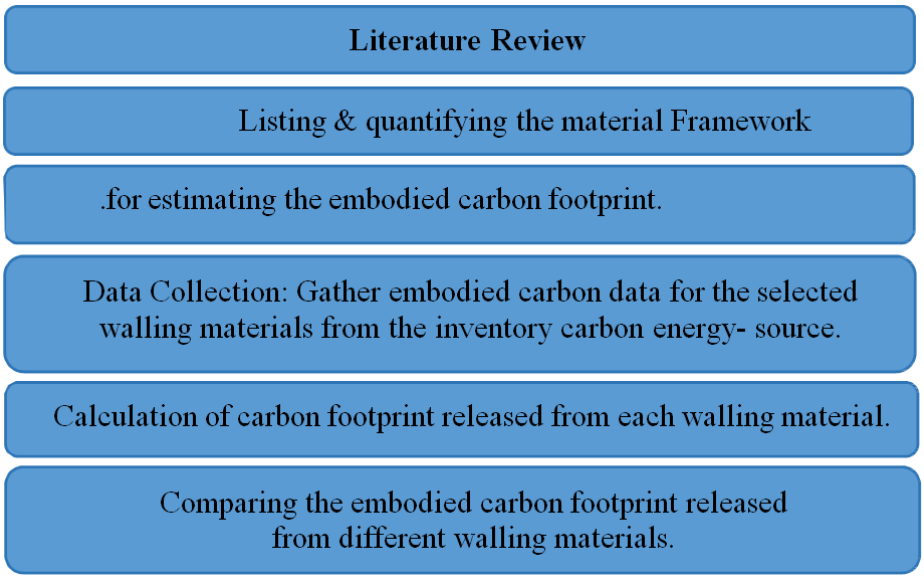
- The analysis of this research will be limited to the cradle-to-gate (factory) phase.
- The research on embodied carbon for walling materials will be limited, particularly for specific regions (Mumbai, India).

3. METHODOLOGY



4. LITERATURE REVIEW

Understanding carbon footprint-Carbon footprint refers to the total amount of greenhouse gases, particularly carbon dioxide (CO_2), emitted directly or indirectly by an individual, organization, event, or product throughout its lifecycle. It is a measure of the impact of human activities on the environment in terms of greenhouse gas emissions. The carbon footprint is typically measured in metric tons of CO_2 or CO_2 equivalents (CO_2e), which account for the impact of other greenhouse gases like methane (CH_4) and nitrous oxide (N_2O) by converting them into their CO_2 equivalent based on their global warming potential.

4.1 Definition

- **Cradle:** The cradle is defined as being the earth, i.e. material deposits within the ground.
- **Cradle-to-gate:** Encompasses all input and output flows (as applicable from the system boundaries) between the confines of the cradle up to the factory gate of the final processing operation.
- **Embodied Carbon (EC):** Embodied carbon is the sum of fuel related carbon emissions (i.e. embodied energy which is combusted—but not the feedstock energy which is retained within the material) and process-related carbon emissions (i.e. non-fuel related emissions which may arise, for example, from chemical reactions). This can be measured from cradle-to-gate, cradle-to-grave, or from cradle-to grave.

Reference: Embodied Carbon—The Inventory of Carbon and Energy (ICE).

Table 2: Literature Review—Article

Article No, 1

Article No, 2

TITLE: Environmental Impact and Carbon Footprint Assessment of Sustainable Buildings: An Experimental Investigation

TITLE: Actions to reduce carbon footprint in materials to healthcare buildings

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Published: 31 March 2022

Author: Juan Pablo Carrasco-Amador , Jose Luis Canito- Lobo, Alberto Casta, no-Liberal, Jesús Manuel Rodríguez-Rego, Manuel Matamoros-Pacheco **Published:** 2022

Conclusion: This article deals with carbon emission of residential building constructed with conventional material in and around Chennai which lead to increase in global warming and climate change .life cycle assessment is used as a tool for accessing life cycle of materials and environmental impact. The assessment is based on Manufacturing, operations, transportation, and life span- end. So the study of the method is done by examining residential building was constructed in Chennai with conventional materials.

Conclusion: In this article, a comparative study was made between two similar buildings. One of the buildings is a concrete structure and the other a metal structure to determine the carbon footprint of the materials used. To determine the carbon footprint, the buildings were first designed and their structures calculated. The 3D dimensioning of the buildings was done with a data model, which was used to measure the materials used in the construction of the building. Budgets were drawn up to determine the costs of the two buildings, and the emissions of the materials and objects that make up each building were inventoried.

5. MATRIX

Let's Assume a wall size of 3 m × 3 m × 0.15 m

5.1 Reinforced Concrete Wall

The concrete mix design is C25/30. The concrete density is 2,400 kg/m³.

The reinforcement density is 7,850 kg/m³. 100 kg of rebar per m cube concrete.

Calculations

volume of concrete:

volume = length × wall height × wall thickness volume = 3 m × 3 m × 0.15 m

volume = 1.35 m³

Mass of concrete:

Mass = concrete volume × concrete density Mass = 1.35 m³ × 2,400 k g/m³

Mass = 3,240 kg

The embodied carbon of the concrete in the wall = 3240 kg × 0.113 kg CO_2/kg = 366.12 kg CO_2. volume of Steel:

The volume of steel is 0.01 × 1.35 m³ = 0.0135 m³.

The mass of the steel in the wall is 0.0135 m³ × 7850 kg/m³ = 106 kg.

The embodied carbon of the steel in the wall = 106 kg × 2.77 kg CO_2/kg steel = **293.62 kg CO_2.**

Total carbon footprint = 366.12 kg CO_2 + 294.58 kg CO_2 = **660.7 kg CO_2**

Therefore, the total embodied carbon of the reinforced concrete wall from cradle to gate phase = 660.7 kg CO_2. 5.2 AAC Blocks- Autoclaved Aerated Concrete

Calculation:

AAC blocks with a density of 600 kg/m^3.

No. of Blocks required - 0.6 × 0.2 × 0.15 = 0.018 m³

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1.35 m³/0.018 = **75**

Volume of AAC block- 0.6 × 0.2 × 0.15 = 0.018 m³ Mass of AAC block- 0.018 m³ × 600 kg/m³ = 10.8 kg/m³

The embodied carbon footprint of the AAC block wall = **10.8 kg × 0.3 kg CO_2 /kg × 75 = 243 kg CO_2 .**

5.3 Calcium Silicate Board

Calculations:

The density of calcium silicate board is 1400 kg/m³. The density of the Aluminium pipe is 2700 kg/m³.

The density of insulation is 20 kg/m³. (12 Kg/M3 – 48 Kg/M3)

Volume of each material:

Volume of 1 calcium silicate board = 2.4 m × 1.2 m × 0.15 m = 0.432 m³ Volume of 1Aluminium pipe = 0.55 × 0.40 × 3 = 0.66 m³

Volume of insulation = 3 m × 3 m × 0.15 m = 1.35 m³

Mass of each material:

Mass of calcium silicate board = volume × density = 0.432 m³ × 1400 kg/m³ = 604.8kg Mass of 1 aluminium pipe = volume × density = 0.66 × 2700 kg/m³ = 1782 kg

Mass of insulation = volume × density = 1.35 m³ × 20 kg/m³ = 27 kg

Embodied carbon footprint of each material:

Calcium silicate board = Mass × Carbon footprint = 604.8 kg × 0.13 kg CO_2/kg × 6 = 471.74 kg CO_2 Aluminium pipe = Mass × Carbon footprint = 1782 kg × 1.45kg CO_2/kg × 8 = 20671.2 kg CO_2 Insulation = Mass × Carbon footprint = 27 kg × 1.35 kg CO_2/kg = 36.45 kg CO_2

Total Embodied carbon footprint:

Total carbon footprint = carbon footprint of calcium silicate board + carbon footprint of Aluminium pipe + carbon footprint of insulation = 471.74 + 20671.2 kg CO_2 + 36.45 kg CO_2 = **21179.39 kg CO_2**

5.4 Fibre Cement Board

Calculations

The density of fibre cement board is 1355 kg/m^3. No. of fibre cement board required = 6

The density of Aluminium pipe is 2700 kg/m³.

The density of insulation is 20 kg/m³. (12 Kg/M3 - 48 Kg/M3)

Volume of each material:

Volume of 1 Fibre cement board = 2.4 m × 1.2 m × 0.18 m = 0.51 m³ Volume of 1 Aluminium pipe = 0.55 × 0.40 × 3 = 0.66 m³

Volume of insulation = 3 m × 3 m × 0.15 m = 1.35 m³

Mass of each material:

Mass of Fibre cement board = volume × density = 0.51 m³ × 1355 kg/m³ = 691.05 kg Mass of 1 aluminium pipe = volume × density = 0.66 × 2700 kg/m³ = 1782 kg Mass of insulation = volume × density = 1.35 m³ × 20 kg/m³ = 27 kg

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Embodied carbon footprint of each material:

carbon footprint of Fibre cement board = Mass ×Carbon footprint = 691.05 kg ×1.09 kg CO_2/kg × 6 = 20671.2 kg CO_2 carbon footprint of aluminium pipe = Mass × Carbon footprint = 1782 kg × 1.45 kg CO_2/kg × 8 = 2619.54 kg CO_2 carbon footprint of insulation = Mass × Carbon footprint = 27 kg × 1.35 kg CO_2/kg = 36.45 kg CO_2

Total carbon footprint:

Total carbon footprint = carbon footprint of Fibre cement board + carbon footprint of Aluminium pipe + carbon footprint of insulation = 753.24 + 20671.2kg CO_2 + 36.45 kg CO_2 = **21460.89 kg/CO_2**

Table 3: Comparative Table of Existing Walling Material

Reinforced Concrete Wall	*AAC Block*	*Calcium Silicate Board*	*Fibre Cement Board*
660.7 kgCO_2.	243 kg CO_2 .	21179.39 kg CO_2	21460.89 kg CO_2

In conclusion, when comparing the carbon emissions associated with different building materials, it shows that fibre cement board and calcium silicate board walls release a higher amount of carbon compared to AAC (Auto claved Aerated Concrete) block walls and reinforced concrete walls. This is because it includes Aluminium pipe for constructing walls which contribute to higher emissions of carbon during production and installation.

However, it is crucial to understand that aluminum constructions, despite having a greater emission rate than concrete, but it exhibit certain environmental advantages. This is primarily due to fact that aluminum/steel structures require fewer tonnes of material and have faster construction times & it is also recyclable whereas concrete creates major waste both during construction and demolition and the concrete waste is very difficult to dispose and it pollutes the environment, hence, Although Aluminium has a greater emission rate than concrete, it should be noted that the use of aluminum pipe in construction pollutes the environment less than concrete structures therefore they have a smaller environmental effect overall as they are recyclable.

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Fenestration Retrofitting as a Solution to Achieve EnergyEfficiency for School Buildings

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ABSTRACT: Climate change is a major challenge faced around the world. In Mumbai, India, rising temperatures is already having a significant impact on the city's buildings and infrastructure. As temperatures continue to climb, the demand for air conditioning is expected to increase, which could lead to higher carbon emissions and energy consumption.

One way to mitigate these impacts is to enhance energy efficiency in buildings. Fenestration, or the window and glazing system, is a key component of building energy performance. Fenestration can have a significant impact on both heating and cooling loads, as well as day lighting and indoor environmental quality (IEQ). IEQ is a holistic concept that encompasses factors beyond just temperature, such as air quality, humidity, lighting, and acoustics. A comfortable and healthy indoor environment is essential for occupant comfort, productivity, and well-being. Fenestration can play a significant role in supporting IEQ by providing access to daylight and fresh air, while also controlling heat gain and loss. In the context of Mumbai, it is particularly important to consider the interconnected aspects of energy efficiency and IEQ in sustainable building design and operation. By carefully selecting and designing fenestration systems, architects and engineers can help to reduce energy consumption, improve indoor comfort, and mitigate the impacts of climate change.

Keywords: *Energy Efficiency. Fenestration, Shading Devices, Retrofitting, Occupant Comfort & Indoor Environment Quality.*

1. INTRODUCTION

1.1 Background Study

1.1.1 *Climatic Condition of Mumbai Region*

In Mumbai, the capital of the state of Maharashtra, the climate is tropical, hot all year round, with a long, sunny season from early/mid-October to early June and rainy season from June to September. Also in the pre-monsoon period, from March to May, the heat becomes intense, such that the temperature can sometimes reach 38/40°C (100/104°F); this partly happens also in the period after the monsoon, in October and November, when it can reach 36/38°C (97/100°F).

In winter, from the month of December to February, the weather is normally hot and sunny. During the day also it gets sometimes very hot, in fact, the temperature can reach 35/36°C (95/97°F) at night, it normally returns below 20°C (68°F), and from time to time, it can even drop below 15°C (59°F): it is better to bring a sweatshirt for safety. The above data shows average temperatures from year 1991 to 2021 which includes Min. Temperature °C (°F), Max. Temperature °C (°F), Precipitation/Rainfall mm (in), Humidity, Rainy days. The relative humidity with the month that shows the highest level is July month with a percentage of 57.22. And, December has recorded as having the lowest amount of relative humidity at only 57.22.

1.1.2 *71% of Green House Gases is Due to Electricity Usage*

Published in—Hindustan times, Published on - 27 August 2021,Written by - Prayag Arora-Desai, Mumbai

The majority contribution of the energy sector is not surprising, as the high domestic demand for power, along withthe fact that 95% of all electricity consumed in Mumbai is entirely coal-based. A staggering 71% of the city's greenhouse gas (GHG) emissions can is due to the energy sector, according to a recent analysis by the World Resources Institute (WRI) India. Electricity generated by thermal power plants in the peri-urban areas, in turn, consumed within the boundaries of the Mumbai city and suburban districts, emitted a total of 24,235,804 tonnes of carbon dioxide equivalent (tCO2Eq) GHGs in 2019. Of the emissions within this 71% bracket, the residential electricity usage makes up 55%, while 45% comes from the commercial and institutional sources, and 4% from industries.

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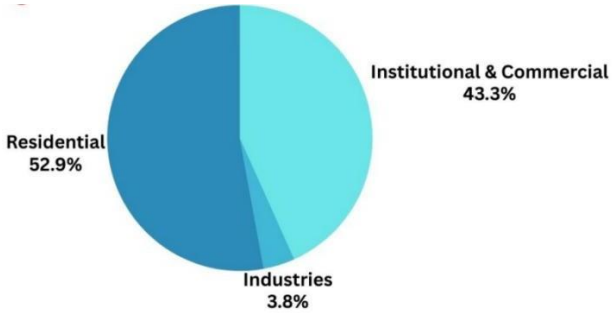

Figure 1: Percentage of Electricity Usage Sector Wise (survey from HT)

The role of greenhouse gases (GHG) in global warming is well documented, and there is an increasing amount of meteorological evidence to demonstrate the effects of global warming in Mumbai. According to data which we got from the India Meteorological Department's automatic weather station, the city has recorded annual mean temperature higher than normal for 14 consecutive years, since the year 2007. The ambient temperature trend analyse by World Resources Institute (WRI) using IMD data over the past 47 years shows a steady increase in night time temperatures throughout the year. Also, the winter months of November to February are warming up at a fast pace.

1.1.3 *Impact of One Air Conditioner on Environment*

The impact of using one air conditioner in India can vary based on factors such as the type of air conditioner, its efficiency, the local climate, and the energy source.

Here are some approximate numbers—Energy consumption per hour is 1.8 kW and Carbon Emissions per hour is 0.80 kg.

Energy Consumption:

Air conditioners require significant amount of electricity to for its operation. The energy used for cooling contributes to the demand on power grids, often relying on fossil fuels for electricity generation.

Increased energy consumption leads to higher carbon dioxide (CO_2) emissions if the electricity is generated from fossil fuels, contributing to climate change.

Greenhouse Gas Emissions:

The manufacturing, transportation, and disposal of air conditioners contribute to greenhouse gas emissions. This includes emissions associated with the production of materials, assembly processes, and transportation of the units.

The energy consumption of air conditioners also indirectly contributes to greenhouse gas emissions if the electricity is produced from fossil fuels.

Heat Island Effect:

The continuous operation of air conditioners in urban areas can contribute to the urban heat island effect. Heat generated from the cooling process is released outdoors, leading to elevated temperatures in the immediate surroundings

1.1.4 *Interconnection between Fenestration, Energy efficiency and indoor environment quality*

In Figure 2 we can see that, Fenestration, encompassing windows, doors, and skylights, serves as a pivotal link between energy efficiency and indoor environmental quality in building design. Strategically designed fenestration can significantly influence a structure's energy efficiency by minimizing heat transfer and optimizing natural light utilization. Energy-efficient windows, equipped with advanced materials and coatings, play a crucial role in reducing the need for artificial heating or cooling. Simultaneously, fenestration profoundly impacts indoor environmental quality.

Thoughtfully positioned windows not only enhance day lighting, positively influencing occupant well-being and productivity but also promote natural ventilation, thereby improving indoor air quality. The integration of energy-efficient practices, help to reduced energy consumption and maintaining a comfortable indoor environment. Achieving an optimal balance

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between maximizing natural light, minimizing heat gain or loss, and ensuring energy efficiency requires a holistic approach from the initial stages of building design, fostering sustainability, occupant comfort, and environmental responsibility.

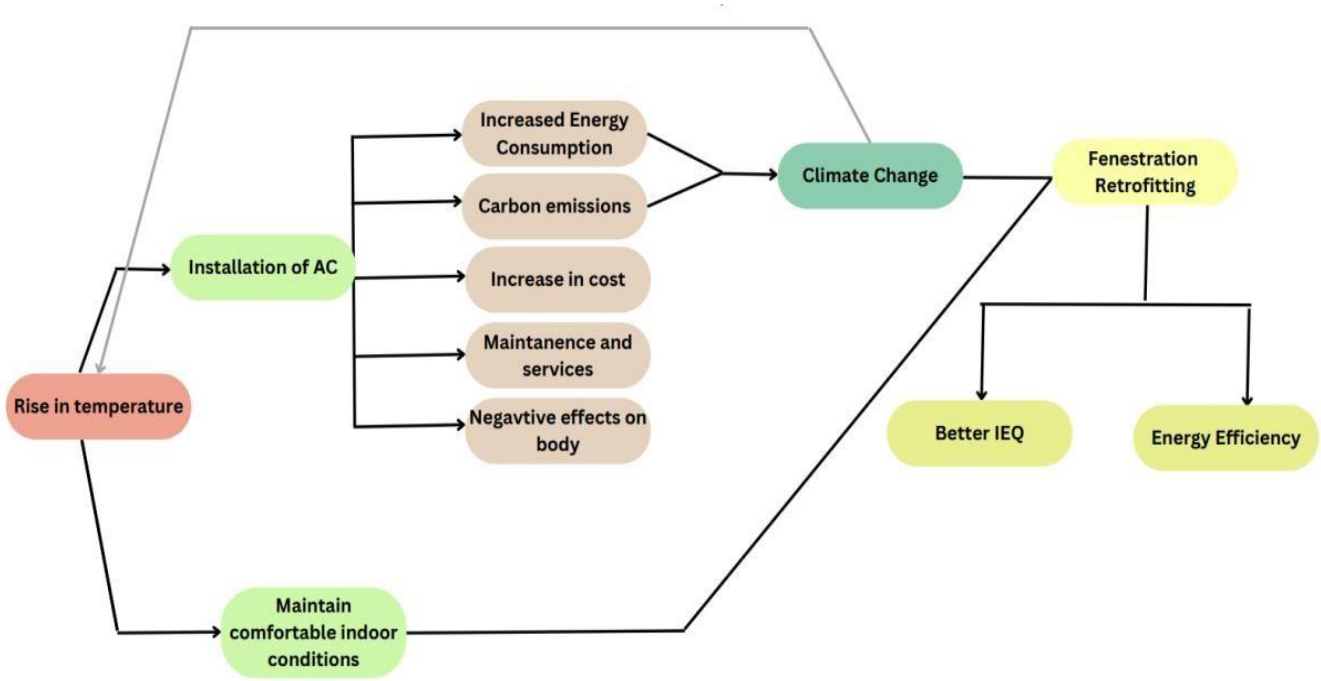

Figure 2: Interconnection between Fenestration, IEQ & EE (By Author)

1.2.1 *Aim*

This study aims to investigate and implement fenestration retrofitting strategies for an existing school buildings to improve energy efficiency.

1.2.2 *Objectives*

To investigate advanced fenestration technologies and design strategies that can contribute to improved indoor environmental quality and energy efficiency.

- To perform a comprehensive cost-benefit analysis that considers the initial investment, operational savings, and long-term benefits of fenestration retrofitting in educational buildings.
- To develop practical guidelines and best practices for fenestration retrofitting in educational buildings that can be applied tosimilar projects.

1.2.3 *Scope*

To promote awareness and education about the benefits of fenestration retrofitting in improving indoor environments and contributing to energy efficiency in educational facilities.

1.2.4 *Limitations*

This study does not cover colleges and universities.

1.2.5 *Methodology*

- In the city like Mumbai we see rise in temperature due which most of schools are opting to install Air conditioning to maintain cooler indoor climate and increase the comfort level of students, instead it is better to look at various fenestration retrofitting options for better Indoor environment quality and energy efficiency.
- Identifying areas of improvement for fenestration retrofitting and conclusion

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2. ARTICLES

2.1.1 Navi Mumbai: Parents Demand Air Conditioned Classroom in NMMC Run Schools

Author	*Published in*	*Published on*	*Takeaways*
Amit Srivastava	Free Press Journal	13 July 2023	• We are aware, the temperatures and humidity in Navi Mumbai are also quite high, particularly during the summer and monsoon months. • Classrooms without air conditioning can become unbearably hot, making it difficult for students to concentrate on their studies. • This can have a significant impact on students academic performance and overall well-being of students. • The parents say that—It is a need to consider installing air conditioning units in all classrooms across the NMMC schools to ensure that students have access to a comfortable learning environment. • This will not only benefit the students but also the teachers and other staff who work to provide quality education.

3. LITERATURE REVIEW

3.1.1 *Indoor Air Quality and Health in Schools: A Critical Review of Developing the Road Map for Future SchoolEnvironment*

Author	*Published in*	*Published on*	*Takeaways*
Anonymous	Science direct journal of building engineering	1 October 2022	• Building materials which include paints, coatings, adhesives, sealants, and furniture that may emit volatile organic compounds (VOCs), substances that vaporize at room temperature and can cause health problems. • Combustion processes in HVAC equipment, fireplaces and vehicles in garages or near entrances. • Mold resulting from moisture in building materials. • Cleaning materials. • Radon or methane from the soil underneath the building. • Pollutants tracked in the occupants shoes. • If the space is polluted with VOC the Air Conditioner is likely to worsen the situation. Due to the fact that AC's recycle the indoor air without purifying unclean air decreasing IEQ.

3.1.2 *A Review on Indoor Environment Quality of Indian School Classrooms*

Author	*Published in*	*Published on*	*Takeaways*
Kishor. S. Kulkarni, Anuj Kumar, Tabish Alam & Ashok Kumar	Mdpi journal on sustainability	27 October 2021	• The assessment of IEQ in school classrooms is important as students and teachers spend 4–8 h during weekdays in schools, which is one-third of their total time. • Children are the most sensitive group which are severely affected by diseases as their immune system is weaker as compared to adults. Children breathe a higher volume of air than adults according to their body weight as their organs are in development stage. Children's metabolic rate is also different from adults.

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Author	Published in	Published on	Takeaways
			• According to the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) Institute for Statistics Data, the total number of enrolled learners in the Indian education system is 320,713,810 (including higher education), which contributes approximately 25% of the Indian population, in which 10,004,418 are at the pre-primary level, 143,227,427 are at the primary level, and 133,144,371 are at the secondary level. • Therefore, it is important to study IEQ in school classrooms as approximately one-fourth of the country's population is related to this study area.

4. CASE STUDIES

4.1.1 *The British School/Morphogenesis, New Delhi*

Project—Elementary & middle school, New Delhi, Year – 2016.

Two key design strategies were used to optimize resources. One was to minimize reliance on mechanical systems. Morphogenesis advocated that 50% of the school to be non-air-conditioned with traditional passive methods used to temper the environment and optimize energy consumption, creating an environmentally experiential learning environment. The second strategy was of planning the school as a system of courtyards scaled such that majority of them are in shade throughout the year, thus making them effective not only as transition spaces but as extended learning environments. Internal courtyards, chajjas (deep overhangs) and verandahs use to provide opportunities for students to engage with the environment and nature.

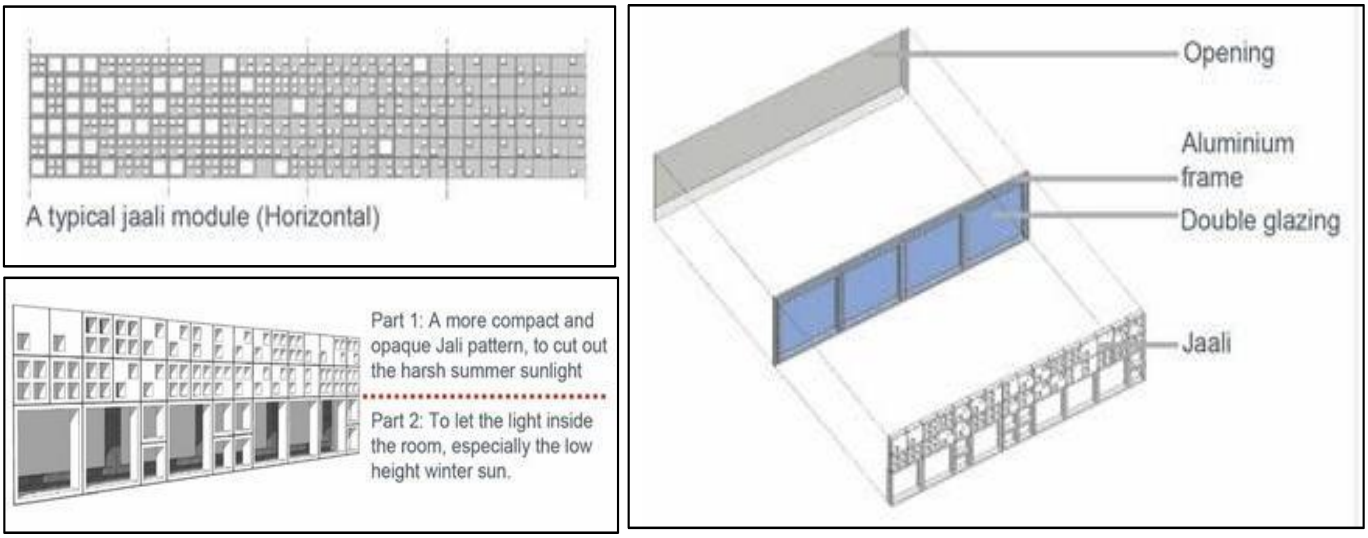

Figure 3: Double Skin & Jali

4.1.2 *SDB-1 at Infosys, Pocharam: Second Skin and Insulated Envelope*

In this building, they harvested adequate amount of natural light, such that windows are split into an upper pane that lets in natural light and lower pane which provides outside view.

- The windows are completely shaded with the help of horizontal louvers and vertical fins to prevent glare.
- Above each window, a light shelf is installed which is a flat horizontal panel that reflects incoming sunlight onto the ceilingby distributing deeper into the space.

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- An envelope with a second skin (i.e., cladding of aerated clay tiles) was used, with an air gap providing isolation of thefaçade from the structure.
- This creates a thermal break and a time lag to keep the heat absorbed by the skin away from the structure.
- A selective double-glazed low-e windows filled with argon, with a low U-value and a light-to-solar-gain ratio of 2.0, were used to maximize visual transmittance and control solar heat gain.

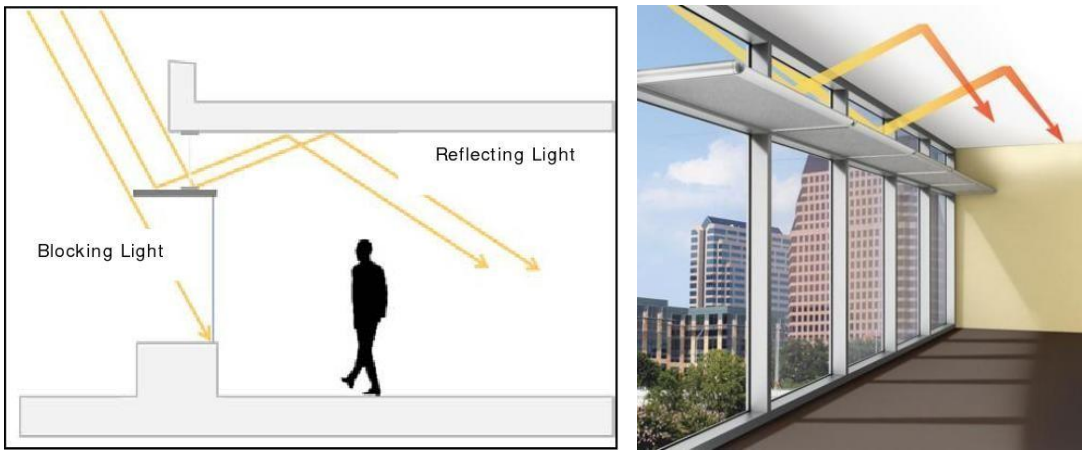

Figure 4: Model with Light Shelf

4.1.3 *Identifying Various Options of Areas of Improvements*

Sr. No.	***Element***	***Uses***
1.	Glazing selection	Can be selected on the factors based on Type of glazing, Visible light, U- factor, SHGC
2.	Orientation criteria	Maximize north and south exposures and fenestration; minimize east and west exposure
3.	Wall and roof insulation	To protect building from external heat gains.
4.	Cool Paint/Cool Roof	Reflect heat and are most effective during the hottest part of the day and the hottest time of year. Cool roofs can save up to 25% of roofing energy loads
5.	Shading devices	Provide shading to mitigate glare. Overhangs for south façade windows; small fins on north; both fins and overhangs for east and west façade windows
6.	Other	Provide lightshelves to improve the distribution of daylight in the interior space. Interior space planning-light colors to maximize the effect of daylighting.

5. CONCLUSION

In the dynamic urban landscape of cities like Mumbai, the escalating temperatures pose a significant challenge to the educational infrastructure, especially within school environments. Recognizing the need to create a comfortable and conducive indoor climate for students, many educational institutions are opting for the installation of air conditioning systems. While this might offer immediate relief, it is essential to critically evaluate alternative approaches that prioritize both indoor environmental quality and energy efficiency. Double glazing, for instance, enhances thermal insulation, reducing heat transfer and minimizing the reliance on air conditioning systems. Reflective coatings on windows can selectively filter out undesirable solar radiation, thereby mitigating heat gain while maintaining adequate natural light. Shading devices, such as external louvers or blinds, offer an effective means of controlling sunlight and heat penetration, fostering a more balanced indoor environment.

The benefits of fenestration retrofitting extend beyond mere temperature control. Improved natural ventilation, increased access to daylight, and a closer connection to the external environment contribute to enhanced indoor environmental

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quality. This, in turn, has been linked to positive impacts on students' health, well-being, and academic performance. Moreover, embracing fenestration retrofitting aligns with broader sustainability goals. By reducing the reliance on energy-intensive air conditioning systems, schools can significantly lower their carbon footprint and contribute to the overall resilience of the urban infrastructure. This approach not only addresses the immediate need for thermal comfort but also establishes a long-term framework for sustainable building practices.

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Experimenting the Use of Recycled Plastic in Mosaic Tiles

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ABSTRACT: In the newspaper report of the economic times India produces 3.4 million tons of plastic waste in a year, and only 30 to 40 percent of it is recycled. The use of recycled plastic in any construction material will be one of the forms of reusing plastic. This research paper is to experiment the use of plastic waste in tiles. For that different types of plastic can be used for the tile making. This experiment is based on the use of recycled plastic in tiles which gives a mosaic look to the tile.

The paper aims to analyse and study the different experiments on tiles. Using waste plastic in any product will help to control the carbon footprint of the environment.

Keywords: *Plastic Waste, Carbon Footprint, Reuse, Recycle, Tiles, Experiment.*

1. INTRODUCTION

Plastic waste consists of the waste of plastic bags, water bottles, drums, straws, and some polythene sheets etc. The use of recycled plastic in any construction material will be one of the forms of reusing plastic. The benefit of such reusing is a reduction in landfill cost, saving in energy, and protection of the environment from possible pollution effects. Plastics areone of the most used materials in the country.

2. BACKGROUND STUDY

Plastic can adopt any shape or form easily. Plastics are made up from natural materials like cellulose, coal, natural gas, salt, and crude oil through a polymerization or polycondensation process. Plastic is used for such a wide variety of applications, from everyday single-use products like packaging and bottles to products, such as furniture, clothes, buildingmaterials and automotive components.

Plastics have replaced a wide range of traditional materials including glass, steel, wood, concrete etc. There are different types of plastic which are available in markets such as Acrylic or Polymethyl Methacrylate (PMMA), Polycarbonate (PC), Polyethylene (PE), Polypropylene (PP), Polyethylene Terephthalate (PETE or PET), Polyvinyl Chloride (PVC), Acrylonitrile-Butadiene-Styrene (ABS). Plastic material is generally not biodegradable, and it is harmful for environment.Recycling can help mitigate the perpetual use of plastic in production, but it presents some challenges and problems. As per the newspaper In Navi Mumbai about 700 MT (metric tons) of plastic is generated per day of the total 2820MT generated in the state. Around 90–110 tons of plastic from Navi Mumbai region are sent for recycling.

2.1 Carbon Footprint Metric in India

- Plastic pollution can alter habitats and natural processes, reducing ecosystems' ability to adapt to climate change, directly affecting millions of people's livelihoods, food production capabilities and social well-being.
- Recycled plastics often contain higher levels of chemicals such as toxic flame retardants, benzene and other
- Carcinogens, environmental pollutants including brominated and chlorinated dioxins, and numerous endocrine disruptorsthat can cause changes to the body's natural hormone levels.

3. SURVEY-NMMC LANDFILL SITE TURBHE

Solid waste management services were taken over by NMMC from CIDCO on May 1, 1997, for CBD-Belapur, Nerul, Turbhe-sanpada, Vashi, Koparkhairane and Airoli nodes. NMMC also looks after solid waste collection from 44 villages from former grampanchayat areas.

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The Figure 1 shows the shredding process of theLDPE Plastic:

- Plastic collection
- Manual sorting
- Shredding
- Washing
- Melting
- Shaping

Figure 1: Plastic Shredding Process

NMMC Environmental status report 2021–2022.

Table 1: Shows the 2021–2022

	Paper	Plastic Waste	Coconut Shells	Organic matter	Cloth	Rubber Waste	Glass	Metals	Debris
	Physical Characterisitcs (% Basis)								
2017-18	6.77	11.81	11.86	58.31	4.35	0.66	5.14	0.63	1.09
2018-19	6.37	9.68	13.60	60.33	5.92	0.67	2.79	0.56	0.80
2019-20	8.08	8.43	11.36	64.03	3.31	0.63	2.83	0.60	1.33
2020-21	6.57	9.88	8.10	68.73	3.96	0.51	1.39	0.72	0.87
2021-22	5.96	10.93	9.87	66.71	4.06	0.43	1.06	0.67	1.00

As per the NMMC report of 2021-2022 the 10.93% of plastic waste is generated in Navi Mumbai.

The aim of this research paper is to reduce the Carbone footprint by reducing the plastic on certain level and used it in any other product or material to control the pollution.

3.1 Objective

- To reuse and recycled the plastic waste and used it in new products.
- To reduce high density of plastic waste by using it in any material.
- To experimenting the different types of recycled plastic in tiles.

3.2 Scope and Limitations

- To introduce the recycled plastic in new product.
- Study of durability and quality of the recycled plastic product.
- To study Project Feasibility of product.

3.3 Methodology

1. Study of different research papers and analysis the methods and techniques which used for tile making.
2. Collecting the different types of plastic waste which can be used for the experiment for example, HDPE, PP, PS, LDPE, PET, PVC etc.

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3. Testing the property of each plastic grade.
4. Design the tile as per the requirement for example, Internal flooring, External flooring, or wall cladding.
5. Manufacture the tile.
6. Checking the strength, durability, and quality of the tile.
7. Comparative analysis with the mosaic tile and plastic mosaic tile.
8. Conclusion.

4. MATERIAL & MANUFACTURING

Figure 2: The Samples of Different Types of Plastic Waste

Experimenting the use of recycles plastic in tiles.

1. Tiles are often used to form wall and floor coverings and can range from simple square tiles to complex or mosaics.
2. For any Cladding or flooring work we use tiles to give aesthetic look it gives proper finishing to the floor or wall.
3. There are different types of tiles are available in market. Usually stone, ceramic tiles, Glass we used for finishing.
4. This experiment is based on use of recycled plastic in tiles which gives a mosaic look to the tile.
5. This tile can be used for the indoor space.

5. MATERIAL SPECIFICATIONS

Table 2: Represent the Types of Material which Used for the Making Tile

Name of Material	***Specification***
Plastic waste	Required material
White cement	Binding material
Cement	Binding material
Wooden Mould	For giving Shape
Resin	For Finishing
Bowl	For Holding materials

6. EXPERIMENTS

Table 3: Represents the Experiments of Plastic Waste Used in Tiles. Step

Experiment No 1

1 2 3 4 5 6

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Experiment no 2.

1 2 3 4 5

Experiment no 3.

1 2 3 4 5 6

1. Add white cement & small particles of plastic in bowl.

- *Step 2:* Mix with water.
- *Step 3:* Set all material in wooden frame.
- *Step 4:* Place plastic particles on top of the tile.
- *Step 5:* Remove outer side of the frame after 30 min.
- *Step 6:* Let tile dry in sunlight for 3 & 4 hrs.
- *Step 7:* Spray water on tile for curing.

7. RESULT AND CONCLUSION

Figure 3: Shows the Final Structure of Tile

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Table 4: Represents the Comparative Analysis of the Plastic Tile and the Mosaic Tile

COMPARATIVE ANALYSIS

	PLASTIC TILES	**MOSAIC TILES**
Size	3" x 3", 3"x 6"	2"x 2" ,3" x 3", 4"x 4"
Material	White cement, Plastic, Cement	Glass, Marble,Stone
Purpose	Wall cladding / Flooring	Wall cladding/ Flooring
Thickness	10mm,12mm	4-20 MM
Shape	Square, Rectangle	All shapes
Colour	Multicolour	Multicolour
Surface finish	Glossy	Matte, Glossy
Price	-	Glass - Rs 62/Square Feet Marble - Rs 150/Piece, Rs 60/Square Feet Stone - Rs 60/Square Feet

7.1 CONCLUSION

Recycling plastic waste and repurposing it to create newitems is one way to reduce plastic waste.

This experiment can be further tested to check the Compressive strength, Flexural test, Water absorption testetc.

This tile can be used for the indoor flooring or Compoundwall for cladding.

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