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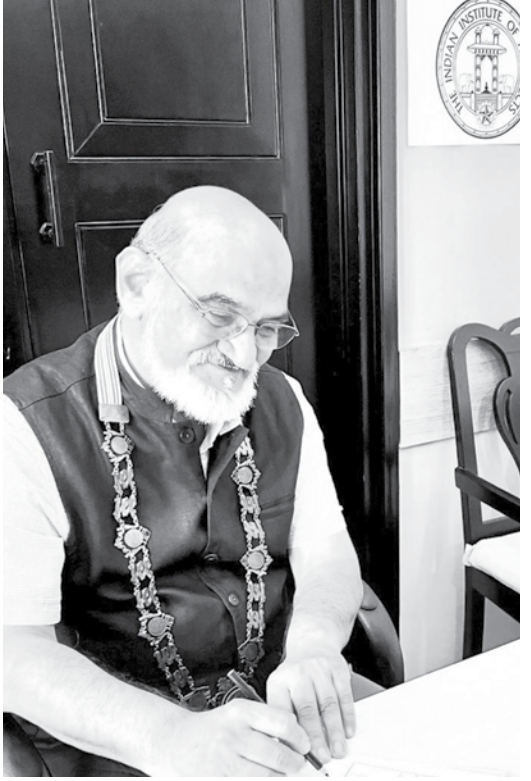
PRESIDENT'S MESSAGE



Dear Members,

Greetings!

The Indian Institute of Architects continues to build strong momentum through key national and international initiatives.

Preparations for the 23rd ARCASIA Forum 2026 across Delhi, Agra, and Jaipur are progressing well. Simultaneously, groundwork for the UIA International Forum 2027 in Mumbai is underway, positioning India at the forefront of global architectural discourse.

I am pleased to share that the Memorandum of Understanding with the Indonesian Institute of Architects (IAI) has been signed, fostering international cooperation in heritage and professional exchange. We are also strengthening collaborations through our partnership with the Institute of Indian Interior Designers (IIID).

I encourage members to participate in the UIA World Congress of Architects 2026 in Barcelona (28 June – 2 July 2026), where IIA will showcase Indian architecture on a global platform.

The Architectural Design Competition for the redevelopment of the IIA Belapur Building is receiving an encouraging response. Based on requests from members, the deadlines for registration and submission have been extended. I especially urge young architects to participate and contribute innovative ideas.

Let us continue to engage actively and contribute to the growth of our profession.

Ar. Vilas Avachat
President
The Indian Institute of Architects

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EDITOR'S NOTE

Greetings to all IIA Members,

As we move into the final quarter of the professional year, the March 2026 issue of The Journal of the Indian Institute of Architects offers a moment to consolidate our reflections on the evolving trajectory of architecture in India. From large-scale infrastructure and housing to emerging domains such as digital ecosystems, healthcare and sustainable urban development, the scope of architectural engagement is expanding rapidly. Architects today are not merely contributors to the built environment but active participants in shaping the nation's economic, social and cultural progress. This shift calls for a redefinition of practice, one that embraces new paradigms of interdisciplinary collaboration, technological integration, environmental sensitivity and inclusive design.

In this context, the role of the Indian Institute of Architects assumes greater significance. As a professional body, the IIA continues to foster dialogue, support innovation and provide platforms that enable architects to engage with both national priorities and global discourse. The forthcoming international engagements further strengthen this vision. With India set to host the ARCASIA Forum in 2026 and the UIA Forum in 2027, the architectural fraternity is presented with a unique opportunity to showcase its capabilities while participating in meaningful global exchange. These platforms are not only milestones in international collaboration but also catalysts for introspection, encouraging us to position Indian architecture within a broader global framework while remaining rooted in our diverse contexts. They reaffirm the importance of collective participation, knowledge sharing, and professional excellence in shaping the future of the discipline.

As we look ahead, it is imperative that architects respond to this phase of growth with clarity of purpose and commitment to responsible practice. The challenges of urbanisation, climate change and social equity demand solutions that are both innovative and grounded. The opportunities before us are vast, and with them comes the responsibility to lead with vision and integrity. The JIIA remains committed to documenting this journey, serving as a platform for ideas, research and reflections that contribute to the advancement of the profession. Let us continue to move forward together, strengthening our collective voice and shaping a future that reflects the aspirations of a dynamic and evolving nation.

Stay united and stay ahead.

Jai Hind.

Prof. Vinit Mirkar
Editor, JIIA

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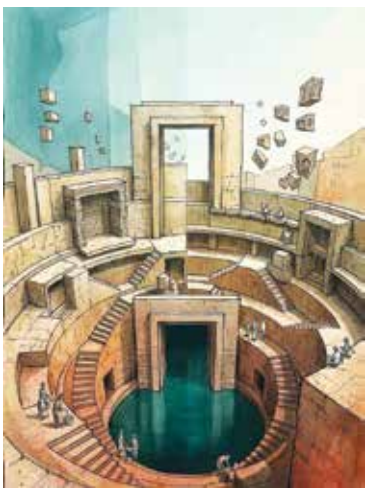

This abstract composition reimagines the Indian stepwell as a spatial system of depth, memory and collective life. Rendered through layered geometries and interlocking planes, the image dissolves the boundary between plan and section, allowing the viewer to read the stepwell simultaneously as surface pattern and vertical descent. The receding terraces, rhythmic stairways and framed voids construct a choreography of movement: one that is both architectural and experiential.

The composition emphasizes the void as presence. At its centre, the water body is not merely an object but a spatial anchor, around which the built fabric organizes itself. The stepped edges articulate gradients of access; public to intimate, light to shadow, surface to subterranean. These transitions reflect a nuanced understanding of spatial hierarchy embedded in traditional Indian architecture, where movement is gradual, ceremonial and deeply tied to climate and ritual.

Historically, stepwells functioned as more than just hydraulic infrastructures. They were community condensers; places of gathering, exchange, rest and reflection. Women drew water, travellers paused in the cool depths and rituals unfolded along the stepped edges. The architecture mediated between utility and social life, transforming the act of water collection into a shared cultural experience.

In this abstraction, the fragmentation and reassembly of forms suggest both continuity and loss. The geometry feels precise yet dislocated, echoing how many stepwells today exist as remnants, disconnected from their original ecological and social contexts. Yet, their spatial intelligence remains profoundly relevant.

At a time marked by water scarcity and ecological imbalance, the stepwell emerges as a model of sustainable thinking. Its passive cooling, groundwater recharge and community-centric design offer lessons for contemporary practice. This image invites a re-engagement with these principles, not as nostalgia, but as a critical resource, urging us to rethink water as a shared, spatial and cultural commons.

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JIIA Call
for Papers, Articles, Projects

The Journal of the Indian Institute of Architects invites original and unpublished contributions from members **ONLY** (academicians, practitioners and students) under the following FOUR categories. Submission in each category is strictly only through the respective google forms.

In order to be accepted for publication, all material sent in these categories should have the following components:

1. MS Word document file with text only. Please do not format it in anyway. The numbered captions for all the images will also be in this document.
2. Folder with all images (minimum 300 dpi), numbered according to the captions given in your text file
3. Photograph of the author/s (minimum 300 dpi).
4. Author biodata – Maximum 50 words.
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Category 1 : Articles

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Essays, interviews, articles (1500- 2500 words), book reviews (600 and 750 words), travelogues, sketches and photo-essays in the areas of architecture, planning, urbanism, pedagogy, heritage, technology, ecology, theory and criticism, visual design, practice or any other relevant subject pertaining to the built environment. (Details of the format will be available on the JIIA website).

- For a design project, please include the 'Fact File' with the following details : Project Name, Location, Plot area, Total built up, Structural consultants, Project completion. Also please give the photo captions and credits. Please ensure that the image is referred to within the text. For eg, "As seen in Figure 1…". This is essential for the layout.
- For design projects, plans and sections of the project are desirable along with the photographs.
- Book reviews should be only of books by Indian authors. please include the "Fact File" with the following details: book title, author name, publisher, year of publication, ISBN, language the book is written in, genre (technical/ fiction/ etc.), no of pages, dimensions (in cm), type (Kindle / paperback/ hardback), available at (amazon.in/ flipkart.com/ others).
- Please send a write-up of about 200-300 words along with sketches and photo-essays.

Category 2 : Student Work

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Summaries of dissertations (2000-3000 words) at the level of B.Arch. & M.Arch., and theses at the Ph.D. level. The Guide for that work will be mentioned as the Co-author. (Format will be available on the JIIA website).

Category 3 : Contributions from Chapter Correspondents

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(a) Chapter News: This includes various interesting activities from the Centres of your Chapters (maxm. 500 words for the news from the entire Chapter).

(b) News of conferences by the academic institutes in your respective Chapters.

(c) Obituaries : Obituaries of IIA members should consist of the photograph of the departed soul, the dates of birth and death and a short 50-word note.

Category 4 : Research Papers

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Research papers (2000-5000 words) in the prescribed format. The research may be based on their ongoing or completed research. (Format is available on the JIIA website). All contributions in this category will be double blind peer-reviewed before being accepted for publication by academic experts of repute.

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Students from affiliated colleges are invited to design the cover page theme. This should be a graphic based on some aspect of Indian Knowledge Systems. The submission will include the graphic file (jpeg or corel draw); a theme note (with a title) of about 500 words explaining the concept of the graphic. Please note that the image you send should be within a SQUARE of 15 x 15 cm. It will be adjusted as per the layout requirements of the JIIA Cover. It should NOT contain any text / slogan/ etc.

Please note:

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2. Submissions will **NOT** be accepted through email.
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4. When you correspond with us, please give your email id (that you regularly use) and your cell no. (preferably with WhatsApp).
5. It is compulsory to mention your IIA regn. No. Submissions will **NOT** be accepted from non-members.
6. The review process takes anywhere between 4-6 weeks. Since it may not be possible to respond to all authors who send in their work, we will definitely revert if and when your work is accepted.
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RESEARCH PAPER

Architect Persona Behind the Architecture of Hussain Doshi Gufa

By Ar. Harshitha G Raju, Dr. Mamata N Rao and Dr. Jignesh Khakhar

ABSTRACT

Architect's persona – their design values, thoughts, beliefs and inclinations on the architecture. This study hypothesises the architect's role as a substantial factor in shaping the architectural design. Thus, it attempts to realise the persona model/ architect role model employed by architect BV Doshi in the design of Hussain-Doshi Gufa. It views the project through the lens of the architect's persona to understand the reasoning behind the design decisions, process and outcomes. The study posits within the constructivist paradigm with a qualitative approach. The data collection is through secondary resources. It includes first-person narratives from published interviews with the architect about the project. Furthermore, the findings reveal that architect Doshi is self-conscious and a pragmatist. The qualitative thematic analysis presents an effective method for critically reviewing an architect's works. The research mainly ascertains the possibility of understanding an architect's work through the framework of architect role models.

KEYWORDS: Architect role models, Qualitative thematic analysis, Self-conscious, Pragmatist, BV Doshi, Hussain-Doshi Gufa

1. INTRODUCTION

1.1 Background

In understanding and critiquing architecture, the commonly taken approach is studying the architectural style, movement, structure, materials, technology and other factors such as place and context. However, one rarely acknowledges the possible influence of the architect's persona – their design values, thoughts, beliefs and inclinations on the architecture.

As there is no one type of architecture, there is no one role, design value or design approach for an architect. The role of an architect can vary based on the client, typology of the project or the values that the architect prefers to focus upon. It could be creative, artistic, collaborative, digital or sustainable; the possibilities are varied. Hence, while studying the architecture of a building, it is important to realise the architect's values, as they contribute to the design outcome. By doing so, one can relate to and understand the architecture better.

This research paper is part of the authors' doctoral research findings. As part of the academic work, the authors have previously proposed the 'architect role models framework' for understanding the architect persona and the built architecture (Raju et al. 2025). Based on personas, this framework specifies six architect role models and their characteristic design values and approaches. In applying this framework, this paper bridges the gap in relating the architect's persona to the built architecture, portraying a possible direction to address this relation.

2. AIM AND OBJECTIVES

The study aims to realise the persona model/ architect role model that architect BV Doshi has employed in the design of Hussain-Doshi Gufa. The study views the project through the lens of the architect's persona to understand the reasoning behind the design decisions, process and outcomes. The objectives are (1) collecting the views and thoughts of the architect about the project and (2) realising the implications of the architect's values and approaches on the built architecture.

The role of an architect has been written about

by various authors like Ackerman (1969), Garrott (1983), Burgess (1983), Littman et al. (1981) and Cuff (1991); however, the term 'architect role models' is used explicitly by Salama (1995, 2016). The recent systematic literature review conducted by the authors (Raju et al. 2025) presents the status quo on the types of persona models and their attributes.

3. LITERATURE REVIEW

3.1 Architect role models

The six architect role models and their core design values and approaches are as follows:

Self-conscious: is identified with self-validating, arbitrary, superficial and individualistic design values. In other words, as one who believes in the 'I give them what I want' attitude. The design approaches are focused on being intuitive, artistic and form-oriented.

Pragmatist: is seen as knowledgeable in catering to the client's demands and meeting the needs of the profession's radical changes. The design values are client- or developer-oriented, with an 'I give them what they want' attitude. Communication, teamwork and interaction take centre stage as design approaches for a pragmatist.

Facilitator: believes in co-creating architecture with the people of a community. Hence, the design values are of being socially collaborative and creating alternative design innovations to address the users' socio-economic conditions. The design approaches are participatory, encouraging co-decision making and learning about users through behavioural and spatial mapping.

Advocate: is observed as a political activist, fighting for spatial rights of the disadvantaged and economically weaker groups. The design values relate to obtaining social justice, legal rights, equality, freedom and developmental services. The design approaches entail legal propositions, raising voices against unlawful developments and channelling the weaker sections to control their future.

Digital architect: relies on modelling complex data to create digital architectural designs. The role holds onto analytical computation-based and inter-organisational networking-based design values. The design approaches use designing models such as shape grammars, isovist tools, visibility graphic analysis and parametrics.

Circular change agent: endorses circular economy and supports minimal resource utilisation to achieve sustainable architectural practices. The design values are of ensuring closed-loop material resources through supply chain collaboration. Cradle to cradle, design for disassembly, design for repair and remanufacturing and life cycle are the design approaches to create a circular economy.

3.2 Architect Role Models (ARM) framework

The framework on architect role models in Figure 1 summarises the findings about architect role models and their design values and approaches and assists in categorising the architects and their projects. However, it is also observed that an architect could be categorised for more than one role, based on the values and approaches.

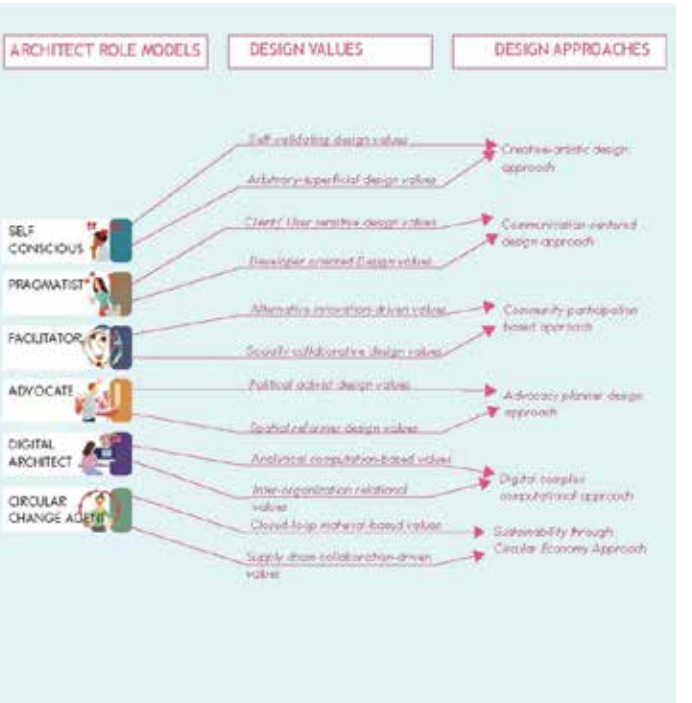

Figure 1: Architect Role Models framework
Source: Raju et al., 2025

4. METHODOLOGY

This study posits within the constructivist paradigm with a qualitative approach. The data collection is through secondary resources. It views published work consisting of interviews with the architect about the project to collect first-person narratives. Here, the chapter titled 'The Revelation' in the book The Complete Architecture of Balkrishna Doshi: Rethinking Modernism for the Developing World (Steele & Doshi 1998) is considered for the study as it provides a detailed, lengthy interview of the architect about the project.

The data analysis is done through qualitative thematic analysis using computer-assisted qualitative data analysis software, Atlas.ti. The use of Atlas.ti software helps to be rigorous and objective through coding,

creating categories and themes. The analysis is done iteratively in repeated cycles following the guidelines by Saldaña (2021) in the following four phases:

Phase 1: Identifying codes in the data

Phase 2: Creating categories of codes and developing high-level categories

Phase 3: High-level categories to generate themes

Phase 4: Applying the emerged themes to the research questions of the study

5. FINDINGS

In this project, architect Balkrishna Doshi builds on cultural references, historical narratives and vernacular traditions that give impeccable identity to the structure, culminating in a seamless, past and present, local and global architecture. Analysing Doshi's chapter 'The Revelation', one realises his inclination towards self-conscious design values. However, the pragmatist design approaches are also present by incorporating the client's (Artist MF Hussain) preferences. Thus, the design values detected are 'Self-validating', 'Arbitrary-superficial', 'Creative-artistic' and 'Communication-centered' design approaches.

5.1 'Self-validating' design values

Self-validating_Individualistic: Architect Doshi mentions, "I decided to begin work on this project again and set up a team following the advice of Kurma (tortoise)" (Steele & Doshi 1998, p. 154). This statement signifies the architect's belief in messages from mythical beings in his subconscious mind.

Self-validating_Experiential: Architect Doshi designed Gufa to evoke sensory and emotional experiences through its form and spaces. He explains the inspiration: "Kurma reminded me of the discoveries made by Giulio Romano and others during the Post-Renaissance and Baroque period. He emphasises how the definition of space and form was gradually being dissolved, three-dimensionally and how the sky was becoming part of the interior space" (Steele & Doshi 1998, p. 151).

Self-validating_Sympathy: "Kurma continued, what this Gufa wants to be is what you see in these forms: a building which is dynamic, difficult to describe, yet great to experience. It must be a building to which everyone should be attracted. It must have places for children, the old, the common man and the elite. What it should do is to provide for the city an example of a nonidentifiable architecture, yet very meaningful and useful to all" (Steele & Doshi 1998, p. 153). The attitude to favour beyond the site's boundaries, to think of it as a valuable addition to the whole city, accounting for all age groups and people of all statures reflects the architect's compassion and sympathy for his people.

5.2 'Arbitrary-superficial' design values

Arbitrary_Self legitimise: Architect Doshi expresses his belief in myths as a source of inspiration in his work. From the quotation, "But for me, life is a theatre because I sense the dialogue and that dialogue is my dialogue. It may not be a real dialogue. It is rather that I make conjectures from the kind of things I am doing, so the myth is already there. Myth is always prevalent in my work" (Doshi 2020, p. 19). Here, the architect acknowledges the belief in mythical characters, the architect's self-legitimising trait. *Arbitrary Superficial:* Doshi recollects his dream, "Immediately, there appeared a body of a large tortoise-like form. Unlike the normal tortoise, this was long and had two large mouths facing each other at opposite ends. They were interconnected with many shells of different shapes and sizes; it had six legs and, in their manner and positions, appeared to be attempting to somehow move" (Steele & Doshi 1998, p. 147).

Arbitrary_follow the Master: Architect Doshi has been an ardent follower of Le Corbusier since his training days under Monsieur in Paris. Remembering those days, he says:

Then he reminded me of my sojourn at Le Corbusier's studio and the design of the Chapel at Ronchamp, where Le Corbusier has skilfully restated the issues raised by the earlier masters in contemporary terms. I then recalled my visit to the Chapel and my experiences of seeing the fluidity of the spaces and forms, which no one has been able to describe or photograph (Steele & Doshi 1998, p. 151).

However, in Gufa, architect Doshi also mentions that he has been able to overcome the influence of his Master by incorporating local techniques.

5.3 'Creative-artistic' design approaches

Artistic_form: The statement, "But even after many months, I could not arrive at any clear image except that the Gufa, as the name suggests, has to be underground and perhaps, without a definite form. The issue of providing natural light, an entrance to the lower level and structural system and materials to be used were not at all thought of" (Steele & Doshi 1998, p. 150) reflects the architect's concern for form and its practicality.

Artistic_Incubation: Design is formulated when the mind processes and reprocesses ideas at a

subconscious level. It takes time for a nascent idea to develop into a practical design. Doshi declares, "I tried to comprehend this strange image and even tried to relate it to the legend of the Kurmaavtar, one of Vishnu's reincarnations. I had this strange feeling that it was trying to convey some message from the ancient mango trees through this neem branch I was holding, but I was unable to fathom" (Steele & Doshi 1998, p. 141). The creatures, their associated sacredness and the messages resonate with the architect's imagination through the incubation phase.

Artistic_Intuitive: As quoted by the architect, "Then after about a minute, I felt a powerful pull from deep within the earth, a sensation I had never ever experienced before. Taking this as a sign of something very unusual about to happen, I closed my eyes. Immediately, there appeared a body of a large tortoise-like form" (Steele & Doshi 1998, p. 147). Thus, the architect's momentary reflections and intuitive behaviour supersede the project's other limitations.

Artistic_ Metaphor: As observed in the following quote, Architect Doshi is fascinated by metaphorical associations in his works. He mentions, "For example, from the mythical images, Lise drew sketches of the Gufa… then Ranga Rao, with Vishnu Joshi, conceptualised the soap bubbles and the fruits… Ravindra Vasavada added his experiences with Frei Otto's tensile catenary structures. Anil Bhai Patel and Suresh Shah helped construct this unusual building with masons and Adivasis. They all helped to realise this strange-looking object" (Steele & Doshi 1998, p. 154).

5.4 'Communication-centered' design approaches

Communication_teamwork: The Husain-Doshi Gufa is a collaborative endeavour, with a keen understanding of the client surpassing the barriers of faith, religion and domains. He says, "Hussain formally asked me to design an underground building which he called the Gufa. He also emphasised that this Gufa should become a demonstration of a positive collaboration between a painter and an architect" (Steele & Doshi 1998, p. 150).

Thus, Architect Balkrishna Doshi's works reflect the self-conscious and pragmatist persona models. He has extended creative freedom beyond collaboration and teamwork boundaries. The project faithfully translates the architect's beliefs, incorporating the client's ideas. By integrating advanced technological concrete construction methods with the vernacular methods familiar to masons, the design is sensitive to the local context. In summary, the studied project is presented in Figure 2 and Figure 3.

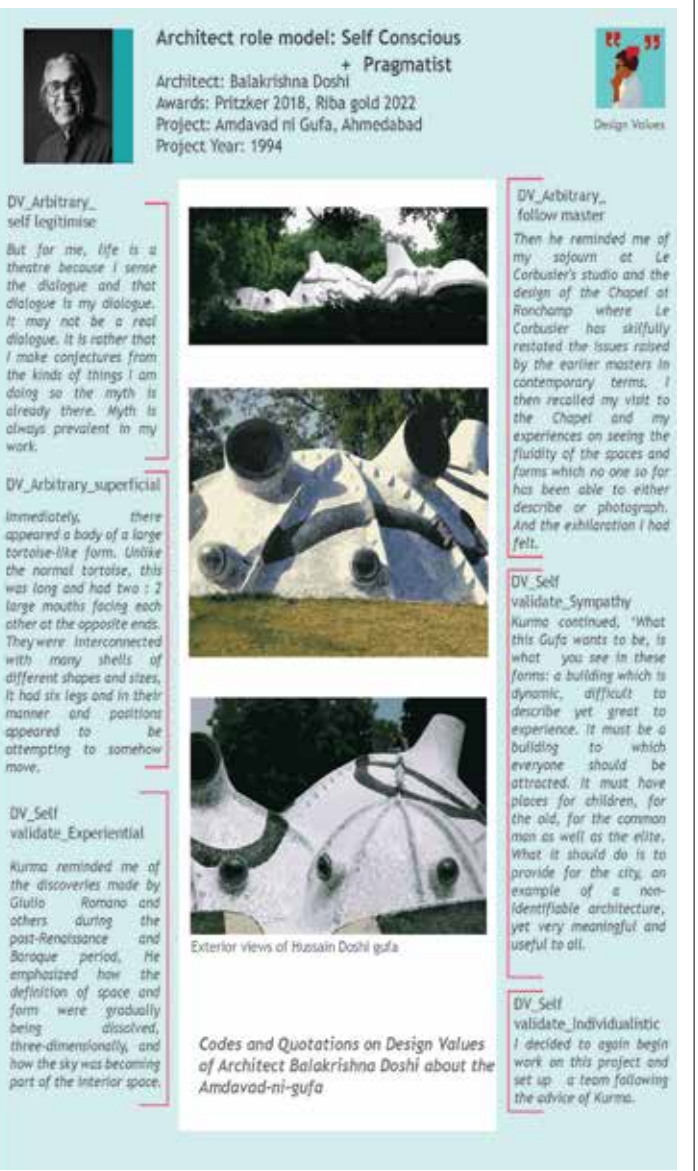

Figure 2: Quotations about design values of architect BV Doshi about Hussain Doshi Gufa
Source : Authors

6. DISCUSSION

The study aimed to realise the persona model/ architect role model that architect BV Doshi has employed in the design of Hussain-Doshi Gufa. The findings reveal that architect Doshi is self-conscious and a pragmatist. The excerpts and quotations coded against the attributes of the role model framework reveal these roles.

Here, the architect has not only given importance to the aesthetics and form but has also considered the needs and aspirations of his client, artist MF Hussain. The Gufa, also natively addressed as Amdavad-ni-gufa, is an example of an architect-client relationship

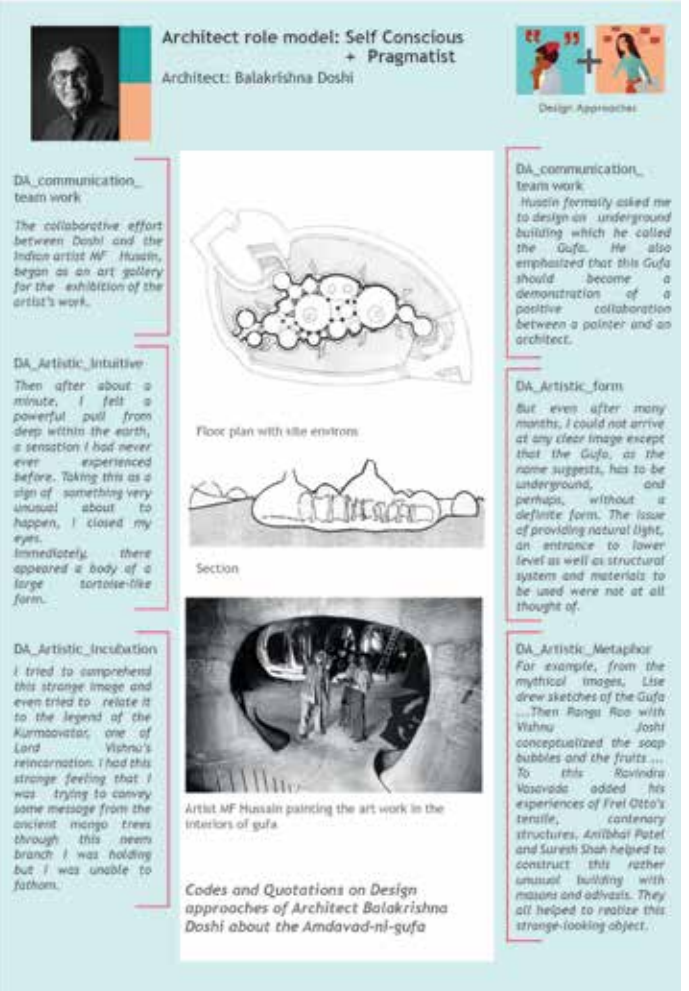

Figure 3: Quotations about the design approaches of architect BV Doshi about Hussain Doshi Gufa
Source : Authors

of mutual respect, bonding and collaboration. Unifying thoughts and views surpasses the egoistic attitude between two great personalities, their religious barriers and beliefs. The structure integrates the outdoor with the indoor through a seamless subterranean structure, with fenestrations that allow air and light and the roof that is easily accessed, doubling as a walking/ playing/ seating area. As mentioned by Doshi, the building is a culmination of principles of modern architecture along with the craftsmanship of local artisans. By designing the project with values and approaches of both self-conscious and pragmatist roles, the architect has justified the intentions of oneself, the client and the project.

Therefore, the findings from this research ascertain the possibility of understanding an architect's work through the framework of architect role models. The thematic analysis presents an effective method for critically reviewing an architect's works.

7. CONCLUSION AND RECOMMENDATIONS

The significance of this paper lies in presenting a method of positioning architecture and the architect. It helps to critique architecture from a unique point of view that was previously unexplored. Using this framework, one can conduct primary interviews and code them to realise the architect's persona. This method is also helpful in teaching architecture, as faculty can realise the probable personas nurtured in design studios by analysing the design briefs. Lastly, this helps in designing through an explicit and critically conscious approach.

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RESEARCH PAPER

Impact of Temperature on Power Generation of Solar Photovoltaic Panels

By Avitesh Vaishnavi Nayak and Dr. Tejwant Singh Brar

Abstract

Solar photovoltaic technology has emerged as a promising renewable energy source, yet its power generation efficiency is susceptible to environmental factors, particularly air temperature. Within the realm of solar energy utilisation, the efficiency of panel stands is a matter of paramount concern and is intertwined intimately with the ever-shifting dynamics of environmental factors. Among these variables, the enigmatic relationship between air temperature and solar PV performance emerges as a focal point, a delicate balance impacting the very essence of energy conversion. This study investigates the paradoxical relationship between air temperature and the power output of PV panels in the NCR, India, where high temperatures prevail for a significant portion of the year. Experimental data were collected from a 55-kWh solar PV system installed in NCR over two years.

The results revealed a substantial decline in power output as the panel's air temperatures rose beyond 25°C. Notably, during the summer months, when air temperatures frequently exceeded 25°C, power generation decreased by up to 20% compared to the rated capacity of the panels. The findings highlight the need for effective thermal management strategies and temperature-resilient solar panel designs tailored for the harsh climatic conditions of the NCR region.

Keywords: PV Panels, Solar Energy, Energy Efficiency, Power Generation, Temperature, Polycrystalline.

1. Introduction

The global energy landscape is undergoing a profound transformation driven by the imperative to transition to sustainable and low-carbon sources. In this context, solar photovoltaic (PV) technology has emerged as a cornerstone of renewable energy strategies worldwide, owing to its abundance, scalability and declining costs. The operational principle of PV panels is the photovoltaic effect, whereby semiconducting materials, typically silicon, convert incident solar radiation directly into electrical energy. The performance and efficiency of this energy conversion process are paramount to the economic viability and energy yield of solar power installations.

A critical and often detrimental factor influencing PV performance is the operational temperature of the solar cells. Contrary to an intuitive assumption, the efficiency of a solar panel is inversely related to its temperature. As ambient temperature rises and solar irradiance is absorbed, the panel's temperature increases, reducing its voltage output. This phenomenon is fundamentally linked to the semiconductor properties of the PV material; elevated temperatures increase the intrinsic carrier concentration, which in turn elevates the saturation current and significantly reduces the open-circuit voltage (Voc), a key electrical parameter. Consequently, the panel's maximum power output diminishes. This temperature-induced efficiency loss poses a substantial challenge, particularly in regions with high solar insolation and elevated ambient temperatures, where cooling energy demand is often at its peak (Dwivedi et al, 2020; Gangopadhyay et al, 2013).

While the qualitative negative correlation between temperature and PV efficiency is well-established in the literature, quantitative analysis under specific

local climatic conditions remains a critical area of investigation. This research paper, therefore, seeks to empirically examine the impact of temperature on the power generation of crystalline silicon solar panels. Through controlled experimentation and data analysis, this study aims to quantify the power degradation coefficient and elucidate the precise relationship between cell temperature and electrical output. The findings will provide valuable insights for system designers, engineers and policymakers, informing better site selection, improved cooling strategies and more accurate energy yield predictions, thereby enhancing the overall reliability and productivity of solar power generation systems (Karthick et. al., 2020).

1.1 Aim

The primary aim of this research is to quantitatively investigate and characterise the influence of temperature on the electrical power generation efficiency of solar photovoltaic (PV) panels in composite climatic conditions.

1.2 Objectives

- To study the correlation between ambient and operational cell temperatures and the resultant decline in the electrical conversion efficiency of photovoltaic arrays.
- To evaluate the performance attenuation of a 55 kW Solar Panel system (Poly crystalline) and the effect of temperature on power generation in a composite climate for a period of two years.

1.3 Scope of the Research

The scope of this research is delineated to provide a focused investigation into the thermal-performance relationship of photovoltaic systems within a built environment context. The study will encompass the empirical monitoring of standardised Poly-crystalline silicon PV panels. Data collection will be conducted over two complete annual cycles in a composite climate zone to capture seasonal thermal variations. The analysis will focus on quantifying the correlation between module temperature, ambient climatic parameters and the resultant electrical power output and conversion efficiency, thereby generating actionable data for architectural energy modeling and system specification.

1.4 Limitations

The research is confined to a single composite climate region and the results may not be directly transferable to areas with arid or consistently cold conditions. The study utilises crystalline silicon PV panels technology and the observed thermal performance coefficients may not fully represent emerging thin-film or bifacial technologies.

2. Literature Review

The integration of solar photovoltaic systems into the built environment is a cornerstone of sustainable architectural design. While solar irradiance is the primary driver of PV power generation, operational panel temperature is a critical and often architecturally influenced factor that significantly modulates system efficiency. This review synthesises extant literature on the impact of temperature on PV power generation, examined through the specific lens of architecture, where building-integrated photovoltaics (BIPV), material choices and local climatic conditions collectively determine the thermal environment of the panels (Gopi et al., 2022; Jha and Tripathi, 2021).

2.1 The Fundamental Thermo-Electrical Relationship in PV Modules

The foundational principle established across engineering studies is the inverse relationship between PV cell temperature and electrical conversion efficiency. As PV cell temperature increases, the semiconductor's bandgap narrows, leading to a higher intrinsic carrier concentration and a consequent decrease in the open-circuit voltage (Voc), which is the primary parameter responsible for power loss (Skoplaki & Palyvos, 2009). Most crystalline silicon panels, the most prevalent type in building applications, experience a linear power reduction coefficient typically ranging from -0.3% to -0.5% per °C rise above the standard test condition (STC) temperature of 25°C. This fundamental relationship underscores the necessity for architectural strategies that mitigate excessive heat gain in PV systems to optimise their energy yield.

2.2 The Role of Climatic Conditions in PV Thermal Performance

The ambient climatic conditions of a building's site are a primary determinant of PV operating temperature. Research by Dubey et al. (2013) demonstrates that in hot-arid climates, characterised by high solar insolation and elevated ambient temperatures, PV panels can consistently operate 30-40°C above ambient, with precipitating efficiency losses exceeding 15%. Conversely, in temperate or cold climates, despite lower irradiance, panels often operate closer to their STC, maintaining higher efficiencies. Furthermore, the microclimatic factor of wind speed and direction, influenced by urban canyon effects and building orientation, can

enhance convective cooling, thereby introducing a site-specific variable that architects must consider during the environmental analysis phase (Elnozahy et al, 2015)

2.3 Architectural Design and Building Integration as Thermal Modulators

The PV integration method is a significant architectural variable affecting panel temperature. Studies comparing Building-Applied Photovoltaics (BAPV) and Building-Integrated Photovoltaics (BIPV) reveal critical thermal differences. BAPV systems, mounted with an air gap over a conventional roof or facade, benefit from natural ventilation at the rear, which dissipates heat. In contrast, BIPV systems, which serve as the actual building envelope, often have restricted rear-side ventilation, leading to higher operating temperatures and a corresponding "thermal penalty" on performance (Peng et al., 2013). The architectural selection of substrate materials, such as the high thermal mass of a concrete roof versus the lower mass of a metal deck, also influences the heat sink effect and the subsequent thermal profile of the integrated PV modules (Kim et. al., 2021).

2.4 Synergistic Strategies: Passive Cooling and Material Science

Architectural research is increasingly exploring synergistic strategies to regulate PV temperature passively. These include the use of reflective (cool) roofing materials to lower the ambient air temperature around rooftop arrays and the design of ventilated facades or double-skin constructions that channel air to cool BIPV elements. Furthermore, advancements in material science are introducing PV components with improved thermal emissivity and the development of photovoltaic-thermal (PV-T) hybrids that actively capture waste heat for building services, thereby improving the overall exergetic efficiency of the building envelope (Saini et al., 2022). These strategies represent a convergence of architectural form and environmental performance, aiming to decouple solar energy harvesting from detrimental thermal gains (Kumar, R., & Rosen, M. A., 2011).

3. Methodology

The methodology adopted for this study is presented in Figure 1.

4. Data Analysis and Findings

The power generation capacity of PV panels is significantly influenced by environmental and installation-specific factors. A primary determinant

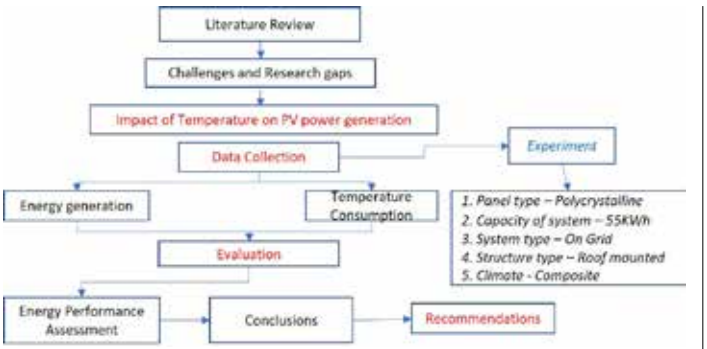

Figure 1: Methodological Approach
Source: Authors

is operational temperature, as PV cell efficiency exhibits an inverse relationship with thermal increase; for crystalline silicon panels, a power reduction coefficient of approximately 0.4% to 0.5% per degree Celsius above the standard 25°C benchmark is typical, underscoring the necessity for effective thermal management. Geographic location further modulates output by dictating the available solar irradiance, with regions experiencing higher insolation and clearer atmospheric conditions yielding superior energy production, while coastal or arid environments may present challenges like soiling or salt deposition. Furthermore, the spatial configuration of the installation is critical, as even marginal shading can disproportionately diminish the output of an entire module string due to the series interconnection of cells. Finally, the azimuth and tilt angle of the panels directly govern the interception of incident solar radiation, with optimal orientation towards the sun and, where feasible, seasonal adjustments or tracking mechanisms serving to maximise energy harvest. Consequently, the overall performance of a PV system is co-determined by the synergistic interplay of these critical parameters.

4.1 Primary Data Collection

Conducting a two-year experiment for primary data collection on solar PV panels in Gurugram, India, involves careful planning and execution to ensure accurate measurements and meaningful analysis. Here's a structured approach to setting up and conducting such an experiment:

4.2 Site Selection:

The site is situated in Sector 55, Gurugram, Haryana. For this study, the D block of Sushant University has been taken. It is a G+5 story of an educational institute.

4.3 Experimental Setup:

- PV Panel Installation:
  - Panel type – Polycrystalline

- Capacity of array – 55KWh
- System type – On Grid
- Structure type – Roof mounted
- Climate – Composite
- No. of panels – 204
- Tilt angle – 18 degrees
- Module make & wattage – Waaree – WS – 280 Wp

- Meteorological Data: Local meteorological data (e.g., temperature, humidity, wind speed, day length) has been taken from a nearby weather station, which is in Gurugram, Haryana, to complement experimental data.

4.4 Parameters to Measure:

- Data Collection Frequency: For this study, a continuous record of solar array power generation and average temperature with day length for every day of the year 2023 and 2023.
- Controlled Variables: Panel orientation, tilt angle and No. of panels.

This data collection presents the impact of temperature on the power generation of solar panels. The daily data collection and graphs represent the interrelation between power generation, atmospheric temperature and the surface temperature of the panel and roof.

5. Results and Discussions

This study experimentally validates a critical inverse relationship between solar panel temperature and power output under composite Indian climatic conditions (2023-2024 data in Tables 1 and 2 and Figure 2). The analysis conclusively demonstrates

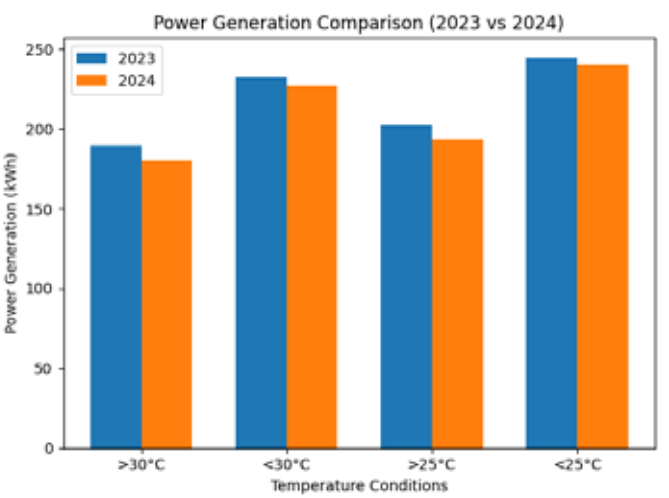

Figure 2: Power generation in 2023 and 2024
Source: Authors

that peak power generation is achieved when panel temperatures fall at or **below 25°C.** Above this threshold, a consistent decline in efficiency is observed, attributable to increased semiconductor charge carrier recombination and reduced open-circuit voltage.

The annual data reveal this phenomenon is most pronounced during the winter months (Nov-Feb) and early mornings, when ambient temperatures are lower and irradiance is still significant. Conversely, during peak summer (Apr-Jun), despite high irradiance, panel temperatures frequently exceed 45°C, leading to a measurable suppression of maximum output by 15-20% compared to the ideal sub-25°C condition. The composite climate, with its wide seasonal variation, provided a robust test environment, clearly isolating temperature as a dominant efficiency-loss factor beyond the rated module conditions.

These findings underscore the significant performance penalty imposed by elevated operational temperatures, which are typical in tropical regions. The results strongly advocate for the integration of active or passive cooling mechanisms in solar installations within composite and similar climates to maintain temperatures closer to the identified 25°C optimum, thereby maximising annual energy yield and improving economic returns.

6. Conclusions and Recommendations

This experimental investigation conclusively establishes that for polycrystalline silicon solar panels operating in India's composite climate, maximum power generation is consistently achieved at module temperatures of 25**°C or lower**. The comprehensive 2023-2024 dataset robustly confirms the detrimental impact of rising temperature on photovoltaic efficiency, with performance degradation becoming significant as operational temperatures exceed this threshold. The findings validate the underlying physics of temperature-dependent voltage loss and highlight a critical operational challenge for regions with high ambient temperatures and solar insolation.

To mitigate efficiency losses, the following measures are recommended:

1. **Prioritise Panel Cooling:** Integrate passive cooling systems, such as rear-ventilated mounting structures or thermally conductive back sheets, for new installations. For critical high-yield sites, evaluate active cooling (e.g., water- or air-based systems) despite their parasitic energy cost.

Table 1: Solar power generation details for the year 2023

	No. of days when avg. temp. is >30°C	Power generation these days	No. of days when avg. temp. is <30°C	Power generation of these days	No. of days when avg. temp. is >25°C	Power generation of these days	No. of days when avg. temp. is <25°C	Power generation of these days
Jan-23	0	0	31	7243	0	0	31	7243
Feb-23	0	0	28	6525	0	0	28	6525
Mar-23	0	0	31	7650	13	3000	18	4650
Apr-23	14	3330	16	3540	30	6870	0	0
May-23	27	4980	4	1050	31	6030	0	0
Jun-23	17	3060	13	3330	30	6390	0	0
Jul-23	17	2820	14	3450	31	6270	0	0
Aug-23	0	0	31	6690	31	5520	0	0
Sep-23	0	0	30	5820	27	5100	3	720
Oct-23	0	0	31	6870	16	3090	15	3780
Nov-23	0	0	30	7860	0	0	30	7860
Dec-23	0	0	31	7350	0	0	31	7350
Total	**75**	**14190**	**290**	**67378**	**209**	**42270**	**156**	**38128**

Table 2: Solar power generation details of year 2024

	No. of days when avg. temp. is >30°C	Power gen-eration these days	No. of days when avg. temp. is <30°C	Power gen-eration of these days	No. of days when avg. temp. is >25°C	Power gen-eration of these days	No. of days when avg. temp. is <25°C	Power gener-ation of these days
Jan-24	0	0	31	7005	0	0	31	7005
Feb-24	0	0	29	6768	0	0	29	6768
Mar-24	0	0	31	7640	6	1350	25	6290
Apr-24	16	3450	14	3660	30	7110	0	0
May-24	28	4890	3	810	31	5700	0	0
Jun-24	30	5100	0	0	30	5100	0	0
Jul-24	18	3150	13	3000	31	6150	0	0
Aug-24	0	0	31	6270	31	6270	0	0
Sep-24	0	0	30	5430	25	4170	5	1260
Oct-24	0	0	31	6150	15	2700	16	3450
Nov-24	0	0	30	7710	0	0	30	7710
Dec-24	0	0	31	7620	0	0	31	7620
Total	**92**	**16590**	**274**	**62063**	**199**	**38550**	**167**	**40103**

2. **Site-Specific Energy Forecasting:** System performance models and financial projections must explicitly incorporate locally validated temperature correction factors, rather than relying solely on standard test condition (STC) ratings.
3. **Future Material Adoption:** Promote the deployment of newer photovoltaic technologies, such as heterojunction (HJT) or perovskite-silicon tandem cells, which exhibit lower temperature coefficients and would be better suited to the regional climate.
4. **Operational Scheduling:** Where feasible, design grid-injection or storage strategies to capitalise on the higher efficiency periods during cooler morning hours in summer.

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AABHAS - A Sense of Home

A Sustainable Model for Migrant Construction Workers

By Ar. Pranjal Tak and Ar. Ashley Fialho

1. Introduction

Migration in India is a large-scale socio-economic phenomenon, primarily driven by the movement of people from rural areas to urban centres in search of better employment, education and living conditions. According to the Periodic Labour Force Survey (PLFS) 2020 -21, the overall migration rate in India was 28.9%**,** with 26.5% in rural areas and 34.9% in urban areas (Government of India, 2021). Migration patterns also show strong gender differences, 47.9% females and 10.7% males were reported as migrants. While 86.8% of female migrants moved due to marriage, nearly 49.6% of male migrated in search of employment (Government of India, 2021).

Migration also contributes significantly to urban growth. As per the Census of India (2011)**,** about 21% of urban population growth is attributed to migration, while 59% is due to natural increase. Beyond demographic changes, migration helps bridge labour shortages and supports rural economies through remittances. Migrant workers also gain skills, social exposure and work experience, which they often carry back to their native places, contributing to local development (Bhagat, 2014)**.**

1.1 Seeking Horizons: Migration as a Necessity

Migration is often driven by the pursuit of better opportunities and the need to overcome adverse living conditions. People move for various reasons such as employment, education, marriage, safety and family reunification. These movements significantly shape social and economic structures, influencing both the regions migrants leave and the places where they settle. Understanding the underlying causes of migration is essential for addressing the challenges and opportunities associated with population mobility.

In India, interstate migration largely follows an economic pattern, where individuals move from economically weaker regions to more industrialised and urbanised states. According to the Census of India (2011) and studies on internal migration, states such as Uttar Pradesh, Bihar, Jharkhand and Odisha are among the major source regions for migrant workers, while Maharashtra, Delhi, Karnataka and Gujarat serve as key destination states due to greater employment opportunities and urban growth.

1.2 Hands that Build: Migrant Construction Workers

Migrant construction workers play a vital role in supporting infrastructure development and urban growth, yet they often face challenging working and living conditions that require stronger labour protections, social security and safer work environments. According to the Census of India (2001), the construction sector employed around 14.6 million workers (excluding brick kiln workers). Among them, 30.4% male workers (3.9 million) and 60.4% female workers (1 million) were identified as migrants, indicating that nearly 10% of non-farm internal migrant workers were employed in construction.

The sector has also experienced rapid expansion. Based on National Sample Survey (NSS) 2007-08 data, the total number of construction workers increased from 15.3 million in 1999-2000 to 29.4 million in

2007-08, reflecting an annual growth of about 8.5%, largely driven by increasing infrastructure and urban development.

Regions with high urbanisation and strong in-migration-such as Delhi-NCR, Gujarat, Maharashtra, Karnataka, Tamil Nadu, Telangana and West Bengal show a higher concentration of migrant construction workers. Mumbai, in particular, remains one of the major destinations for migrant labour due to its continuous construction and infrastructure activity (Census of India, 2001; NSSO, 2007-08).

1.2.1 Challenges Faced by Migrant Construction Workers

Migrant construction workers face multiple challenges that affect their livelihood and well-being. They often work under low wages, delayed payments and insecure employment conditions, frequently in hazardous environments with minimal safety training. Their living conditions are equally difficult, as many reside in overcrowded and unsanitary temporary settlements with limited access to healthcare and basic services.

Due to the absence of proper documentation and official identity in many cases, migrant workers are often excluded from planning and policy processes. This lack of recognition prevents them from accessing social security, welfare schemes and other basic citizenship rights available to the urban population. As a result, they remain socially and economically marginalised, with little access to the administrative and institutional frameworks of cities.

Although many urban slums in India have gradually gained recognition, basic services and housing rights, migrant settlements at construction sites often remain informal and vulnerable to displacement. Over time, this persistent lack of security and support has limited their ability to improve both their working conditions in cities and their living conditions in their home regions (Bhagat, 2017).

1.2.2 Effects of COVID-19

The COVID-19 pandemic significantly affected migrant construction workers, intensifying their existing vulnerabilities. Nationwide lockdowns led to the suspension of construction activities, resulting in widespread job losses and severe income insecurity. Studies indicate that while 95% of workers were employed in construction before March 2020, only about one-third remained employed by August 2020, reflecting nearly a 65% decline in employment in the sector during the pandemic (NSSO, 2020; ILO, 2021). Overcrowded living conditions at construction sites increased the risk of virus transmission, while limited access to healthcare further complicated their ability to seek treatment (Sharma, 2021). The sudden loss of livelihoods forced many migrant workers to return to their home regions, placing additional pressure on rural resources. At the same time, mobility restrictions and separation from families intensified social isolation and emotional distress. Access to government relief measures also proved difficult due to bureaucratic barriers and lack of documentation, leaving many workers without adequate support during the crisis (World Bank, 2020; Organisation, 2021). Overall, the pandemic created long-term uncertainty about employment and livelihood security for migrant construction workers.

2. Building Lives: Worker's Living Conditions

In labour *nakas* and temporary colonies, migrant construction workers live and work in close-knit communities, interacting daily with subcontractors, fellow labourers and informal markets for materials. These settlements are often physically separated from the surrounding city, making the quality of living conditions crucial to the social and cultural life of the residents.

However, the living conditions of migrant construction workers are frequently overcrowded, poorly maintained and unsanitary, exposing them to serious health risks. Due to the temporary nature of construction work, stable housing is rarely provided. Workers usually depend on contractors not only for employment but also for accommodation.

At new construction sites, workers are typically assigned a location and basic materials by contractors, after which they must construct their own temporary shelters. These shelters are built quickly using limited resources and often lack essential amenities, privacy and security. With little control over their living environment, workers are forced to adapt to these inadequate conditions. As a result, many migrant workers reside in makeshift shelters located in basements, unfinished buildings, or even under flyovers, highlighting the urgent need for dignified and safe housing solutions for this vulnerable workforce.

2.1 Literature Review

Renu Desai, an independent researcher based in Ahmedabad with a PhD in architecture from UC Berkeley, focuses on urban transformation and housing in Indian cities. Her research covers topics like equitable development, informality, slum eviction and gendered mobility, with a

particular emphasis on circular labor migrants in the construction sector. Desai has also explored issues of sanitation in Mumbai's informal settlements and housing in cities like Nagpur and Guwahati. Her book, 'Living at Worksites: Policy and Governance for Migrant Worker Housing in Ahmedabad's Construction Sector' (2020) examines the living conditions of migrant construction workers residing at construction sites in Ahmedabad. It highlights that most workers live in temporary, makeshift settlements controlled by private contractors, where basic services such as clean water, sanitation and electricity are often absent.

Desai argues that these poor living conditions stem from weak policy implementation and gaps in governance. Although laws such as the Interstate Migrant Workmen Act exist to protect migrant workers, they are often outdated or poorly enforced, leaving workers excluded from formal housing policies and welfare systems. Contractors, aiming to minimise costs, typically provide only minimal and poorly designed shelter.

The study also emphasises the spatial and social marginalisation of migrant workers, who are often located on the edges of cities and disconnected from public infrastructure and services. Desai calls for stronger policy frameworks and governance mechanisms to ensure safe, affordable and dignified housing, recognising migrant workers as an integral part of urban development rather than temporary occupants.

2.2 Government Initiatives and NGOs

The Building and Other Construction Workers Act (1996) and the BOCW Welfare Cess Act (1996) aim to improve the welfare of construction workers by collecting a 1-2% cess on projects above ₹10 lakh, which funds benefits such as pensions, healthcare, education support and housing for registered workers (MoLE, 1996). However, implementation has been weak. Although ₹38,685 crore was collected as welfare cess, only 25.8% has been utilised and by 2015 only 45.5% of construction workers were registered, highlighting a major gap between policy and practice (NCEUS, 2019).

The Inter-State Migrant Workmen Act (1979) also aims to protect migrant workers through contractor regulation, fair wages and travel allowances, but enforcement remains limited. Other initiatives such as Atmanirbhar Bharat Abhiyan (2020), Pradhan Mantri Shram Yogi Maan-Dhan (2019) and One Nation One Ration Card (2020) seek to improve social security, yet many migrant workers remain unaware of these schemes.

Non-Governmental Organisations (NGOs) play an important role in supporting migrant construction workers by addressing gaps in education, healthcare, legal aid and welfare. Mumbai Mobile Creches (1972) provides childcare, preschool education, nutrition and healthcare for children of migrant workers through day-care centres at construction sites, reaching around 1,000 children each month (Reddy & Sethi, 2022). Aajeevika Bureau (2005) supports migrant workers through registration, skill training, legal assistance and access to healthcare, helping improve their livelihoods (Singh & Sharma, 2023). SEWA - Self Employed Women's Association (1972) empowers women in the informal sector by providing financial services, healthcare and vocational training while advocating for workers' rights (SEWA, 2023).

3. Invisible Families: The Impact on Migrant Households

3.1 Women in Construction

"Gender equality is not about women or men - it is about making workplaces work for everyone." - Michelle King

Women working in the construction sector face significant challenges, including gender-based violence and harassment (GBVH). The construction environment often becomes risk-prone due to the influx of migrant male workers, unequal power dynamics and limited oversight. According to the International Labour Organisation (ILO, 2019), such conditions can increase vulnerability to harassment and exploitation. A recent study found that 74% of female construction workers reported experiencing sexual harassment at worksites, often by supervisors or male co-workers (Desai, 2024).

Several factors intensify these risks, including the presence of a transient male workforce, limited access to support services in remote work locations and misuse of authority by security personnel. Beyond these social challenges, women also perform extremely demanding physical labour. They carry heavy construction materials such as bricks, concrete bundles and mud over long distances, often repeating these tasks for hours with minimal breaks. These strenuous working conditions highlight the need for safer workplaces, stronger labour protections and greater gender-sensitive policies in the construction sector.

3.2 Children in Construction

Children of migrant construction workers often grow up around construction sites due to poverty, migration and limited access to education. Frequent

relocation and lack of nearby schools or childcare facilities make it difficult for parents to ensure regular schooling. As a result, many children spend their time at worksites, exposed to unsafe environments and health risks. Several factors contribute to their vulnerability. Many construction sites lack daycare facilities, proper nutrition and adequate sanitation, while limited breaks make it difficult for mothers to breastfeed regularly. Overcrowded or insufficient toilets also lead to poor hygiene conditions. These challenges increase the risks of malnutrition, poor health and developmental issues among children.

Globally, the ILO (2020) warns that millions of children are at risk of entering child labour due to the economic impact of the COVID-19 pandemic, potentially reversing decades of progress. In a developing country like India, it is crucial to strengthen efforts to prevent child labour and extend welfare benefits, education and childcare support to the children of construction workers to safeguard their well-being and future (UNICEF, 2021). Figure 1 shows the conversations with the construction workers telling about their current situation.

Figure 1: The noises within the silence.

3.3 Aim and Objectives

This dissertation aims to improve the living conditions, give educational and economic opportunities for migrant construction workers' families by developing a cost-effective, sustainable and transportable architectural model, meeting their basic needs and fostering community cohesion.

3.4 Objectives

- To Identify essential infrastructure improvements for enhancing living and educational environments of families of migrant construction workers
- To design a scalable, vertically stackable and adaptable model that can be dismantled and reassembled for various site conditions, especially in compact site situations.
- To reuse and recycle the onsite construction waste to create a cost effective and sustainable model

4. Methodology

To achieve the objectives of this study, various research methods has been used to collect and analyse relevant data. A systematic approach is adopted to understand the key issues related to the topic and to develop appropriate solutions based on the findings.

- Literature review to understand the living conditions of migrant construction workers and identify key challenges.
- Architectural case studies of ephemeral architecture, modular housing systems and design approaches using construction waste.
- Study of cultural practices to understand spatial needs, traditions and festival celebrations of migrants from different states.
- Interviews and conversations with workers and their families to gain first-hand insights into their daily lives and needs.

5. Architectural case studies

Studying architectural case studies based on ephemeral architecture, modular housing systems and design approaches using construction waste to understand how construction systems enable easy assembly and disassembly for temporary structures. The study also examines material selection based on cost, availability and reusability, explores how a standard structural framework can accommodate different infill materials depending on site conditions and analyses ways to integrate community spaces within spatial and site constraints. Table 1 highlights the key aspects and insights derived from each case study, forming a foundation for understanding the construction systems, material choices and modular design strategies.

6. Design Description: AABHAS- a sense of home

Aabhas - a sense of home reimagines the living conditions of migrant construction workers, not as temporary occupants, but as carriers of culture, memory and identity. Instead of treating migration as a break from home, the project proposes an architectural system where culture travels with people, embedding familiar spatial practices, materials and community life into adaptable, modular settlements. By rethinking housing, sanitation, education and shared spaces through this lens, the aim is to create environments that do more

Table 1: Key aspects derived from Architectural Case Studies
Source: Adapted by Author

Sr. No	Criteria	Case study	Takeaways from Each Case Study
1.	Ephemeral Architecture	Container housing, Japan Architect - Shigeru Ban	• Vertical stacking • Human centric design • Rapid deployment • Buffer spaces and circulation • Future flexibility
		Modskool, Delhi, India Architect - Social Design Collaborative	• Usage of local materials • Natural ventilation and airflow • Resilience to displacement • Community engagement
2.	Modular housing systems	Changodar Housing, Aavaas by Nebula, Ahmedabad, India Architect - Hannah Broatch and Mason Rattray of Hatch Workshop	• Material selection and comfort • Playful and interactive spaces • Corporate social responsibility • Innovative modular design
		Urban Nomads, Thane, Mumbai, India Architect – Aniket Risbud	• Versatile design • Personalisation to the module • Flexibility in material usage • Adaptive and modular design
3.	Designs from construction waste	Pavilion, Kochi Muziris Biennale, India Architect – Samira Rathod	• Integration with nature • Duration of construction • Construction waste usage • Spatial experience
		Toilet 01, Amritsar, India Architect – R+D Studio	• Sustainable use of materials • Construction and design

than provide shelter-they reconstruct belonging.

6.1 Design Development

Site: The chosen site acts as a staging ground for possibilities, located in Juinagar, Navi Mumbai. The site offers three distinct labour camp settings - linear, compact and spread-out. Each type presents unique challenges, allowing exploration of cluster formations and site arrangements. The design tests both ground level and G+1 structures, linked by pathways that double as social corridors. Figure 2 shows three labour camp sites within a larger site.

Figure 2: Site-staging ground for possibilities

Approach: In this system driven by time and cost, craft is often the first to disappear. This project brings it back - not as decoration, but as construction logic. Craft is reinterpreted as:

- Clarity of detailing
- Ease of assembly
- Efficiency of repetition

Within this efficient structure, spatial cultural values are seamlessly integrated, ensuring that speed and economy do not come at the cost of identity. The design adopts a 1.2m × 1.2m modular grid, derived from panel sizes, making the system flexible. This allows the module and cluster to scale up or down seamlessly, accommodating varied family sizes and site conditions. Seven types of panels form the building blocks of the unit, connected through dry plate-and-bolt joineries. These joints are simple enough for workers themselves to assemble, dismantle, or reconfigure without dependency on specialised skills or heavy machinery.

Programme Formation: After carefully understanding the users and analysing their everyday activities, the programme extends far beyond the provision of housing units, addressing the diverse needs of migrant construction workers and their families. It begins with residences designed separately for male workers and families, but expands into spaces that nurture community life and well-being. Recreational and communal areas such as a creche, shared kitchen and gathering spaces for festivals and events encourage social interaction and cultural exchange among people from different regions. Economic feasibility is integrated through workshops for women and small shops, empowering families with livelihood opportunities. Finally, sanitation and safety are prioritised with dedicated toilet and bathing units, a medical room, daycare facilities and a security cabin. Together, these elements create a holistic system that not only provides shelter but also encourages dignity, safety, connection and growth. Figure 3 and 4 shows all the modules design for different programmes.

6.2 Materials and structural system

Material selection was guided by criteria such as - affordability, durability, thermal comfort and local availability, ensuring that the construction remains practical and sustainable. Bison boards for walls, PUF panels for roof, PVC tiles for flooring and bamboo for doors and windows were selected materials. Simple dry plate-and-bolt joineries allow workers to easily assemble, dismantle and reconfigure the units without specialised skills or machinery, making it a truly hands-on home, designed for speed and temporality. The MS structural framework forms a fixed skeleton, while the infill materials remain flexible, allowing the system to adapt to different climate and contexts, making it globally adaptable. Aluminium or tin sheets in colder climates, tetrapack with air gaps for insulation and reflecting heat in hot and humid climate, PVC flex in composite conditions and bamboo mats in temperate climate for natural ventilation. Figure 5 shows the joineries and the structural connections.

The entire prototype can be assembled in 8 simple steps and the estimated duration for construction of one module is 2-3 days. A single unit is designed as a flexible space, transforming into a creche, a women's workshop, or a medical room as needed. This adaptability allows different groups to inhabit the same space over time, fostering interaction, shared experiences and the continuous exchange of culture.

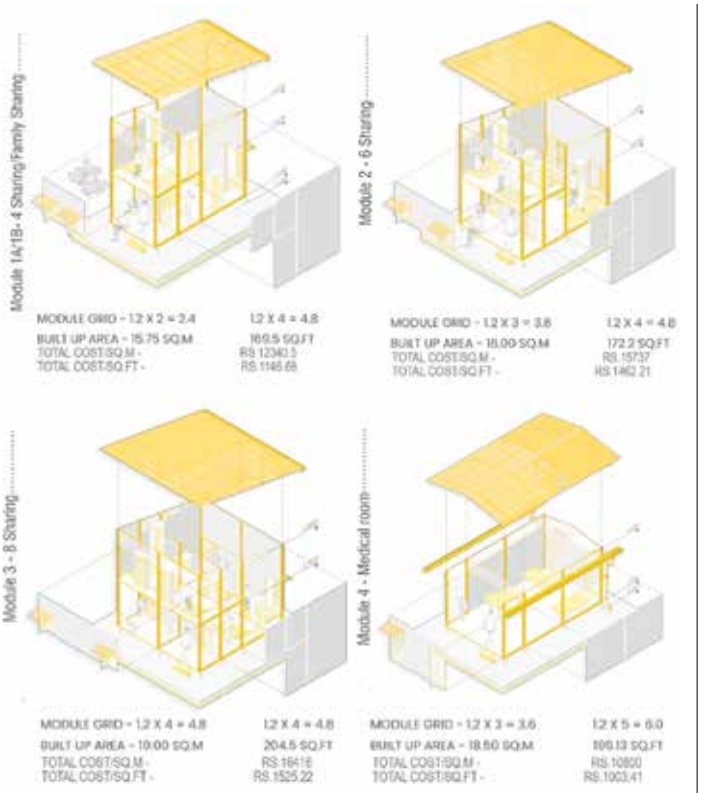

Figure 3: Designed units according to the programme

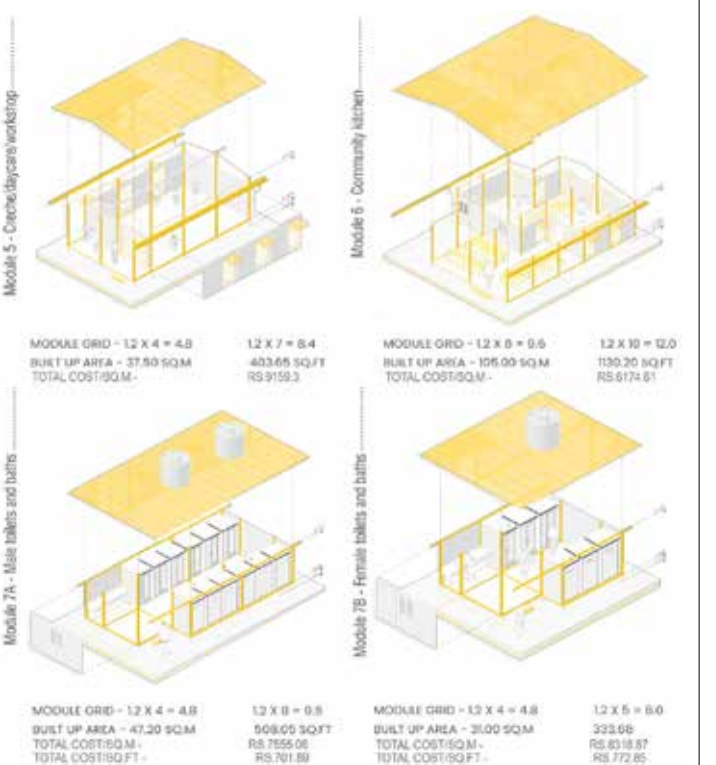

Figure 4: Designed units according to the programme

6.3 Spaces that weave diverse lives together: Cluster Formation

The units eventually forming modules and modules forming clusters. The formation of cluster is done keeping in mind criteria like comfort, privacy, personalisation and seasonal modifications according

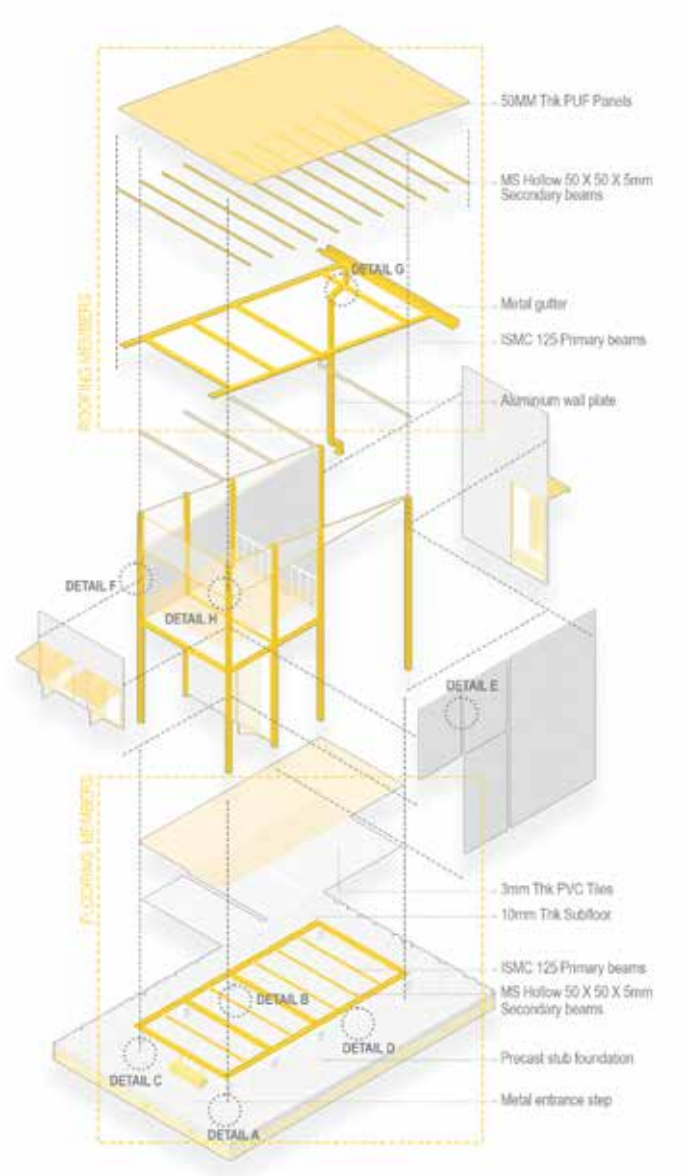

Figure 5: Joineries and connection system

to their requirements. G+1 cluster for the narrow site has 7 units of different configurations, G+1 cluster for the compact site has 16 units and ground floor clusters for the spread-out sites has 10 units.

Architectural Elements: The cluster framework uses verandahs as active thresholds, supporting everyday life like resting or drying clothes, while transforming during festivals into vibrant spaces for *rangoli, diyas* and celebration. The second element is the *saanchi chaat* -shared terraces for upper units that support everyday activities like drying papad and pickles, while transforming during festivals into lively spaces for kite flying and collective celebration.

The third element is the *aangan* - a private courtyard for each unit that supports personal rituals, such as a *tulsi* plant, while also adapting during festivals like *Harela* into green patches for planting and nurturing growth. Hence the cluster is formed to carry the memories of the culture that they follow, eventually giving them a sense of belonging even in the unfamiliar land. Figure 6 shows the cluster formation for all three sites and the elements used during cluster formation. Figure 7 shows personalisation of the clusters by the users

6.4 Site arrangements

The design is envisioned as a universal system, a framework that can be adapted to any site, condition, or climate through a set of simple thumb rules and the inherent flexibility of its modular structure. Flexibility is embedded at multiple levels. To suit diverse climates, simple orientation and placement rules are applied. Verandas, windows and ventilators can be oriented toward prevailing winds for ventilation or shaded from harsh sun for thermal comfort. The site arrangements for all three sites are done according to the thumb rules - the narrow site, the compact site and its planning and the spread-out site with all the programs and facilities. All together it forms an ecosystem designed to uplift.

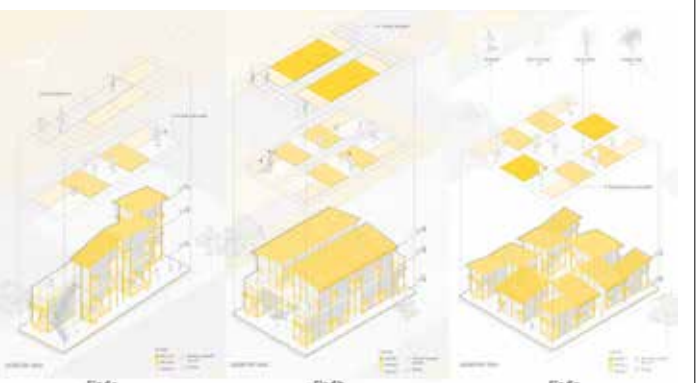

Figure 6: Cluster Formation
a: Cluster for narrow site, b: Cluster for compact site, c: Cluster for spread-out site

Figure 7: Personalisation of the units

The Manoranjan Chowk: The central common courtyard is called the *Manoranjan chowk* where the festivals like *Chatt puja* where a water body is kept in centre, *Durga puja*, *Janmashtami* etc. are celebrated all together. Along with festivals like *Sarhul* and *Karam* which is worshiping a sacred tree or, in this case, a small stem of the tree is also celebrated collectively. The same space adapts during festivals like *Sohrai* and *Madhubani*, where walls become living canvases for painting, carrying these cultural expressions to the next site and allowing them to be renewed over time. Lastly it can also be used to screen movies or cricket matches during evenings on a white cloth as is done in rural areas. Figure 8 shows the site arrangements in the narrow and spread-out sites.

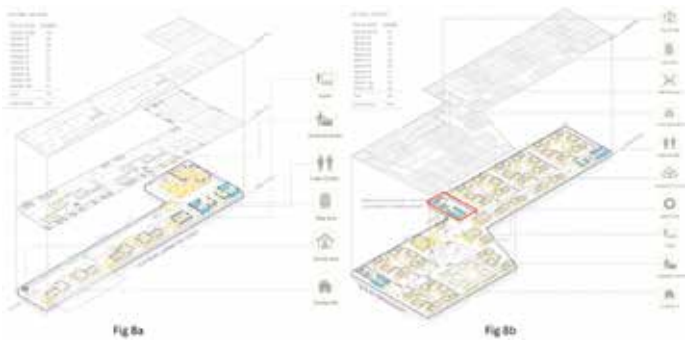

Figure 8: Site arrangements - a: Narrow site with G+1 clusters, b: Spread-out site with single storey clusters

6.5 Treating the Edge

Since the labour camps are always tucked at the edges of the site, the idea is to open up the street edge and make the edge porous for exchange of flavours and crafts from their states to the outside world. This enables interaction not just inside the camp but outside as well. This will also reinforce women empowerment and add to the betterment of their economic conditions. Figure 9 shows the street edge opening up and its connection from inside to the outside world.

Figure 9: Opening up the street edge

Figure 10: A courtyard with shared moments, children at play and the soul of community life.

6.6 Services

Services are designed to suit the temporary nature of the settlement - efficient, low-cost and easy to set-up or dismantle. Pathways use repurposed construction waste, making them sustainable and site-responsive. Sanitation is handled through mobile FRP bio-digesters placed between toilet blocks and near kitchens, ensuring safe waste treatment. Water use is minimised with pour-flush toilets (6 – 8l vs. 15l) and bucket baths (10 -15l vs. 40l showers). Deployable water tanks (500l - 50,000l) provide flexible storage for drinking, harvesting and firefighting. The planting strategy relies on fast-growing, short-lifespan species like neem, bamboo, papaya, tulsi, aloe, vetiver. These add shade, food, health benefits and cooling effects. Together, these services create a sustainable, adaptable and resource-efficient system tailored for temporary living. Occupant comfort and ventilation is achieved through the use of eco-coolers made of recycled plastic bottles, adding to the low cost methods.

7. Design Overview and Conclusions

Comparison to other modules in the market: The designed modules were compared with the readily available modules in the market in terms of lifespan, speed of construction, reusability and flexibility. According to the analysis, a single module can be reused four to six times over a span of 20 years and four to five modules can be transported at a time in a standard truck.

This is an architectural response that does not treat labour housing as an afterthought, but as an ecosystem of life and potential. Figure 10 shows the overall design culmination through views. This project emphasises that housing is not just shelter. The efficiency of these houses does not have to erase identity and it highlights that culture is not fixed to place, it travels with people. Finally, it shows that architecture can do more than provide space. It can restore what migration takes away.

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All images courtesy author

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ARTICLE

A Century of Modernism in Architecture

By Ar. Vedula VLN Murthy

The Dawn of Modernism in Architecture

During the 18th and 19th centuries, industries and cities had swelled and crammed with little planning and not much concern about safety and health. Necessity is the mother of invention. Sometimes unfortunate situations create opportunities. The three-day Chicago fire accident in 1871 destroyed over 17,000 structures and left over 100,000 residents homeless - that led to the reconstruction of the city by raising taller buildings leading to advancement in fire safety and building codes, byelaws, regulations and city planning to govern different land uses and zones. It also alerted the local administration, professionals, engineers, technologists and industrialists to search for new solutions.

Industrialisation brought new building materials such as reinforced cement concrete, steel and glass that played a major role in construction that ushered a great change in architectural designs and construction methods. The invention of the elevator by Elisha Otis in 1852 facilitated the construction of multi-storey structures. The London Garden city founder Ebenezer Howard's ideas on town planning raised concern towards open city and green city ideas.

Arts and Crafts Movement

The Arts and Crafts movement that was flourishing between 1880 and 1910 continued until the 1930s. In 1908, the essay 'Ornament and Crime' written by Austrian architect and Theorist Adolf Loos (1870-1933) proclaimed that architectural ornamentation is crime, which would waste materials and need efforts to add ornamentation. His literary contributions sparked the establishment of Vienna Secession movement and Modernism. He was passionate towards smooth and precious surfaces. His essay came out when the Art Nouveau movement was at its height. Further, the writings of the German architect Hugo Haring (1882-1958) on organic architecture during the 1920s and 1930s led to over simplification and reductionist mind-set and methodologies that claimed to be scientific and rational.

Modernist Movement

Modernism was a paradigm shift in design and a break-away from the embellished styles of the past. Freedom of expression, intense personal designs and desire for new beauty, finding solutions rather than following specific style had paved the way to new designs. Use of industrial materials had become an integral part of the design philosophy. New activities of the developing cities required new built environs that brought new solutions and new forms in architecture. Functionalism and pragmatism, simplicity, open spaces, human-centred approach led to efficient designs but sterile buildings. The 1939 New York World Fair with the theme of 'The World of Tomorrow' marked a breaking point between Art Deco and Modernist style, in which the Pavilions of Finland by Alvar Aalto and of Sweden by Sven Markelius and of Brazil by Oscar Niemeyer and Lucio Costa presented new styles. The principles of Modernism in architecture are unfolded in the following three phases:

Early Modernism, 1880-1900 C.E.

Iron frame design of the Crystal palace, London (1851) paved the way for experiments and exhibitions; and the Eiffel Tower in Paris (1889)

and steel frame construction in Chicago created altogether new avenues. Louis Sullivan, known as the father of modern architecture as well as father of skyscrapers, raised the idea of practical purpose and functionalism and used the idiom "Form follows Function".

Late Modernism, 1900-1960 C.E.

In Europe and USA, the Art Deco was still in course during the early period of the Modernism movement. The New Objectivity movement in architecture in Weimar in Germany opposed the excesses of Expressionist architecture and the architects Bruno Taut and Erich Mendelsohn turned towards Objectivity's functional approach. After shifting the German Bauhaus school from Weimar to Dessau in 1925, Walter Gropius designed the new buildings and its asymmetrical layout, horizontal windows, white walls and flat roofs distinguished it as a Modernist monument that embraced every aspect of life. Bauhaus influenced American architecture that paved way to international modernism, an offshoot of Modernism in America. Gropius' house in Lincoln in Massachusetts (1938) created a sensational effect. Functionalism and Minimalism brought sleek and plain surfaces. The period brought open floor plans, expansive glazing for natural light and pilotis to elevate the structure and brought different styles and philosophies within itself, which could not be separated from each other and were inter-linked. The following ideologies were emerged within Modernism in architecture:

- Bauhaus school movement
- Expressionism
- Organic Modernism
- Functionalism
- Internationalism
- Brutalism
- Minimalism
- Desert Modernism
- Structuralism
- Constructivism
- Deconstructivism
- Formalism
- Hitech-modernism
- Stalinist architecture

Early Modernist architects and their Philosophies

All-time great architect Frank Lloyd Wright was a sensation in the field of architecture in the U.S.A., who brought Organic architecture within Modernism. Wright's organic architecture was modelled in response to function and nature and in relation to the site. Prairie houses and Usonian houses, Falling Waters, Johnson Wax Buildings and Guggenheim Museum were the hits that created a great impact on contemporary architects. Wright's principles of organic architecture inspired a generation of architects to consider the ecological context of their designs.

Image 1: Falling waters, Pennsylvania
Source: Fallingwater, Pennsylvania [Photograph]. (n.d.). Our Dogs. https://ena.our-dogs.infofacts-i.html

Le Corbusier's ideals like- Building on pilotis to minimise ground disruption, ribbon windows for day lighting and rooftop gardens— a precursor to today's green roofs, are relevant even today. Unite d' Habitation in Marseilles in France attempted to reconcile the built and natural environments.

Image 2: Unite d' Habitation, Marseilles, France
Source: Unite d'Habitation, Marseilles, France [Photograph]. (n.d.). Pinterest. https://in.pinterest.com/pin/304696731036511717/

The main aims - to reduce urban heat, improve air quality and provide communal areas, reflect a commitment to holistic design. Since then, the thought of sustainability and connecting to nature have been surfacing and influencing the minds of architects and people. Le Corbusier considered the context of climate in India like the scorching sun and extreme monsoon, while designing the city of Chandigarh.

Mies van der Rohe's epitomes like- Minimalism, all glass walls and merging of inside and outside brought many further changes. Germany Pavilion in International Exhibition in Barcelona, Illinois Institute of Technology, Chicago and Farnsworth House, Illinois stood without any competition.

Image 3: Farnsworth House, Illinois
Source: The Farnsworth House by Ludwig Mies van der Rohe [Photograph]. (n.d.). Reddit. https://www.reddit.com/r/ArchitecturePorn/comments/73p77d/the_farnsworth_house_by_ludwig_mies_van_der_rohe/

The box-type form of the Farnsworth House and Richard Neutra's Desert Modernism and International style of architecture and his linear and rectangular forms and open floor plans are still visible with some modifications. Neutra coined the word Bio-realism to describe the inherent and inseparable relationship between man and nature.

The versatile architect Eero Saarinen was first to create robust, sculptural and curvilinear geometries of great Scale and Monumentality and Institutional presence. His Expressionist visual drama was unknown both in architecture and furniture until then and it brought exciting results during the time, when boring uniformity and austerity of International style of architecture was prevalent. The Dulles International Airport, Washington, TWA Flight Centre, New York, St. Louis Gateway Arch in Missouri and Kresge Auditorium in Cambridge were his landmark structures.

Louis Kahn projected Functionalism, Formalism and Natural light and his notion of Bio-Realism aimed to incorporate biological sciences into architectural design. He created spaces that not only appealed to the senses but also fostered a deep connection with nature. His buildings often show large-scale

Image 4: TWA Flight Centre, New York
Source: Acroterion. (n.d.). TWA Flight Center, New York [Photograph]. Wikimedia Commons. https://commons.wikimedia.org (Licensed under CC BY-SA 4.0)

geometrical windows and voids that allow natural light inside. Jorn Utzon's Expressionist and sculpture-like Opera House in Sydney stands as a landmark structure forever not only in Australia, but in the whole world.

Image 5: Opera House, Sydney
Source: Georgfotoart. (n.d.). Sydney Opera House [Photograph]. Wikimedia Commons. https://commons.wikimedia.org (Licensed under CC BY-SA 4.0)

Finnish architect Alvar Aalto's solutions were highly individual and relevant to the needs of users. He was less interested in arguing about specific styles of architecture and their names. The China-born American architect Ieoh Ming Pie did not believe theoretical concerns and is known for the use of large, sharp, geometrical designs encompassing Modernism with Cubist themes. In China, Ieoh Ming means to inscribe brightly and I. M. Pei proved it right. His formalism truly reflects in the National Gallery East Building, Washington and the Bank of China, Hong Kong.

Oscar Niemeyer broke away from the rigid, straight lines of the contemporary times and created flamboyant curved forms that left an indelible mark in the field of architecture. The Cathedral of Brazilia and Niteroi Art museum in Rio de Janeiro are standing among the strange buildings of the world. Niemeyer was very particular about the form of the building, hence said, "My work is not about Form follows Function, but Form follows Beauty or even better, Form follows Feminine."

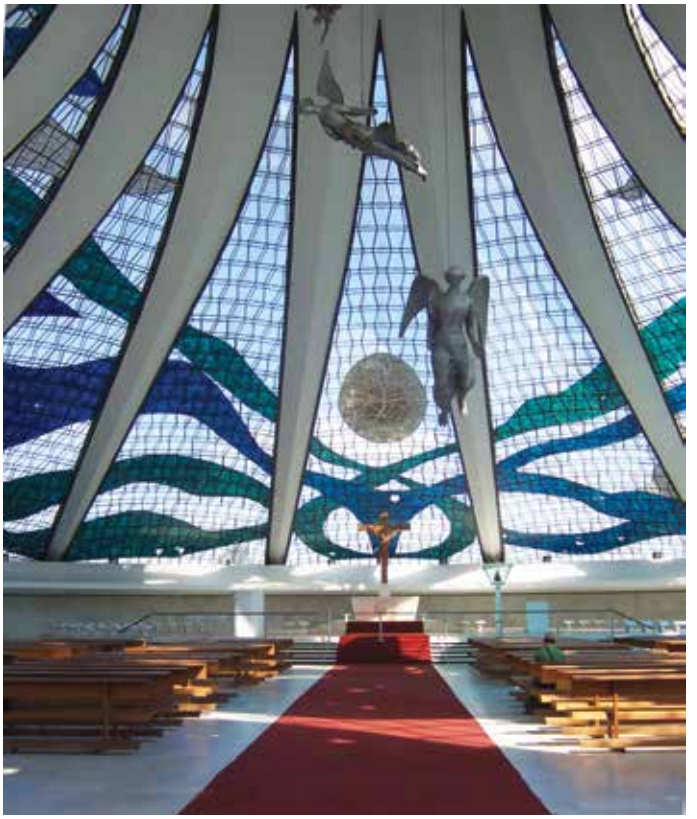

Image 6: Cathedral of Brasilia, Inside
Source: Souza, T. de A. de. (n.d.). Cathedral of Brasília [Photograph]. Wikimedia Commons. https://commons.wikimedia.org/index.php?curid=95326993 (Licensed under CC BY-SA 4.0)

Mexican-Spanish architect Felix Candela believed that strength should come from form and not from material or mass. He relied on the geometrical properties of shells for the analyses of complex mathematical means and explored tensile shell structures.

Image 7: Restaurante Los Manantiales, Mexico City, Mexico
Source: Restaurant Los Manantiales, Mexico City [Photograph]. (n.d.). Pinterest. https://mx.pinterest.com

Inspired by the transparency of spider's web and the strength of fisherman's net, German architect Frei Otto created light-weight tent-like structures and grid shells. Engineer Pie Luigi Nervi's contributions are also praise worthy.

Japanese architect Kengo Tange's designs reveal Machinist modernism and Constructivist principles, having sturdy orthogonal lines, clarity and beauty and using Beton Brut concrete finishes in a raw and undecorated way. Further, Tadao Ando, a great name for poetics has produced archetypes of pure unadorned large-scale geometries where light and shadow, full and empty, solid and void and contrast of opposites draw attention. His structures follow natural forms of the landscape rather than disturbing the landscape. Rudolph Schindler (Schindler House and Lovell Beach House, California), Marcel Breuer (UNESCO Head Quarters, Paris and Wassily Chair), Paul Rudolf (Milam residence and University of Massachusetts- Brutalist Design); Skidmore, Owings & Merrill- SOM (Burj Khalifa, Dubai), Moshe Safdie (The Jewel Changi Airport, Singapore and the stacked structure of Habitat 67, Montreal) all contributed much to the Modernist movement.

Post-Modernism, From 1960s to Present

Nazis labelled Bauhaus Modernism as degenerate and accused of abandoning German national heritage for the sake of International formalism. Hence, Bauhaus was closed down in 1933 and many architects from the Bauhaus movement went to America, where the Bauhaus' legacy continued. Post-Modernism asserted that every nation and community have cultural components that are to be revered and that the local architecture should reflect this.

During the 1960s, modern architecture was thought to be barren and lacking meaning, as it got out of proportion by the monotonous glass and steel structures appearing everywhere. Reformers felt that architecture should be responsive to the peoples' needs. Thus, architecture moved from aesthetics to empirical science. Environmental design approaches consisting of basic theory, design methods and social and philosophical determinants of form were considered, thus giving scope to Post-Modernism that also brought High-tech Modernism. Philip Johnson, who was an ardent champion of Modernism often, changed his ideas with time. And sometime during 1970s, Johnson was first to abandon Modernist style in favour of Post-Modernism, a movement that helped to shift the American architecture to a new dimension by the reuse of traditional elements, when he added a Baroque element called Chippendale top in Sony Tower (AT &T Building) in New York during 1984. Johnson also tried Deconstructivist designs of Frank Gehry in the Da-monsta House in his Glass House compound in Connecticut. All-concrete, red and black Monsta looks like a sculpture, rather than a house, which is contrary to his earlier Glass House.

Image 8: Da-monsta by Philip Johnson in New Canaan, Connecticut
Source: Staib. (n.d.). Da-Monsta, New Canaan, Connecticut [Photograph]. Wikimedia Commons. https://commons.wikimedia.org (Licensed under CC BY-SA 3.0)

American architect Robert Venturi criticised the absence of cultural meaning in modern architecture and believed that structure and decoration should remain separate and the decoration should reflect the culture. Venturi coined the postmodern antidote- Less is Bore as a counter to Mies' phrase Less is More. Subsequently, Enrique Tovar coined Frameless is More in an article written for Vitrocsa minimalist window systems published in archdaily. com.

Sustainability and Cultural Components in Modern Architecture

Industrialisation that was perceived as development has now seen to become detrimental to the climate as well as humans. The widespread use of concrete and steel required significant energy to maintain the inner climate and the embodied carbon they carried was neglected. The Mies' Farnsworth House relied on large expanses of glass panes, leading to poor thermal performance and high energy consumption. The Seagram Building with its glass facade offered minimal insulation resulting in significant heating and cooling demands. Le Corbusier's Villa Savoye, Poissy in France sought harmony with its rural surroundings, but relied on mechanical systems for comfort neglecting ecological sustainability.

Even so, the modernist architecture laid the groundwork for sustainable practices. From Wright's integration of nature to Le Corbusier's rooftop gardens, the seeds of environment-conscious designs were undeniably present, although limited in their execution. Buckminster Fuller emphasised the importance of energy-efficiency and paved the way for sustainable designs. The need for sustainability gained momentum during the 1960s and the idioms of Modernism like- true to nature and merging into nature continue to guide the functional and ecological balance.

Architecture has now evolved beyond Modernism emphasising the cultural and environmental responses, integration of local materials, vernacular traditions and sustainable design practices. While the basic principles of Modernism were the same, but they were shaped according to the local cultures and interests.

In India, Balakrishna V. Doshi, who worked under Le Corbusier and Louis Kahn, was well associated with technology and progress; but Doshi's designs were deeply rooted respecting Indian culture and the use of local materials. Doshi was strongly impressed by the cool vaulted space, brick piers and the deep turf roof of Vikram Sarabhai's house designed by Le Corbusier. Doshi wisely interpreted the vision of modernism and localised it to suit the contexts of climate and cultural traditions and the way of life and economical aspects in India. His architectural studio Sangath is an example of this philosophy connecting the buildings harmoniously with nature and landscape. Further, Laurie Baker in India was a practical man, who truly produced low-cost and energy-efficient designs which are true to nature and sustainable.

Egyptian architect Hassan Fathy, who was considered the father of sustainable architecture of the Middle East, believed that the poor do not benefit from the merit of aesthetics and the straight line is the line of duty, while the curve is the path of beauty. Sri Lankan architect Geoffry Bawa developed his own Regional Modernism appropriate to the site and context and produced sustainable architecture well before the term was quoted.

Modernism in Architecture in 21st Century

Focus on design diversion and unconventional design approaches and producing stylish or stunning buildings or unusual buildings has become a trend. Frank Gehry moved away from conventional designs to Deconstructivist designs and transformed his unusual dramatic forms into built forms. Deconstructivism is characterised by an absence of harmony, continuity or symmetry in buildings.

The Architects-Trio Richard Rogers, Norman Foster and Renzo Piano are producing great iconic structures by embracing technological advantages aiming towards uninterrupted flexible interior spaces for total functionality - termed Late-Modernism or Hitch-

Image 9: Walt Disney Concert Hall, Los Angeles
Source: Jjron. (n.d.). Walt Disney Concert Hall, Los Angeles [Photograph]. Wikimedia Commons. https://commons.wikimedia.org/index.php?curid=19436299 (Licensed under GFDL 1.2)

tech Modernism. Like Oscar Niemeyer, Zaha Hadid adopted curves as a design tool to reinvestigate the untested experiments of Modernism to unveil new buildings. She liberated architectural geometry, giving it an expressive and expansive identity by a whole new dimension. Her awe-inspiring buildings have become great landmarks.

Image 10: Heydar Aliyev Center in Baku, Azerbaijan
Source: Heydar Aliyev Center, Baku [Photograph]. (n.d.). Architectural Digest India. https://www.architecturaldigest.in/content/zaha-hadids-iconic-creations-heydar-aliyev-center-baku-philosophy-architecture/

Conclusion

Modernist architecture that began a century ago has contributed its might and still is streaming down endless varieties of forms and functions providing suitable environs for the people. Architecture continues to evolve, respond and reform according to the changing contemporary technologies and should serve all communities. The idea of preserving the culture and traditions in architecture still has to grow and evolve. The buildings and spaces can be useful for cultural exchanges and can improve local economies. Let noble thoughts in architecture shower and solve common man's shelter problems and be sustainable.

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The Book 'Modern, Postmodern Architecture and Pioneer Architects' by Vedula VLN Murthy

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ARTICLE

Visual Environment of Indian Cities

A Case of Lucknow

By Prof. Subodh Shankar

As a common perception, the word environment gets confined only to climatic and pollution issues, while the aesthetic aspect of environment is missed out of seminars and conferences all over the globe. Undoubtedly, people are more concerned about their health and wellbeing; however after visiting a well-designed and aesthetically pleasing urban space, they feel elated and do not forget to mention about the aesthetic quality of the place. Beauty has been defined as visual input that gives pleasure to the mind; thus, aesthetics offer as per definition a positive experience. Of late, scientists and medical professionals have started researching the relationship of aesthetics and people's health, especially the psychic aspects. According to the World Health Organisation (WHO), the process of present-day urbanisation, which is mostly devoid of 'visual quality', is leading to a steady growth of psychic diseases, mainly because of 'poor visual environment'. Therefore, while focusing on air and water pollution, 'visual pollution' also needs to be considered while deliberating on the topic of urban environment. In this context, the article discusses the visual environmental issues of Indian towns, taking a case of Lucknow, the capital of the most populated state of the country. Simultaneously, the study advocates for the creation of fully empowered 'State Level Urban Art Commissions' across the country. The main focus of these commissions would be to create 'Vision' documents for all important towns and cities of the state along with creation of their 'aesthetic profiles'. The study also brings forth the shortcomings of the 'Smart City Mission' which has completely ignored the 'aesthetic' component of urban planning and design. There appears an urgent need for a movement similar to 'The City Beautiful Movement' of the United States incorporating all the technological inputs available with us now.

Introduction

The Oxford dictionary defines aesthetics as "knowledge derived from the senses" while well-known German philosopher Immanuel Kant considers it as *"science of the condition of sensuous perception"* (Porteous, 1996). According to Kevin E.Y. Low, a Singapore based social scientist (Low, 2017), **"**aesthetics derives etymologically from the Greek word 'aesthesis'; meaning sense perception or sensory cognition. Consequently, urban aesthetics deals with sensory information provided by the built environment and its effects on humans individually or humans as a group." As 'sensuality' is central to aesthetics, urban planning and architectural design personnel dealing with aesthetics, order and the form of the city should be especially interested in understanding sensory characteristics of urban spaces. Further, according to J.L. Nasar, an environmental psychologist and urban designer at the Ohio State University, quality of aesthetics is identified as a major dimension in the public perception of their surroundings: variables such as pleasure or beauty represent the most influential dimension of environmental assessments and aesthetic factors have a major influence on judgments of community satisfaction (Nasar, 1988). In sequence, an aesthetic response is to be considered as a mix of high pleasure, excitement and relaxation. Still further, Stephen C. Pepper, Professor of Aesthetics at the University of California feels, "a beautiful city --- still caresses our nerves and sooths us with its scarcely perceived delights" (Pepper, 1945).

Urbanisation and Mental Health

According to some psychiatrists' estimation, 80 % of their patients suffer from so called "syndrome of big city", the main signs of which are depression, psychic unbalanced state and aggression. There are grounds to think that the growth of psychic diseases is caused by unnatural urban visual environment. The meta-analysis by Reddy and Chandrashekhar (1998) revealed higher prevalence of mental disorders in urban areas i.e., 80.6%, whereas it was 48.9% in rural areas (Reddy & Chandrashekhar, 1998). Mental disorders primarily composed of depression and neurotic disorders. It is also a known fact that aggressive visual fields are strong visual irritants. In some persons, they can provoke epileptic seizures. It is believed that where the visual environment is poor, more violations of the law happen – hooliganism, hard drinking, ribaldry etc.

Nature and Human Health and Wellness

It is an established fact that plants and greenery are the best healer and it greatly helps in rejuvenating the human psyche. However, due to the lust for maximising built spaces, the green cover is being sacrificed day by day in most of the Indian cities. Over the past decades, an increasing number of studies have documented that experiences in, or of nature can be beneficial for human health and well-being. The issue has been reviewed in a report for the Health Council of the Netherlands (2004), which concludes that there is a positive link between health indicators and living close to nature. More specifically, contact with nature has been reported to have psychological benefits by reducing stress, improving attention, by having a positive effect on mental restoration and by coping with attention deficit. Undisputedly, loss of green cover badly affects the visual environment and aesthetic perception of any urban area, leading to stress and ill health. The above discussion clearly indicates an urgent need for deliberating the topic of urban aesthetics, not only for the purpose of beauty but for reasons of human health and wellness.

The Case of Lucknow

Let us now take the case of an important city of the country, which once upon a time was considered as the 'Constantinople of India'. It is the capital of India's most populous state, having an extremely rich history dating back to the legendary times of Lakshman, the younger brother of Lord Rama. It is a multicultural city which was once the capital of Awadh Region and is popularly known as the city of Nawabs and is characterised by the courtly manners, beautiful gardens, poetry, music and fine cuisine. It is also known as the 'Golden City of the East', 'Shiraz-i-Hind'. The town was also known for its gardens namely Dilkusha Garden, Charbagh, Kaiserbagh, Moosabagh etc. Like most of the historical towns, Lucknow too has three distinct areas – the heritage zones, downtown and the upcoming urban agglomerations. We shall now try to briefly study the aesthetics quality of each one of these and find out whether they all represent an aesthetically pleasing character or they are creating visual pollution – individually or as group entities and leading to medical issues, especially the psychic ones as discussed above.

The Heritage Areas: Lucknow has three major heritage areas namely, Hussainabad and Kaiserbagh complexes and Hazrat Ganj market centre. Both Hussainabad and Kaiserbagh complexes represent Nawabi style of architecture. Hazrat Ganj is the elite shopping and entertainment centre of the British rulers and it represents the Indo-British style of architecture. Some of the important buildings of these areas are illustrated in figures 1 to 5.

Figure 1: The Hussainabad Complex
Source: https://up.nic.in/gallery/asifi-masjid/; https://en.wikipedia.org/wiki/Chota_Imambara

Figure 2: The Kaisarbagh Baradari
Source: http://double-dolphin.blogspot.com/2015/10/safed-baradari-lucknow.html

Figure 3: The La Martiniere Lucknow
Source: https://www.trawell.in/uttar-pradesh/lucknow/la-martiniere-college

Figure 4: Hazrat Ganj Shopping Arcade
Source: http://tradional-lucknow.blogspot.com/2016/01/visit-to-hazratganj.html

Figure 5: Charbagh Railway Station
Source: Author

The Upcoming Lucknow: The recent developments of Lucknow do not match with the strong heritage characteristics which the city is proud of. A particular political dispensation, according to its whims and fancies created architecture of its 'own' as is depicted in the photographic illustrations seen in figure 6 and 7. As is depicted in the figure, the area is completely devoid of green spaces, thereby negating the past glory of the 'city of baghs (gardens)'. Instead of providing mental solace, visiting these spaces cause 'visual aggressiveness' leading to mental stresses. Besides the 'ruler' specific architecture, other buildings (figure 7) also do not give any credence to the rich heritage of the city. The recently built Chaudhary Charan Singh Airport (figure 8) is a glaring example of how to defy the local heritage. Are these monumental buildings not 'visual pollutants' for a city which boosts itself to be the 'golden city of the east?

Similarly new multi-storey housing also does not pay any heed to the rich art and culture of the city as is evident from figure 9. These illustrations indicate

Figure 6: Dr. B.R. Ambedkar Samajik Parivartan Sthal
Source: Author

Figure 7: Gomti Nagar Railway Station in Lucknow
Source: https://www.facebook.com/photo?fbid=1385296219658887&set=pcb.1385296266325549

Figure 8: The New Airport Building at Lucknow
(Source: https://www.icad.com/projects/lucknow-international-airport/

Figure 9: Modern Housing in Lucknow
Source: https://www.magicbricks.com/

that local buildings have no respect for the rich heritage of Lucknow. Now let us take a glimpse of the common man's Lucknow which is also a glaring example of gross 'non- aesthetic or aesthetically polluted development'. The illustrations are self-explanatory and clearly defy the meaning of 'beauty' which has been defined as visual input that gives pleasure to the mind. All the illustrations of Nawabi Lucknow, modern Lucknow and downtown have no similarity between themselves and do not indicate any cohesion or a Luckhnavi, Nawabi or Awadhi culture or style. In fact, indeed, this is the story of all our historical towns – be it Agra, Bhopal, Delhi, Jaipur, Hyderabad or Varanasi.

The Smart City Mission, Lucknow – unconcerned about visual environment

The Lucknow Smart City Project is completely devoid of 'visual -environments', as it focuses and incorporates only a variety of smart infrastructure upgrades from smart traffic lights to integrated waste collection. A central command control centre monitors city-wide activities like traffic, water supply and emergency services. Intelligent street lighting, high-speed internet zones and CCTV surveillance enhance both convenience and security. Public bike-sharing systems and smart parking solutions have also been introduced, all aiming to create a seamless and tech-enabled urban experience for the people of Smart City Lucknow.

State-level Urban Art Commissions

As planners, we certainly feel saddened with the present state of affairs in the country and therefore it appears imminent that each city should identify itself and then abide by its distinct character or the cityscape. However, as of now, this phenomenon does not exist in our country. Also, as of now, there is no mechanism or law in place, through which the objective of town identity or town character could be achieved. Some of the building bye-laws do refer to street character or elevation control, but these too do not envisage anything at the town or city level. The only hope appears in the creation of a statutory agency consisting of urban planners, architects and urban managers which could formulate and get implemented the urban characteristics which are so necessary for a healthy and orderly development of our unruly and dying cities.

At the crossroads, our memory lane moves towards the 'The City Beautiful Movement' of early last century, when great emphasis started flowing towards aesthetics and visual environment. We are aware about Delhi Urban Arts Commission,

Figure 10: The ugly, filthy and aesthetically unpleasant Lucknow
Source: Author

which although has been created through an Act of Parliament but barely serves its intent in its true sense and sprit. Thus there is an urgent need for its revamping by providing it with enough 'teeth' to curb the menace of visual pollution or maintain the urban aesthetic ambiance which is necessary for the well-being of the people living in these towns. Unfortunately, the Smart City Movement, which was considered to be a game changer for urban planning and development has confined itself only to the development of smart urban infrastructure and has no meaningful mandate for upholding the aesthetic and artistic qualities of our towns. It is thus suggested to create an 'Urban Art Commission' in each state of the country with an objective to ensure aesthetically pleasing and environmentally sustainable cities and towns. Following are some the suggested roles of this commission:

1. Creation of a 'vision document' for all important cities and towns of the state.
2. Creation of an 'aesthetic profile' for all important cities and towns of the state.
3. Revisiting the local building bye-laws with respect to urban aesthetic considerations.
4. Organisation of national/international competitions for all urban planning and design projects of national/state importance.
5. Approval of 'urban profile' of all urban development projects of national/state importance proposed within the state.
6. Organisation of exhibitions and seminars on the outstanding works of urban planning and design with an objective of creating aesthetic awareness among planners, architects and city administrators and also the general public.
7. Monitoring of the follow-up of the objectives of the commission.

For effectively achieving the objectives, the high-level Commission needs to be headed by none other than the state's Chief Minister. Following is the suggested organisational structure of the Commission:

1.	Chief Minister	Chairperson
2.	Secretary, Urban Planning/ Development, State Govt.	Member
3.	Chief Town Planner, State Govt.	Member
4.	An Urban Planner/ Urban Designer of National Eminence	Member
5.	An Architect of National Eminence	Member
6.	Superintending Archaeologist, ASI	Member
7.	Environment Director, State Govt.	Member
8.	State Head, INTACH	Member
9.	Chairman, State Chapter of Institute of Town Planners Member	Secretary

Conclusion

For healthy, harmonious and conducive growth of our towns and cities, it appears imperative to consider 'urban aesthetics' as an important ingredient of urban planning to combat the menace of 'aesthetic pollution', which is increasingly a concern not only for professionals but also for the general public. For achieving this goal, there appears an immediate need for establishing 'effective' Urban Art Commissions in each and every state of the country.

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Entropy in Housing Neighbourhood

By Ar. Krishna Sahani and Dr. Venkata Krishna Kumar Sadhu

Entropy concept:

The concept of entropy was introduced in 1867 by German physicist Rudolf Clausius, who formulated the Second Law of Thermodynamics. Entropy is a measure of disorder or randomness in a system. It indicates the direction of natural processes, with systems tending toward higher entropy. In thermodynamics, it relates to energy unavailability; in information theory, it measures uncertainty or information content. In the context of housing neighbourhoods, entropy can be seen as a measure of disorder, unpredictability, or diversity within the urban fabric. A high-entropy neighbourhood may have a mix of building types, land uses, incomes and population groups—reflecting variety and complexity, which can support resilience and adaptability. Conversely, low entropy may indicate uniformity and order, such as in gated communities or strictly zoned areas, which can be efficient but less flexible. Over time, urban entropy may increase due to unplanned growth, informal settlements, or social fragmentation, often reducing quality of life and straining infrastructure. Understanding entropy in housing helps urban planners manage growth, encourage sustainable diversity and prevent urban decay.

Introduction:

Urban growth and housing development are dynamic processes influenced by a range of socioeconomic, environmental and infrastructural factors. As cities expand, the spatial and functional organisation of neighbourhoods transforms, often resulting in varying degrees of order and disorder. This transformation can be understood through the concept of entropy—a measure of unpredictability and randomness within urban systems. Entropy plays a significant role in shaping housing neighbourhoods, impacting their functionality, sustainability and overall liveability.

According to UN-Habitat (2022), 56% of the global population currently resides in urban areas, a figure projected to rise to 68% by 2050. This rapid urbanisation has spurred informal settlements, fragmented land use and infrastructure gaps—resulting in high entropy in many cities. In India, nearly 65 million people live in slums (Census 2011), highlighting unplanned urban expansion and spatial disorder, which contribute to rising levels of entropy in urban environments.

Several factors contribute to the high levels of entropy in housing neighbourhoods, including unregulated development, socio-economic disparity, inadequate infrastructure and weak urban planning mechanisms. These factors interact in complex ways to create chaotic and inefficient urban environments, particularly in informal areas where planning and regulation are often absent or insufficient.

Entropy can be measured through various analytical methods, such as land-use diversity, built form and street network configuration. Shannon entropy models and fractal analysis demonstrate that unplanned cities tend to exhibit higher entropy, which results in problems like congestion, poor services and environmental degradation. In contrast, planned developments, such as Singapore's HDB estates, exhibit lower entropy and better sustainability, offering lessons for managing urban growth. (orkar zeyel guzelci, 2020)

This paper will examine the following key topics: the Impacts of Entropy on Housing Neighbourhoods, Factors Contributing to Entropy in Housing Neighbourhoods, Measuring Entropy in Housing Neighbourhoods, Striking the Right Balance, Strategies to Manage Entropy in Housing Neighbourhoods and Case Studies: Managing Entropy in Urban Neighbourhoods. Through an analysis of case studies, this research will provide valuable Key Inferences from Urban Entropy Case Studies, offering insights into effective urban planning strategies for managing entropy in housing neighbourhoods and fostering more sustainable urban environments.

By understanding and managing the forces of entropy, cities can mitigate the negative impacts of unregulated urban expansion and work towards creating more resilient, efficient and equitable housing neighbourhoods.

1. Impacts of Entropy on Housing neighbourhood

Entropy, a concept borrowed from thermodynamics and adapted to urban studies, plays a crucial role in shaping housing neighbourhoods. When applied to urban sprawl and residential development, entropy refers to the degree of disorder, diversity, or spatial dispersion within urban spaces. A well-balanced level of entropy can significantly enhance a neighbourhood's functionality by promoting social diversity, economic resilience and spatial inclusivity. Mixed-use and mixed-income developments, for instance, can foster vibrant communities where residents enjoy access to a variety of services and amenities, reduce segregation and improve quality of life through well-distributed infrastructure and green spaces.

However, the effects of entropy are not uniformly positive. Excessive entropy—often manifesting as uncontrolled urban sprawl—can lead to fragmented, low-density developments that increase reliance on private vehicles, resulting in traffic congestion, higher emissions and rising infrastructure costs. It may also encroach upon agricultural and ecological lands, disrupting ecosystems and biodiversity. On the other hand, too little entropy—characterised by rigid, overly uniform housing patterns—can suppress innovation, limit housing choices and reduce a neighbourhood's adaptability to economic or environmental changes. Thus, while entropy holds the potential to improve urban living conditions, it must be carefully managed to avoid adverse social, environmental and economic consequences. (Pedro Cabral Pedro Cabral, 2013)

1.1 Positive Effects of Entropy in neighbourhoods

A moderate level of entropy in housing neighbourhoods can foster social diversity and economic resilience. Mixed-income and multi-use developments create vibrant communities where residents have access to varied services, reducing segregation and promoting inclusivity. Additionally, neighbourhoods with balanced entropy often feature better-distributed amenities, such as schools, healthcare facilities and retail spaces, improving overall accessibility without overburdening any single area. Environmental benefits also arise when urban planning incorporates green spaces and sustainable infrastructure within moderately dispersed developments, mitigating pollution and enhancing residents' quality of life.

However, excessive entropy—manifested as uncontrolled urban sprawl—can lead to negative consequences. Low-density, fragmented development increases reliance on private vehicles, contributing to traffic congestion, higher emissions and greater infrastructure costs. Such sprawl also consumes agricultural and natural land, threatening ecosystems and biodiversity. Socially, extreme entropy can result in uneven development, where affluent and impoverished areas become sharply divided, weakening community cohesion. Conversely, too little entropy (excessive uniformity) may stifle innovation, limit housing variety and make neighbourhoods vulnerable to economic or environmental shocks due to a lack of adaptability.

1.2 Negative effects of Entropy in neighbourhoods

On the other hand, excessive or insufficient entropy in housing neighbourhoods can lead to several urban challenges. High entropy, often seen in the form of uncontrolled urban sprawl, results in fragmented and low-density development that increases reliance on private vehicles. This, in turn, contributes to traffic congestion, higher emissions and increased transportation and infrastructure maintenance costs. Additionally, such sprawl frequently encroaches upon agricultural and ecologically sensitive lands, posing significant threats to biodiversity and natural ecosystems. From a social perspective, uneven spatial development can intensify socio-economic divides, creating stark contrasts between affluent and marginalised communities and weakening social cohesion. Conversely, very low entropy—characterised by overly uniform and rigid housing layouts—can hinder adaptability and innovation. These highly planned environments often lack the

diversity needed to absorb economic or environmental shocks, rendering such neighbourhoods vulnerable in times of crisis.

2. Factors Contributing to Entropy in Housing neighbourhoods

The concept of entropy in housing neighbourhoods refers to the gradual decline in order, functionality and livability within urban residential areas. In rapidly urbanising nations like India, this entropy is accelerated by multiple interconnected factors. Unplanned urban sprawl, deep-rooted social segregation and uneven resource distribution all contribute to the fragmentation and degradation of housing environments. These dynamics not only undermine urban sustainability but also deepen socio-economic inequalities, posing significant challenges to inclusive and resilient city planning.

2.1. Rapid Urbanisation and Sprawl

India's rapid urbanisation, driven by rural-urban migration and economic opportunities, has led to chaotic urban sprawl. Cities like Mumbai, Delhi and Bengaluru face unplanned growth, with migrants settling in informal slums due to the absence of affordable housing. For instance, Mumbai's Dharavi slum—home to over 1 million people—epitomises this disorder, where cramped living conditions coexist with informal industries. Infrastructure development lags population growth, resulting in water shortages, as seen during Chennai's 2019 "Day Zero" crisis and inadequate sanitation, where 16% of urban households lack toilets (National Family Health Survey-5, 2019–21). The proliferation of informal settlements, housing 65 million Indians, highlights systemic planning failures and legal exclusion of marginalised communities. (CENSUS 2011, 2011).

The map of Delhi's housing (Figure 1) footprint reveals significant spatial entropy across various neighborhoods, reflecting the disorder and irregularity in urban growth patterns. High entropy is observed in North, East and Southeast Delhi—such as Rohini, Seelampur and Okhla—where dense, fragmented building clusters indicate informal settlements and unplanned development. Moderate entropy is seen in South-West and West Delhi, including areas like Dwarka and Janakpuri, where semi-organised layouts are disrupted by encroachments and peripheral sprawl. In contrast, Central Delhi and Lutyens' zones, like Connaught Place and Defence Colony, exhibit low entropy with well-ordered, planned infrastructure. Peripheral areas bordering Gurugram and Faridabad show sprawling, patchy development—typical of peri-urban zones—pointing to rising entropy due

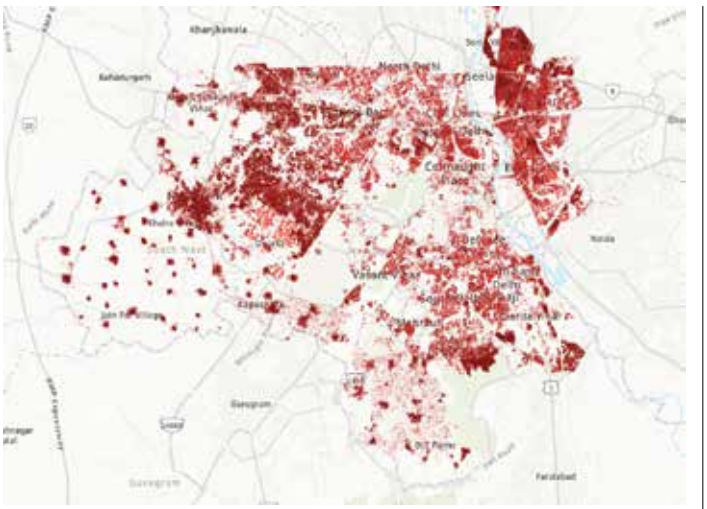

Figure 1: Delhi housing footprint plan
Source: Author

to uncontrolled expansion. The absence of built-up structures in central patches highlights the presence of reserved green zones like the Delhi Ridge. Overall, the map underscores the need for integrated planning, zoning enforcement and infrastructure upgrading in high-entropy zones to address urban disorder and improve livability. (herris, 2025)

2.2 Social Segregation and Inequality

Social hierarchies, rooted in caste and religion, perpetuate spatial segregation in Indian cities. Dalit *bastis* in Uttar Pradesh and Bihar remain isolated, lacking access to basic services, while Muslim-majority areas like Delhi's Okhla face neglect and stigmatisation (Khan, 2022). Economic disparities further fragment neighbourhoods: luxury gated communities in Gurugram contrast sharply with nearby *jhuggi-jhopris* (slums), reflecting India's stark wealth divide (Bhan, 2012). Gentrification in cities like Mumbai displaces low-income groups to peripheries, exacerbating social alienation. Communal tensions in Ahmedabad and caste-based violence in Tamil Nadu underscore how segregation fuels distrust and fractures urban social cohesion.

2.3 Uneven Resource Distribution

Resource allocation in Indian cities remains skewed toward affluent neighbourhoods. For example, South Delhi's Vasant Kunj enjoys 24/7 water supply, while Sangam Vihar, a low-income neighbourhood, relies on erratic tankers. Environmental degradation compounds these disparities: Delhi's air pollution (AQI often exceeding 500) and Bengaluru's waste mismanagement (40% of 5,000 daily metric tons untreated) disproportionately affect marginalised communities The lack of green spaces—Mumbai provides only 1.24 sqm per capita versus WHO's 9

sqm recommendation—worsens urban heat islands and flood risks, as seen during Chennai's 2015 deluge (Sivakumar, 2018).

3. Measuring Entropy in Housing neighbourhoods

Understanding the spatial and organisational complexity of housing neighbourhoods requires tools that can quantify variations in layout, land use and urban form. Entropy-based approaches provide a way to measure this complexity by assessing how ordered or disordered these systems are. Different models and methods—ranging from statistical mechanics and fractal theory to urban morphology—can help evaluate the degree of spatial heterogeneity, compactness and dispersion within a neighbourhood. Below are key approaches used to measure entropy in housing neighbourhoods.

3.1 Shannon Entropy Model:

Used in GIS and remote sensing to analyse urban spatial patterns.

The term 'entropy' originates from the work of R. Clausius (1865) and L. Boltzmann (1877) in thermodynamics. C.E. Shannon (1948) defined the term 'information entropy' (later also called 'Shannon's entropy'), following the advice of John von Neumann who had told him that "in the first place, a mathematical development very much like yours already exists in Boltzmann's statistical mechanics and in the second place, no one understands entropy very well, so in any discussion you will be in a position of advantage". Yeh and Li claimed that Shannon's entropy, is capable of measuring "the degree of spatial concentration or dispersion of a geographical variable (xi)". They overlaid urban land use images to measure the density of land development in a set of buffer zones that were created around city centers and along roads. They calculated the value of entropy to measure the density of land development among n zones, the degree of urban sprawl was then determined by examining whether land development in a city or town was dispersed or compact.

$$H_n = \sum_{i=1}^{n} p_i \log\left(\frac{1}{p_i}\right)$$

3.2 Fractal Analysis:

Helps in understanding self-organised complexity in neighbourhood layouts.

Fractal Analysis The theory of fractals is coined by Mandelbrot (B.B and Mandelbrot, 1983). Fractals are scale invariant, self-similar structures which can be expressed as the union of sets of each reduce copy of geometrically similar structure that forms the full set. Many natural objects such as clouds, coastlines, mountains having non smooth shapes shows fractal nature. The fractal nature of city is a valuable input for studying the characteristics of a city. Fractal dimension quantifies the fractal characteristics of the city (Batty and Longley, 1994). One of the methods of determining the fractal dimension is box counting method. Box counting method is mathematically defined as in equation (3), suppose that F is a limited fractal figure on a plane. Cover F with square grids which are built by boxes whose side length is δ. The number of boxes intersecting on F is N. If N is satisfied with the power law

$$N(\delta) \alpha \delta^{-D},$$

then as $\delta \to 0$, the ratio of logarithm and D is defined as the box dimension of 'F' (Kriti Rastogi Gaurav V JAIN, 2018)

$$D = \frac{\ln N(\delta)}{\ln(\frac{1}{\delta})}$$

3.3 Urban Morphology Studies:

It Examines Street networks, building densities and land use patterns.

Urban morphology is the study of the physical form and structure of urban spaces, analysing how cities and towns are organised and evolve over time through elements like street patterns, building densities and land use zones, to inform urban planning, historical analysis, sustainability efforts and transportation improvements; it encompasses key concepts such as urban form (the layout of streets, buildings and open spaces), city layout (including street patterns and land use zones), historical development, architectural and spatial analysis (studying building types and spatial relationships), functional areas like the Central Business District and urban morphological models like the Concentric Zone, Sector and Multiple Nuclei Models. (Cliffnotes, 2024)

3.4 Simulation Models:

Computational models used to predict urban entropy in housing neighborhoods rely on demographic and economic data to simulate and assess the diversity or disorder within urban areas. These models incorporate various factors such as population composition, income distribution, housing types, land use patterns and transportation accessibility. Through algorithms like machine learning or agent-based models, tools such as NetLogo, UrbanSim and AnyLogic are commonly used to simulate

complex urban systems and predict how different variables influence the entropy of a neighborhood. Additionally, MATLAB with the Entropy Toolbox and GIS software like ArcGIS or QGIS provide powerful platforms for spatial analysis and entropy calculation. These tools help urban planners understand the effects of policies, economic changes, or development interventions, offering insights into promoting diversity, mitigating gentrification, or evaluating zoning laws, although challenges such as data accuracy, model complexity and ethical considerations must be carefully managed. (Rosser, 2016)

4. Striking the Right Balance

Striking the right balance of entropy is essential for achieving sustainable urban development in housing neighbourhoods. Entropy, when optimally managed, can enhance spatial diversity, accessibility and adaptability without leading to the negative consequences of either excessive sprawl or rigid uniformity. High levels of entropy, characterised by dispersed and low-density development, often result in inefficient land use, increased car dependency and environmental degradation. Conversely, very low entropy can produce overly homogeneous neighbourhoods that lack functional diversity and resilience. To address these challenges, urban planners must adopt smart zoning strategies that promote mixed-use and transit-oriented development, ensuring both spatial variety and compactness. The integration of green corridors and efficient public transportation systems can further mitigate the environmental and social drawbacks associated with spatial dispersion. By carefully managing entropy, planners can foster neighbourhoods that are resilient, equitable and environmentally sustainable, ultimately enhancing long-term liveability for all residents (Figure 2).

5. Case Studies: Managing Entropy in Urban neighbourhoods

Comparative Analysis of High vs. Low Entropy neighbourhoods

This section examines two high-entropy informal settlements (Dharavi, Rocinha) and two low-entropy planned developments (Chandigarh, Singapore) to demonstrate how urban planning strategies impact neighbourhood order, infrastructure and quality of life.

Figure 2: Cycle of sustainable urban development
Source: Author

5.1. High-Entropy neighbourhoods: Chaos from Unplanned Growth

High-entropy neighborhoods arise from unregulated and fragmented urban growth, where the lack of coordinated planning results in spatial chaos, overburdened infrastructure and socio-environmental disparities. The following case studies illustrate this phenomenon in detail.

5.1.1. Dharavi, Mumbai - Asia's Largest Informal Settlement

Dharavi is a striking example of extreme urban entropy, characterised by its dense and unplanned development. Home to nearly one million people within just 2.1 square kilometers, the area faces severe overcrowding, with instances of up to 15 individuals sharing a single room. The neighborhood exhibits chaotic mixed land use, where residential, industrial and commercial activities overlap without clear zoning. Infrastructure is critically inadequate, marked by open sewage systems and unreliable electricity supply. Despite these challenging conditions, Dharavi sustains a remarkably vibrant informal economy, generating an estimated $1 billion annually (Figure 3).

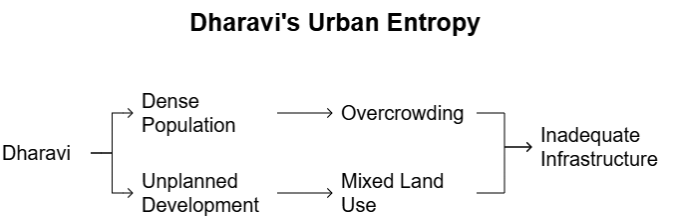

Figure 3: Dharavi's urban entropy
Source: Author

Table 1: Table showing data of Dharavi
Source: Author

Feature	Description
Type	Informal/Unplanned settlement (slum)
Population Density	Over 300,000 people per sq. km
Structure Type	Self-built units: mostly ground + 1 (G+1) or G+2 with tin, brick, concrete
Access	Narrow, unplanned lanes < 1.5 m wide; no clear circulation hierarchy
Utilities	Limited sewerage, shared toilets, intermittent water
Livelihoods	Recycling, pottery, leather, textiles, food industries
Land Ownership	Mixture of public land (government) and private claims

Redevelopment Challenges:
Multiple rehabilitation schemes have failed due to a combination of complex socio-political and economic factors. Political conflicts over land rights have often hindered the smooth implementation of such projects, as disputes between stakeholders delay or obstruct development. Additionally, residents frequently resist displacement, fearing the loss of community ties, livelihood disruptions, or inadequate compensation. Unrealistic profit expectations from developers further complicate the situation, as they may prioritise financial gain over the social objectives of rehabilitation, leading to poorly planned or abandoned initiatives (Figure 4).

Figure 4: Dharavi slum
Source: Author

5.1.2. Rocinha, Rio de Janeiro - Brazil's Most Notorious Favela

Rocinha, located in Rio de Janeiro, stands as one of Brazil's most notorious favelas and a vivid representation of urban entropy in Latin America. The settlement is marked by precarious hillside construction that poses significant risks of landslides, especially during heavy rains. Law enforcement faces major challenges in maintaining order, as large portions of the area are controlled by gangs, severely restricting police access. Basic infrastructure is lacking, with only about 65% of residents having formal water connections, highlighting the deep infrastructural and governance deficits that define the area.

Improvement Efforts:
The Favela-Bairro program in Brazil achieved partial success in its efforts to improve living conditions within informal settlements. It managed to install basic sanitation facilities in 60% of homes and contributed to urban integration by constructing new roads and community centers. However, despite these physical upgrades, the program ultimately fell short of addressing the deeper, systemic issues of poverty and crime, limiting its long-term impact on the socio-economic transformation of favela communities (Figure 5).

Figure 5: Ariel view of Rocinha, Rio de Janeiro - Brazil's Most Notorious Favela
Source: Author

5.2. Low-Entropy neighbourhoods: Order Through Planning

Low-entropy neighbourhoods exemplify urban areas where thoughtful, coordinated planning fosters spatial coherence, efficient infrastructure and environmental harmony. These neighbourhoods are typically characterised by organised layouts, accessible public services and sustainable growth patterns—demonstrating how proactive planning can create resilient and livable communities (Figure 6).

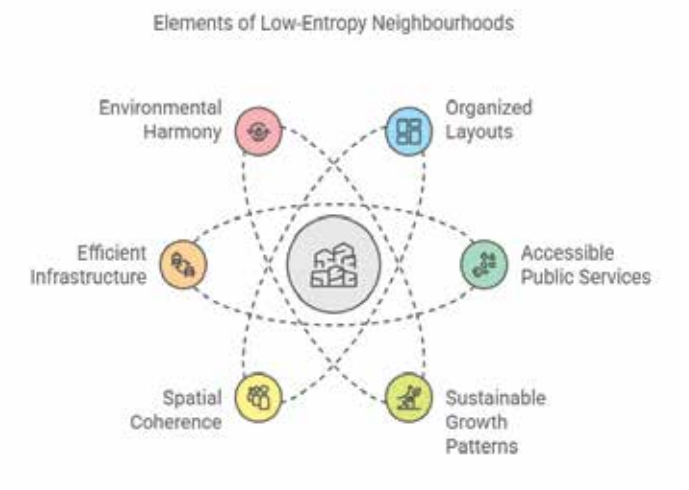

Figure 6: Element of non-entropy neighbourhood
Source: Author

5.2.1. Chandigarh, India - Le Corbusier's Planned City

Chandigarh is a model of low-entropy urban planning, designed by Le Corbusier with a grid-based layout, distinct zoning and ample green spaces. It reflects order, functionality and modernist planning principles in a post-independence Indian context. This meticulously designed city demonstrates:

The city demonstrates effective urban planning through strict sector-based zoning, which clearly separates residential, commercial and industrial areas. It maintains a healthy environment with 26% green cover, supported by well-integrated park systems that enhance public spaces. Additionally, the city benefits from efficient underground utility networks, reducing visual clutter and improving infrastructure management. These features contribute to its consistently high rankings in Indian urban liveability surveys, reflecting a well-balanced and sustainable urban environment.

Zoning is well shown in the master plan as seen in Figure 7.

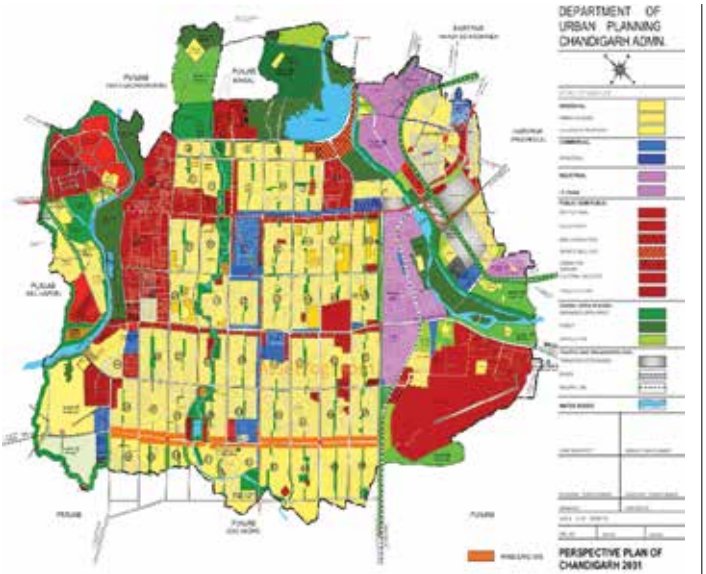

Figure 7: Master plan of Chandigarh
Source: Author

Current Challenges:

Rapid population growth in urban areas often places significant strain on the original design capacity of housing neighbourhoods, leading to a mismatch between existing infrastructure and current demands. As the number of residents increases, roads, utilities, public services and open spaces initially planned for smaller populations become inadequate. One of the most immediate consequences is the emergence of traffic congestion, particularly in central sectors where commercial, institutional and residential activities converge. These bottlenecks not only reduce mobility but also impact air quality and the overall urban experience. In response to spatial limitations and rising land values, there is growing pressure for vertical development, with multi-story residential and commercial buildings replacing low-rise structures. While this can accommodate more people and promote land efficiency, it also requires updated planning strategies to ensure sustainability, livability and adequate service provision.

5.2.2. Singapore's HDB Towns - Model Public Housing

Singapore's HDB towns exemplify low-entropy development, with integrated land use, efficient infrastructure and planned amenities. These self-contained, high-density communities reflect strategic urban planning aimed at providing affordable, organised and sustainable living environments (Figure 8).

Table 2: Table shows settlement characteristics
Source: Author

Aspect	Low Entropy (Planned Stage)	Increasing Entropy (Over Time)
Urban Layout	Grid-based, sectoral modular planning	Encroachments and irregular spatial usage in certain areas
Land Use	Strict zoning – residential, commercial, institutional zones clearly separated	Mixed use emerged in residential areas (e.g., shops in homes)
Building Regulations	Uniform built form – height, setbacks and typology controlled	Unauthorised extensions, vertical expansions, varied façades
Mobility & Road Network	7-level road hierarchy ensures order and reduces traffic conflict	Increase in private vehicles caused parking overflow and informal road usage
Public Spaces	Well-distributed green belts, parks and leisure valleys	Green areas encroached in some sectors; reduced accessibility
Infrastructure Services	Equitably distributed and efficiently planned (water, sewage, electricity)	Pressure on infrastructure due to population growth and informal housing
Aesthetic Order	Visual harmony through material control and architectural coherence	Varied architectural expressions and façade treatments altered original intent
Housing Typology	Clearly categorised (EWS, LIG, MIG, HIG) with uniformity	Blurred distinctions due to renovations, upgrades and unauthorised construction
Social Organisation	Community-centric sectors with shared amenities	Socio-economic diversification led to contrasting lifestyles within the same sector
Peripheral Development	Originally contained within defined boundaries	Emergence of informal settlements on urban peripheries due to migration and affordability issues

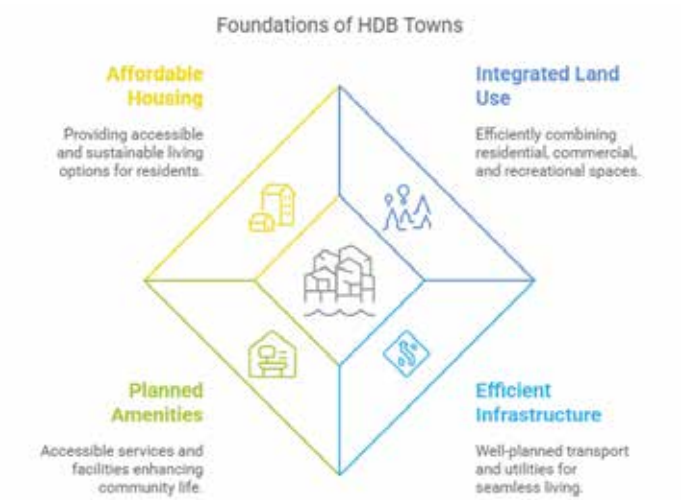

Figure 8: Foundation of HD towns
Source: Author

Singapore's solution features:
The neighbourhood is characterised by an 80% home ownership rate, one of the highest in the world, reflecting a strong sense of community and stability among its residents. The design of these self-contained neighbourhood units is focused on convenience and accessibility. Key amenities are strategically placed to ensure that schools are within 500 meters of all homes, fostering easy access to education for families. Additionally, retail hubs are integrated within every precinct, promoting local commerce and reducing the need for long-distance travel for daily necessities. The neighbourhood also features integrated public transport, ensuring seamless connectivity and reducing reliance on private vehicles, which is crucial for reducing traffic congestion and promoting sustainability. Furthermore, the inclusion of AI-assisted predictive maintenance systems enhances the efficiency of infrastructure management by anticipating and addressing potential issues before they become problems, contributing to the long-term sustainability and resilience of the community.

5.2.3 Key Innovations:
A key strength of the neighbourhood's planning framework is its Ethnic Integration Policy, which proactively prevents ghettoisation by ensuring a balanced mix of ethnic groups within residential areas. This policy fosters social cohesion and cultural harmony, creating inclusive communities where

diversity is embedded in daily life. Complementing this social strategy is the neighbourhood's car-lite urban design, which prioritises sustainable mobility through extensive cycling paths and pedestrian-friendly infrastructure. This approach reduces reliance on private vehicles, lowers carbon emissions and promotes healthier lifestyles. In addition to social and mobility planning, environmental sustainability is addressed through the SolarNova program, which integrates renewable energy solutions such as solar panels into public housing and community facilities. Together, these initiatives exemplify a holistic model of urban development that balances social equity, environmental stewardship and long-term livability.

5.3. Comparative Analysis: Key Metrics

This comparative analysis highlights stark contrasts between high-entropy informal settlements (Dharavi/Rocinha) and low-entropy planned cities (Chandigarh/Singapore) across critical urban metrics. The data reveals dramatic disparities in living conditions, resource access and economic outcomes between these two development models.

6. Strategies to Manage Entropy in Housing neighbourhoods

Entropy in urban environments refers to the gradual decline into disorder due to uncontrolled growth, inefficient resource use and poor planning. Managing entropy in housing neighbourhoods requires structured strategies that balance development with sustainability. Below are key approaches to maintaining order and efficiency in urban spaces.

6.1. Smart Urban Planning: Mixed-Use Zoning with Spatial Order

Objective: Reduce urban sprawl and enhance liveability by integrating different land uses while maintaining structure.

Mixed-use zoning combines residential, commercial and recreational spaces within the same area, reducing the need for long commutes and improving walkability. Hierarchical zoning ensures that high-density developments (like city centres) coexist with low-density suburbs in an organized manner. Transit-Oriented Development (TOD) focuses on building neighbourhoods around public transport hubs to minimise traffic congestion. Strict regulatory frameworks prevent haphazard construction, ensuring spatial coherence.

6.2. Infrastructure Optimisation: Efficient Transport and Utility Networks

Objective: Improve mobility and resource distribution to prevent systemic inefficiencies.

A well-planned multi-modal transport system—including buses, metro networks, cycling lanes and pedestrian pathways—reduces traffic chaos. Smart grids and IoT-based utility management (water, electricity, waste) optimise resource use. Decentralised infrastructure, such as micro-grids and rainwater harvesting, increases resilience. AI-driven traffic management systems adjust signals and lane usage dynamically to ease congestion.

6.3. Participatory Urban Design: Community-Led Sustainable Growth

Objective: Ensure development aligns with residents' needs to prevent social and spatial fragmentation.

Engaging communities in urban planning through workshops and consultations leads to more inclusive neighbourhood designs. Cooperative housing models and community land trusts encourage shared ownership and responsibility. Digital feedback platforms allow residents to contribute ideas and report issues in real time. Empowering neighbourhood associations helps implement

Table 3: Table showing disparities in living conditions, resource access and economic outcomes between these two development models
Source: Author

Metric	High-Entropy (Dharavi/Rocinha)	Low-Entropy (Chandigarh/Singapore)
Population Density	500,000/sq km (Dharavi)	11,000/sq km (Chandigarh)
Water Access	3 hours/day average supply	24/7 pressurised supply
Green Space	0.5 sq m per capita	15 sq.m per capita
Crime Rate	5x national average	50% below national average
Economic Productivity	$3,000 GDP/capita (informal)	$65,000 GDP/capita (formal)
Infrastructure Life	5-7 years before failure	30+ years with maintenance

localised solutions, such as park maintenance and safety improvements.

6.4. GIS and AI-Based Urban Management: Data-Driven Decision-Making

Objective: Use technology to monitor and manage urban growth proactively.

Geographic Information Systems (GIS) map land use, population density and infrastructure gaps to guide planning. AI-powered predictive analytics forecast traffic, energy demand and housing shortages before they become critical. Digital twins—virtual city models—simulate the impact of new projects before construction begins. Automated maintenance systems, including drones and sensors, detect and repair infrastructure issues quickly (Figure 9).

Figure 9: Enhancing urban management with technology
Source: Author

6.5. Sustainable Development Policies: Green Spaces and Compact Cities

Objective: Promote eco-friendly growth to counteract environmental and structural decay.

Green corridors—such as urban parks, rooftop gardens and tree-lined streets—reduce heat islands and improve air quality. Compact city models prioritise vertical growth over urban sprawl, preserving natural landscapes. Circular economy principles, like recycling construction waste, minimise resource wastage. Urban Growth Boundaries (UGBs) legally restrict unchecked expansion, directing development inward through infill projects.

7. Key Inferences from Urban Entropy Case Studies

The comparative analysis of high and low-entropy urban environments reveals critical insights into the impact of governance, infrastructure and planning on sustainability, economic productivity and social outcomes. These findings underscore the importance of strategic, coordinated urban development for long-term success and livability

7.1. Governance as the Foundation for Urban Order

The most striking finding from our comparative analysis reveals that strong governance systems form the fundamental differentiator between chaotic and orderly urban development. Singapore's Housing Development Board (HDB) and Chandigarh's development authority demonstrate how centralised planning with robust enforcement mechanisms can create and maintain urban order. In contrast, Mumbai's Dharavi and Rio's Rocinha showcase how weak municipal capacity and inadequate regulatory frameworks inevitably lead to chaotic, organic growth patterns. This suggests that cities must prioritise building capable planning institutions before population pressures reach critical levels, as retroactive solutions prove significantly more challenging and costly to implement.

7.2. Infrastructure Quality as a Determinant of Sustainability

Our examination of infrastructure systems reveals dramatic disparities between planned and unplanned neighbourhoods. High-entropy areas typically suffer from intermittent water supply (3-4 hours daily), narrow inaccessible alleys (2-3m width) and open sewage channels, while their low-entropy counterparts enjoy 24/7 pressurised water, 30m wide avenues and underground drainage. These infrastructure gaps don't merely represent different starting points but compound over time, making retrofitting exponentially more expensive than proper initial planning. The data shows that infrastructure in planned areas lasts 3-4 times longer while requiring just 25% of the maintenance costs of informal settlements.

7.3. The Economic Paradox of Informal Settlements

Our analysis uncovered a fascinating contradiction in economic productivity. While Dharavi generates an impressive $1 billion annually from informal industries, worker productivity remains just 22% of formal sector levels. This suggests that informal settlements, despite demonstrating remarkable entrepreneurial energy, fail to achieve the scale economies and efficiency gains possible in planned areas. The economic vibrancy exists despite the urban chaos, not because of it, indicating even greater potential could be unlocked with proper planning frameworks.

7.4. Technology Adoption Follows Urban Order

The case studies reveal a clear progression pattern in technological implementation: basic order must precede stable infrastructure, which then enables digital systems and ultimately smart city solutions. High-entropy areas remain stuck at the first stage, unable to implement advanced solutions like sensors and IoT networks without first establishing basic utilities. Singapore's success with 5G-enabled HDB towns demonstrates how proper sequencing of development creates the foundation for technological advancement. This finding crucially suggests that cities cannot leapfrog to smart solutions without first establishing fundamental urban order.

7.5 Dramatic Divergence in Social Outcomes

The comparative social metrics between planned and unplanned neighbourhood reveal staggering differences. Child mortality rates in planned areas (18/1000) are five times lower than in informal settlements (92/1000), while disease incidence is three times higher in high-entropy areas. Education outcomes show similar disparities, with school completion rates of 98% in planned neighbourhood versus 47% in unplanned ones and digital literacy gaps of 82% compared to 29%. These findings strongly suggest that urban entropy creates self-perpetuating poverty traps that comprehensive planning can prevent.

7.6 Cost-Benefit Analysis of Development Approaches

Our financial analysis comparing retrofitting versus planned development reveals important insights. While slum upgrading appears cheaper initially at 12,000perunitversus12,000 per unit versus18,000 for new planned housing, the long-term picture changes dramatically. Over 30 years, maintenance costs make unplanned development 2.7 times more expensive overall, with much shorter infrastructure lifespans (15 years versus 50 years). This cost-benefit analysis provides compelling evidence for the economic wisdom of proper initial planning.

8. Conclusion

In conclusion, the study of entropy in housing neighbourhood underscores the critical importance of structured urban planning in creating sustainable and liveable communities. The stark contrast between high-entropy informal settlements like Dharavi and Rocinha versus planned developments like Chandigarh and Singapore's HDB towns reveals that governance quality, infrastructure investment and forward-looking policies are decisive factors in shaping urban outcomes. While informal settlements demonstrate remarkable economic resilience and community vitality, they do so despite systemic disadvantages - including inadequate services, environmental hazards and social inequities that ultimately limit their long-term potential. The research demonstrates that planned neighbourhood achieve superior results across all metrics: they deliver 3-4 times longer infrastructure lifespan at a quarter of the maintenance cost, enable five times better child survival rates and foster more inclusive economic opportunities. As urbanisation accelerates globally, the lessons from these case studies present a clear imperative: cities must prioritise strong planning institutions, phased formalisation of informal areas and technology-enhanced governance to manage entropy effectively. The choice facing rapidly growing cities is not between development and order, but rather between investing in planned growth now or paying far greater costs to remedy disorder later. By adopting hybrid models that combine the dynamism of organic communities with the efficiency of planned systems, urban areas can achieve the delicate balance between vibrancy and sustainability that defines truly successful neighbourhood for all residents.

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Exploring Pathways for Sustainable Heritage Tourism

Kalinjar Fort Complex, Banda (UP)

By Dr. Nirmita Mehrotra

1. Introduction

A heritage management plan is an integrated development plan addressing approaches to dovetail development with conservation. The plan should sensitise local community and policy makers facilitating stakeholder participation. Based on outstanding universal value, the plan should make continued use of the heritage property and promote adaptive reuse while protecting its significant features. Kalinjar Fort Complex, Banda, is one of such sites in Uttar Pradesh's Chitrakoot Division.

Kalinjar Fort is located in Banda district, Chitrakoot dham Division of Uttar Pradesh (figure 1). The fort stands on an isolated flat-topped hill of the Vindhya Range, which rises to a height of 800 feet above the plain. The fort covers an area of about 8 km and is surrounded by a 7 km long wall that has eight gates. The fort complex has 40 buildings and structures within its premises that serve different purposes and functions. Some of the buildings are religious, such as temples, shrines and mosques. Some of the buildings are secular such as palaces, barracks and granaries. Some of the buildings are functional, such as water tanks, wells and drains.

Bundelkhand Circuit

Bundelkhand region comprises Jhansi, Lalitpur, Deogarh, Kalinjar and Chitrakoot. Bundelkhand is the heartland of India divided among Uttar Pradesh and Madhya Pradesh, which is full of places, forts, temples, lakes and reservoirs with significant religious and cultural values particularly legendary Rani Laxmi bai of Jhansi Chandelas and Bundelas dynasties (table

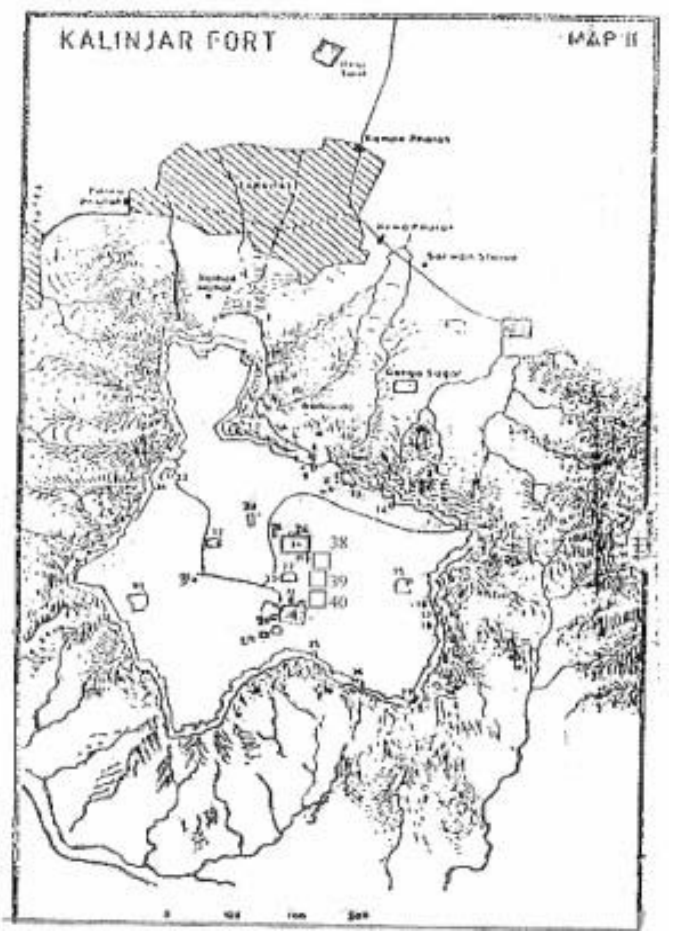

Figure 1: Kalinjar Fort overlooking Budelkhand Plains
Source: https://banda.nic.in/gallery/kalinjar-fort/

1). Kalinjar Fort is often compared with Gwalior fort for its grandeur. Gwalior is 1.75 miles in length by 0.5 mile in breadth, with a parapet of rather more than 5 miles in extent.

Table 1: Bundelkhand Circuit - significant places and their cultural values
Source: Author

Jhansi	Rani Laxmibai of Jhansi, Jhansi Fort, Barua Sagar, Rani Mahal
Sukwa Dhukwa Dam	Historical dam with arched walkways of immense tourist value
Kalpi	Chaurasi Gumbaz, Ved Vyas Temple, Lanka Minar
Mahoba	City of lakes and forts, granite Sun temple at Rahila
Kalinjar	Kalinjar Fort, Neelkanth Temple
Deogarh	Dashavatar Temple, Jain Temples, Sidha Ki Gufa, Rajghati etc.
Lalitpur	Matatila dam, Tal Behat, Mansarover Lake, Narsingh rock cut sculpture
	Lord Rama spent his exile here; Hanuman Dhara, Kamad Giri and Ram Ghat

2. Significance of Kalinjar Fort

Some of the buildings are decorative such as pavilions, gardens and fountains. The fort also played a role in the 18th and 19th century, when it was involved in the Maratha wars and the Indian rebellion of 1857. The fort was finally captured by the British in 1812, after which it was abandoned and dilapidated until it was declared a protected monument by the Archaeological Survey of India (ASI) in 1955.

Kalanjar has been occupied from the most remote times (table 2). It is mentioned in the Vedas and Puranas as one of the *tapasyasthanas*, or "spots adopted to practices of austere devotion." The fort also witnessed many invasions and battles, as it was coveted by many rulers and conquerors.

The fort was first mentioned in the 5th century, when it was ruled by the Gupta dynasty. It then passed on to the Pratihara dynasty, who made it their capital in the 9th century**.** The fort reached its peak of glory under the Chandella dynasty, who ruled over Bundelkhand from the 10th to the 13th century. In the 12th century, the fort was attacked by Prithviraj Chauhan, the king of Delhi, who defeated the Chandellas and captured the fort. However, he soon lost it to Qutub-ud-din Aibak, the founder of the Delhi Sultanate, who also plundered and destroyed many temples and monuments in the fort. The fort then changed hands between various Muslim and Hindu rulers, such as the Khiljis, the Tughlaqs, the Lodis, the Gonds and the Bundelas. The Chandellas were known for their patronage of art, culture and religion and they built many temples, palaces and sculptures in the fort. The name Kalinjar means "the destroyer of time", and it reflects the ancient and enduring nature of the fort.

Components of the Fort Complex

The fort is a veritable historical treasure house. Situated at a height of 700 feet in the Vindhya ranges, this old and massive fort is accessible through seven gateways: the Alamgir Darwaza, Ganesh Dwar, Chandi or Chauburji Darwaza, Buddha Bhadra Dwar, Hanuman Dwar, Lai Darwaza and Bara Darwaza. Within the fort are the remains of two palaces – the Raja Mahal and the Rani Mahal, as well as several other places of interest. These include the Sita Sej, a small cave containing a stone bed and pillow once used by hermits, a reservoir known as Patal Ganga, Pandu-Kund, where water trickles from the horizontal crevices of stratified rocks, Buddha-Buddhi Taal,

Table 2: Kalinjar Fort's regimes
Source: Author

Period	**Under Regimes**
Mentioned in Vedas & Puranas	
Mentioned in Mahabharat	
5th Century	Gupta Dynasty
9th Century	Pratihara Dynasty
10-12th Century	Chendella Dynasty
12th Century	Rajputana Prathvi Raj Chuhan
13th century onwards	Delhi Sultanate

the water of which is believed to possess healing qualities, Bhairav-ki-Jharia or Manduk Bhairav with the colossal figure of Lord Bhairav carved on the rock, the Mrigdhara or Antelope's spring, situated within an inner chamber of the rampart and Koti Tirth pond, an important bathing site, as lepers are believed to be cured by its water.

There are two entrances to the fort of Kalanjar, of which the principal one is on the north side towards the town and the other at the south-east angle leads towards Panna. The latter one, which is still called the Panna Gate, is now closed. The other entrance is guarded by seven different gates which are named:

1. Alam or Alamgiri gate
2. Ganesh gate.
3. Chandi or Chau-burji gate or "gate of the four towers"
4. Budh-bhadr gate
5. Hanuman gate
6. Lal darwaza

Figure 2: Bada Darwaja of the Kalinjar Fort
Source: https://banda.nic.in/gallery/kalinjar-fort/

7. Bada darwaza (figure 2)

At a short distance higher up in the bend of the road stands the third gate, named the Chandi Darwaza. There is a double gate, with four towers which is also known as the Chau-burji Darwaza or *gate of the four towers*. The fourth gate, named Budha-bhadra Darwaza, is the gate of the "auspicious planet Mars (Budha)." It is also named the Swarga Rohana, or "heaven-ascending gate" owing to the stiff climb required to reach it. The fifth gate, or Hanuman Darwaza, is named after a figure of the monkey-god carved on a slab resting against a rock. There are numerous rock sculptures and a reservoir called Hanuman Kund. The scriptures are of Mahadeva and Parvati, Ganesa, the Bull Nandi and the Lingam with two inscriptions dating to 1530 and 1580. The sixth gate, called the Lal Darwaza, gets its name from its red colour. To the west of this gate is the Bhairavakund, with a colossal figure of Bhairava cut in the rock. Seventh gate is Bara Darwaja which is the main gate. The most famous siege of Kalinjar Fort took place in the 16th century, when it was attacked by Sher Shah Suri, the Afghan ruler who challenged the Mughal Empire.

3. Architectural Style and Features

The fort is a living museum that showcases the history and culture of India in a captivating and captivating way. Kalinjar Fort is a treasure trove of attractions and monuments that showcase the cultural and artistic heritage of the fort. There are forty structures in the fort complex out of which 22 are religious as in table 3.

There are many temples, palaces, sculptures and inscriptions within the fort. The complex exhibits various architectural styles and features, reflecting tastes and preferences of different rulers and periods. Some of the styles and features are Hindu, such as the *shikhara*, the *mandapa* and the *garbha-griha*; the dome, the arch and the minaret are Islamic. Some of the styles and features are British, some features are Gothic, Victorian and Georgian. It is a masterpiece of human creativity and ingenuity that has stood the test of time and nature. The lower part of the ascent is tolerably easy, but the middle portion is very steep, while the upper part is nearly perpendicular and quite inaccessible. The main body of the fort, which lies from east to west, is oblong in form, being nearly a mile in length by half a mile in breadth. The whole area is therefore considerably less than 1 square mile, while the parapet walls are nearly 4 miles in length.

3.1 Neelkanth Temple: This is the oldest and most sacred temple in the fort, dedicated to Lord

Figure 3: Neelkanth temple's mandapam in dilapidated condition
Source: https://banda.nic.in/gallery/kalinjar-fort/

Tble 3: Significant places in the fort
Source: Author

	Type of Monument	Name of Monument
1	Gateways to the fort	Alam /Alamgir Darwaza
		Ganesh Darwaza
		Chandi Gate also known as Chauburji Darwaza
		Budhabhadra Darwaza
		Gate leading to Balkhandi Mahadeo
		Hanuman Darwaza also accompanied by hanuman kund
		Lai Darwaza
		Bada Darwaza or the main gate
		Panna Gate
2	15 kund and ponds	Hanuman Kund
		Bhairon Kund
		Sita Sej or the cave
		Sita Kund
		Patal Ganga
		Pandu Kund
		Pani Ki Aman Kund
		Bhagwan Sej
		Bijli talao
		Ram katora talao
		Taliyya talao (“Ramna”)
		Sidh Ki Gupha
		Koti tirth orHoly Place is main pilgrimage of Kalanjar
		Budhbhadra talao (“Budhi Budha/burhiya”)
		Sanichari talao
3	Palaces inside the fort	Raja Aman Singh Palace
		Rani Mahal and Venkat Bihari Mahal
		Chaube Mahal
		Rang Mahal
		Zakira Mahal
		Moti Mahal
4	Mosque & Tomb	Qanati mosque
		Islam Shah mosque
		Two Tomb
5	Temples	Nilkantha Temple
		Parmarddi Gate of Nilkantha Temple
		Bhairon Ka Jhirka
		Mrigdhara
6	Others	Dak Bungalow/ Guest House

Shiva (figure 3). The sacred temple is located at the highest point of the fort, having simple and elegant structure, with a shikhara, a mandapa and a garbhagriha. The temple is decorated with many sculptures and carvings that depict the various forms of Lord Shiva, such as Nataraja, Ardha-narishvara and Bhairava (figures 4 and 6). According to legend, Lord Shiva, after consuming poison that emerged from the churning of the ocean, came here and rested for some time. To commemorate the event, Chandela ruler Parmardideva built this temple. A big Shiva lingam is mounted here. The lingam is made of a dark blue stone, 4.5 feet high and has silver eyes. The outer part of the temple has fine carvings. In a

Figure 4: Beautiful rock-cut sculptures and carvings of Hindu deities on the stones and walls near the Neelkanth Mahadev Temple at Kalinjar Fort
Source: https://banda.nic.in/gallery/kalinjar-fort/

Figure 5: Colossal statue of the 24 feet high Lord Kal Bhairav
Source: https://banda.nic.in/gallery/kalinjar-fort/

niche by the rock-cut Swargarohan Kund, stands a colossal 18-armed, 17 feet broad and 24 feet high image of Lord Kal Bhairav (figure 5). Inside the fort on the north face are four places named Sitakund,

Figure 6: Stone Carvings at Neelkan Mahadev Temple
Source: https://banda.nic.in/gallery/kalinjar-fort/

Sitasej, Patal Ganga and Pandu-kund.

3.2 Sita Sej: This is a small and secluded chamber, located near Neelkanth Temple. It is believed to be the place where Sita, the wife of Lord Rama, spent some time during her exile. The chamber has a stone bed, on which Sita is said to have rested. The chamber also has a small window, through which Sita is said to have gazed at the stars. The chamber is a symbol of the love and devotion of Sita, who followed her husband in his trials and tribulations.

The Patal Ganga is a large deep well or reservoir, cut in the rock. The water is deep and is constantly dripping and trickling from the roof and sides.

3.3 Kot-Tirth is a large reservoir, nearly 100 yards in length, with several flights of steps. Kot-Tirth is the chief object of pilgrimage in Kalanjar, considered equivalent to 10 million places of pilgrimage. The name Koth-tirth means the place where lepers are cured by bathing.

3.4 Pandu-Kund: Pandu-kund is a shallow circular basin, about 12 feet in diameter, into which water is constantly trickling in from the crevices in the horizontal strata of rock. This is a natural spring, located near Neelkanth Temple. The spring has clear and cool water, which is said to have medicinal qualities. The spring also has a small shrine, which is dedicated to the Pandavas with short inscriptions in Gupta characters reading “Manoratha”.

3.5 Mrityunjaya Mahadev Temple: This is another temple dedicated to Lord Shiva, located near Alamgir Gate. It is also known as the temple of the conqueror of death, as it is believed that Lord Shiva granted immortality to a devotee who worshipped him here. The temple has a shiva lingam, which is said to have miraculous powers. The temple also has a water tank which is said to have healing properties. The temple is a symbol of the power and grace of Lord Shiva,

Figure 7: View of Kalinjar Fort
Source: https://www.kalinjarfort.com/research

Figure 8: Qunati Mosque in Kalinjar Fort
Source: https://www.kalinjarfort.com/research/fort-of-kalinjar-and-its-medieval-structures

who bestows blessings and boons to his followers.

Buddha Mandir: This is a temple dedicated to Lord Buddha, located near the Panna Gate. It is one of the rare examples of Buddhist architecture in the fort, as most of the fort is dominated by Hindu and Islamic elements. The temple has a dome, a stupa and a statue of Lord Buddha, sitting in a meditative pose. The temple also has a small museum which displays some relics and artefacts related to Buddhism. The temple is a symbol of the peace and harmony of Buddhism.

3.7 Chauburji Mosque: This is a mosque built by the Mughals, located near Budhi Gate. It is also known as the four-towered mosque, as it has four minarets at its corners. The mosque has a dome, an arch and a prayer hall, all of which are typical of Islamic architecture. The mosque also has some inscriptions and paintings, which depict the verses and scenes from the Quran. The mosque is a symbol of the faith and devotion of Islam, which ruled over India for many centuries.

3.8 Bara Darwaza: This is the main gate of the fort, located on the western side. It is also known as the big gate, as it is the largest and most impressive gate of the fort. The gate has a massive arch, which is decorated with sculptures and carvings. The gate also has a famous inscription, which records the victory of Sher Shah Suri over the Mughals in 1545 CE. The gate is a symbol of the glory and pride of the fort which resisted and defeated many enemies.

3.9 Bhairon Ki Jharia: This is a cave located near the Mrityunjaya Mahadev Temple. It is believed to be the abode of Bhairava, a fierce form of Lord Shiva. The cave has a dark and narrow passage which leads to a chamber where a statue of Bhairava was installed. The cave also has some rock-cut sculptures and paintings which depict the various aspects and manifestations of Bhairava. The cave is a symbol of the fear and awe of Bhairava, who is the protector and destroyer of the fort.

4. Urban Conservation and Heritage Tourism

Conservation of monuments is not always an easy task. Urban conservation preserves a city's historic, cultural and architectural character while integrating modern development, sustainability and adaptive reuse. It involves protecting built fabric, streetscapes and the natural ecosystem to support climate resilience and economic vitality through adaptive reuse and community engagement. Based on the

Table 4: Grades of Heritage Buildings and Precincts
Source: Heritage Conservation Committee Delhi

Grade I: Comprises buildings etc. of national or historic importance. No interventions be permitted either on exterior or interior of the heritage building etc. unless it is necessary in the interest of strengthening and prolonging the life of the building etc.
Grade II: Comprises building etc. of regional or local importance possessing special architectural or aesthetic merit or historical significance.
a. Grade II A: Internal changes and adaptive reuse may by and large be allowed.
b. Grade II B: In addition to the above, extension to additional building in same plot or compound could in certain circumstances allowed provided it is in harmony with existing building etc.
Grade III: Comprises building and precincts of importance for townscape that evoke architectural, aesthetics or sociological interest. Internal changes and adaptive reuse may by and large be allowed. Changes can include extensions and additional buildings in the same plot / compound provided they are in harmony with the existing building etc.

present physical conditions of the heritage and its outstanding value, heritage monuments and precincts are categorised in the grades given in table 4.

Heritage Tourism contributes extensively to the conservation of historic fabrics and also boosts local economy. Through community engagement, it creates awareness about the glorious past and inculcates a sense of pride and belongingness. It has potential for raising revenues through heritage and harnesses these for conservation by generating funding, educating the community and influencing policy. There are certain charters being formulated for integrated conservation of cultural heritage. The Athens Charter of 1933 contains urban ensembles in the definition of the built heritage and emphasises the cultural, economic and spiritual value of the architectural heritage. The Venice Charter of 1964 is a remarkable document that sets out to define the common responsibility of nations to safeguard cultural heritage for future generations. UNESCO Charter of 1945 dwells on the aim of UNESCO's tourism, culture and development agenda which is to contribute to the creation of a discerning type of tourism that recognises the principles of cultural diversity, the preservation of fragile cultural and natural resources, their mobilisation for sustainable development and poverty alleviation and the expression of socially differentiated cultural identities.

Sustainable tourism advancement addresses the issues of present visitors and host cities while securing and upgrading opportunities for the future. It is conceived as the management of all assets so that economic, social and aesthetic needs can be fulfilled while maintaining cultural, integrity, essential ecological processes, biological diversity and life support systems. The fundamental components of sustainable development are ecological sustainability, economic sustainability and equity, which also remain as main components of the research framework. The advantages of cultural and heritage tourism can be categorised into three groups: economic, social and environmental.

Economic benefits of cultural and heritage tourism:

- Generate new avenues for investment in the local economy.
- Boosts the existing businesses and tax revenue.
- Tourism always has a multiplier effect on other sectors of the economy.
- Creates business and livelihood opportunities.
- Supports small businesses and local craft.
- Helps small businesses to expand.
- Helps in building relationships within and among local communities.
- Encourages the development of new/existing community amenities.

Social benefits of cultural and heritage tourism:

- Helps construct social capital.
- Advances conservation of local traditions, customs and culture.
- Helps improve the city's image and pride.
- Promotes host city beautification.
- Generate opportunities for local communities to build networks and associations.
- Generate awareness about historical and cultural legacy associated with identity of place.
- Generate recreational opportunities for the local community and visitors.
- Raises local investment in heritage resources and amenities that support tourism services.

Environmental benefits of cultural and heritage tourism:

- Cultivate culture and practices of heritage preservation.
- Increases awareness of the tourist sites and attractions.
- Supports local residents and visitors to be mindful about their impact on the natural and built environment.

4.1 Heritage Management Plan

Heritage Management Plan fulfils multiple functions to protect, conserve and enhance the heritage property's significant features and encourage the continued use of the heritage through original or adaptive reuse. Ensuring significant national and local partnership and fostering social inclusion, promoting knowledge of the historic fabric and its significance to local and global audiences. To be implementable, the heritage management plan must be an integrated development plan comprising a legal framework and existing regulations binding on the heritage areas. It should encompass visitor management, potential tourist inflow, risk management and safety from disasters. It should utilise available resources optimally and ensure future financial sustainability. Heritage management plan may formulate action plan for key areas while focussing on the objectives in different stages outlined below (figure 9).

a) It should provide an understanding of the heritage property within its historical and

Figure 9: Methodology for conservation of cultural heritage: to ensure sustainable development in collaboration with state TCPO Act
Source: Adapted from Conservation Brief INTACH 2012 by author

contemporary context. Its development sequence, relationship with setting and cultural influences which has shaped the historic fabric.

b) It identifies key features and characteristics, elements of the heritage property, defining Outstanding Universal Values (OUV) and cultural significance i.e. architectural significance, historical significance, religious or spiritual significance, archaeological significance, natural setting and prominence.

c) It identifies issues and brings forth objectives and action plans for addressing those issues. It should also identify key areas where actions are desired for continued function and management.

d) It enables a holistic view to be taken with regards to challenges and opportunities.

e) Establishes principles and policies to enable the sustainable management and protection of the property.

f) Present a program of action to ensure management of the heritage and prescribed adaptive reuse.

g) Identifies and balances the economic and cultural benefits of the heritage precinct, engage local community to maximise these benefits without damaging the cultural resources.

h) Increase public awareness and interest in the heritage property and promote the educational and cultural value of the property.

4.2 World Heritage Sites

India has 28 world heritage sites. Kalinjar fort has all the parameters to be taken up for world heritage in line with Fatehpur Sikri, Agra Fort and Taj Mahal. To be included in the UNESCO World Heritage List, a site

Table 5: Criteria for Selection in World Heritage List
Source: www. unesco.org

S. No	Criteria for Selection in World Heritage List
1	To represent a masterpiece of human creative genius;
2	To exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design
3	To bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared
4	To be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history
5	To be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change
6	To be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.
7	To contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance
8	To be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features
9	To be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals
10	To contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation

must be of "Outstanding Universal Value" (OUV) and meet at least one of the ten selection criteria (table 5). It must also meet conditions of authenticity and integrity and have an adequate management system to ensure its protection. Adaptive reuse is one of the sustainable ways to maintain the value for the community and their belongingness. Tagging a world heritage site with UNESCO creates identity at a global level which brings funds to continue protection and management and also enhance foreign tourism.

5.0 Conclusion

Heritage conservation is not a static concept – there is always some kind of transformation or change. Such changes can occur in a controlled way, when there is conservation and use, or haphazard development. When heritage sites are left abandoned, they get worse, whereas development of heritage sites for tourism keeps them orderly and periodically maintained. As explained here, there are numerous ways and initiatives possible to ensure integrated development of heritage monuments and precincts like Kalinjar fort complex. It is important to conserve the built cultural heritage as a part of the sustainable development agenda and develop a tourism development plan based on the capacity and constraints of the site and limitations in accepting changes.

Development of a heritage management plan in partnership with the local community of Banda and the State town and country planning organisation is the need of the hour to generate momentum to promote and protect the cultural and religious heritage of Kalinjar.

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DESIGN PROJECT

Karna Bungalow Demonstrates the Geometry of Growing with Time

How a 90s Family Home Adapts Across Three Generations—and Still Feels Just Right

By Ar. Athulya Aby

Image 1: A view of the renovated Karna Bungalow, with its protruding blocks and unconventional angles.

Fact File:

- Project Name: Karna Bungalow
- Client Name: Ar. Vishwas Kulkarni
- Built Area: 206sq.m
- Site area: 338sq.m
- Originally built in: 1992
- Renovated in: 2024
- Project Location: Kothrud, Pune

"In our previous joint home, our room was at the far end, so I had to walk across the entire house to see who was at the door. So I had only one demand – I should be able to see who has come from the kitchen, where I spend most of my time. See!" [pointing to the front gate that can be seen from the kitchen, through the living room window] "It's so convenient for me. Our bedroom balcony also faces the street so I can see who's coming from there also." [Refer img.2] – Maneesha Kulkarni, lady of the house

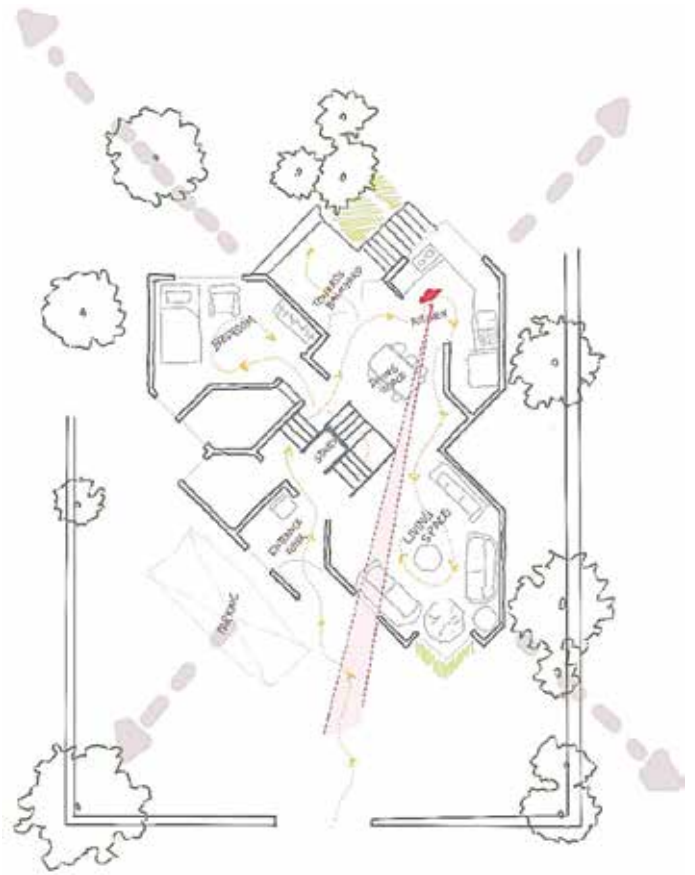

Image 2: The layout allows visual connection from the kitchen to the main gate, combining functionality with design.
Illustration credits: Aayushi Shrivastav

Image 3: An exploded view of the Karna Bungalow reveals its key elements: central staircase, gradually rising levels and chamfered corners.
Illustration credits: Aejaz Sheikh

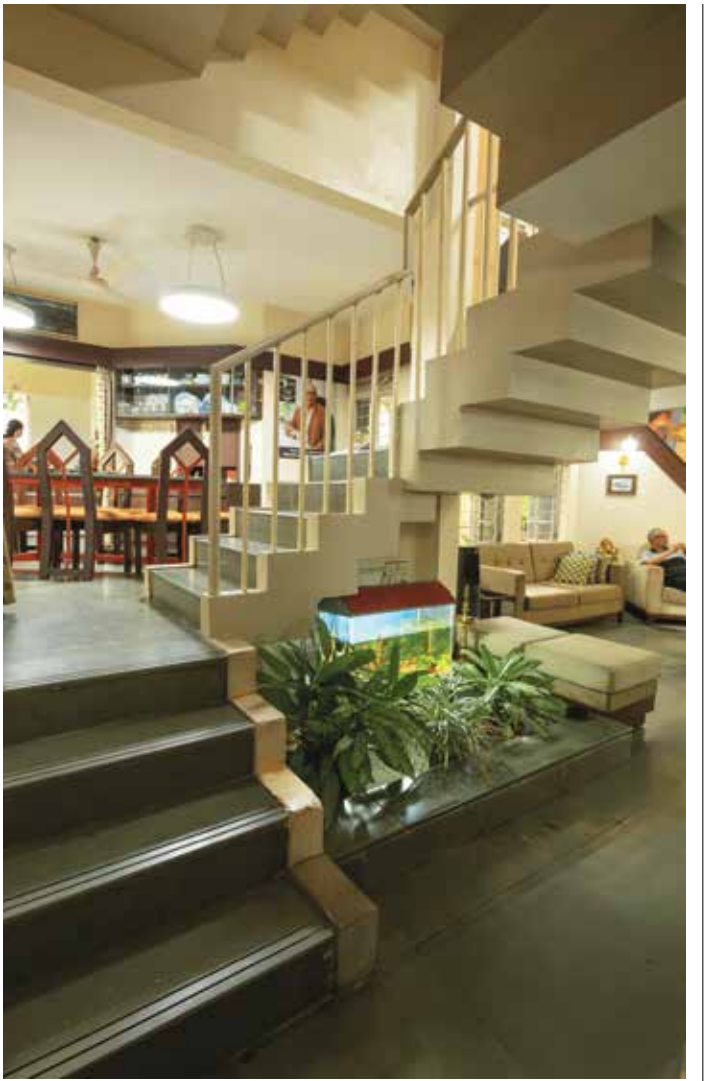

Image 4: The central staircase is the spine of the house. On the lowest level, the living room offers guests a quiet nook, while everyday life goes on above and around. (Photographed before renovation)

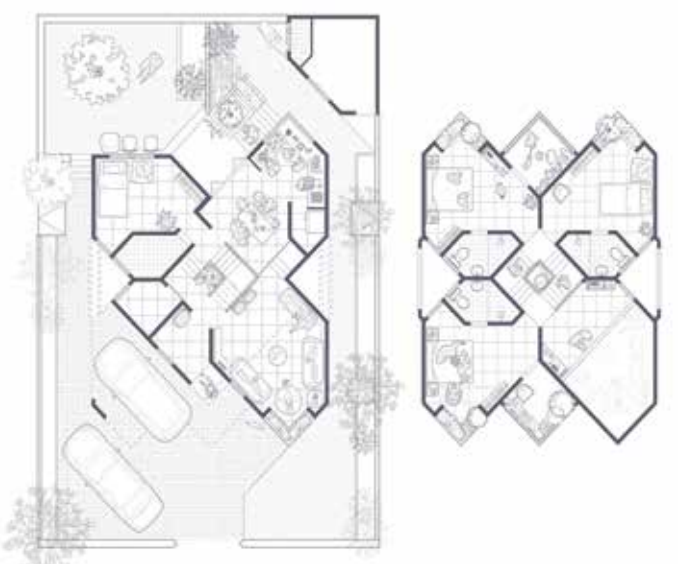

Image 5: A glimpse into the geometry - the floor plans reflect Karna Bungalow's unique diagonal orientation within the compact plot.

There are homes that are built to impress. And then there are homes like Karna Bungalow - built to live in, to grow into, to grow with.

After designing multiple residences and apartments for individuals, cooperative societies and developers, Ar. Vishwas Kulkarni designed Karna Bungalow for his own family in 1992. Standing quietly in a modest neighbourhood in Kothrud, Pune, it has housed three generations over three decades.

From the outside, the building may appear to nod toward Cubism with its stark geometry and angular volumes, but Kulkarni never believed in confining his work to a particular style. Instead, his goal was clear: to make the most of a compact 15m x 22m plot, both spatially and emotionally. The result was a plan where every corner served a purpose and every view was considered.

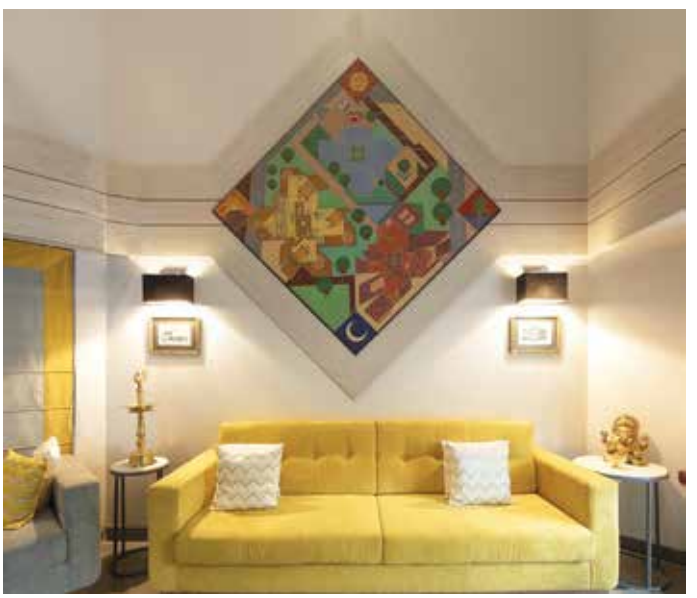

Image 6: An abstract drawing of Karna Bungalow, created by Elephant Design in 1990, captures the home's unique geometry and angularity.

Image 7: A cozy mezzanine family lounge overlooks the double-height living room, creating a visual and spatial connection between private and shared areas.

The home's spatial organisation revolves around a central staircase - its spine - which eliminates the need for corridors and minimises circulation space. A foundational cross-grid layout breaks into dynamic square volumes: living room, dining area, kitchen, bedrooms. Each of these spaces opens out to gardens or balconies, ensuring natural light, cross-ventilation and a visual connection with the outside.

What truly sets this house apart, though, is its diagonal positioning on the site. This small but defining move altered the entire spatial dynamic, enabling a fluid and flexible flow across levels. Fittingly, the house was named *Karna*, the Marathi word for "diagonal."

The form evolved naturally from site boundaries: chamfered square volumes cluster around the staircase, with corners softened or sliced depending on setbacks and spatial logic. The living room is tucked slightly lower than the rest, while the dining, kitchen and bedrooms gradually step upward. It's clever planning at its best, allowing the ever-present

Image 8: View from the street before renovation

Image 9: View from the street after renovation

Image 10: During the evenings, the sit-out attached to the dining, tucked into the back of the house, became the family's escape in the urban setting.

guests to be entertained without disturbing the privacy of family life. During the evenings, the sit-out attached to the dining, tucked into the back of the house, becomes the family's escape in the urban setting.

Upon entering, visitors are greeted not by a conventional nameplate, but by an abstract drawing of the house created by Elephant Designs in 1990. Rendered in miniature-style perspective, it celebrates the building's angularity and sharp lines. It's no surprise that countless architecture students in the late 1990s and early 2000s visited the bungalow as a case study. As a testament to its uniqueness, his son Ar. Hrishikesh Kulkarni, was once interviewing a candidate in the UK who produced a drawing of the house, prompting him to exclaim, "I live here!"

The family Vishwas Kulkarni designed for has changed. Children have grown up and moved out with children of their own. Lifestyles have evolved and time has left its mark on the structure.

So the recent renovation sought to maintain the building's original soul while upgrading it for present-day living. "We didn't want to change the feeling of the house," says Hrishikesh, "but we did want to make it work better for today."

The exterior received a bright refresh. A brick and concrete panel façade now lends depth and texture to the geometry. A sliding gate replaced the older one to save space and make access easier. At the back, the beloved family sit-out was finished with ceramic brick tiles and artificial grass, creating a low-maintenance retreat that continues to be a cherished evening corner. Concealed LED strip lighting, embedded in custom strip boxes, gently illuminates the landscape by night. More than 200 custom-designed pots and planters now dot the windows, balconies and thresholds, adding a layer of greenery to the composition.

Inside, changes were subtle. The original furniture was retained, with updated upholstery. Wooden shutters on doors were upgraded to wooden laminate finishes, lending a fresh but familiar feel. The structure remained untouched; the essence, unaltered.

In a time when design often seeks to make bold statements, Karna Bungalow offers something else: continuity. Perhaps, architecture isn't just about form or function. Maybe it's about foresight, or how it ages as gracefully as the people within it.

Photo Credit: Anup Gandhe from VK Group

A post-graduate in Architectural History and Theory, Athulya Aby is a writer, researcher and academician who dreams of combining her love for travel, stories and architecture. She currently works as the Communications Manager and Architectural Writer for VK Group, headed by Ar Vishwas Kulkarni (A13142), Pune. When she's not writing or teaching, she is travelling.
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OUTPOST 12

A Genius Loci awakened by Human Influence

By Ruchi Saxena

Fact File

Name of project: Outpost 12 - an Eco Forest Lodge in Kanha

Name of Firm: Setu Design Studio

Location of Project: Outpost 12, 171/2, Village Tilari, Kanha National Park, Madhya Pradesh

Plot Area: 14 acres

Built Area: 24,000/- sq ft

Name of Consultants: Setu Design Studio – Landscape Consultant

MAC consulting Engineers – Structural Consultant

Project Completion: December 2024

With Economic, Environmental and Social sustainability at its core, this "forest first" bio-lodge demonstrates how human interaction can harmoniously elevate the locale's essence. A sense of abundant nature prevails.

Outpost 12, a unit of Sinali Experiences Private Limited, is a forest first, naturalist led, safari bio-lodge at Kanha, Madhya Pradesh (India). With just nine cottages on a ten-acre site, the lodge places utmost priority to its natural terrain and vegetation, in creating an exclusive luxury experience.

Natural biome Preservation and Enrichment

The young owners who bought the riverside site were mindful of its distinctive character from the very beginning. Their design brief was clear: No trees shall be cut to make way for buildings. Before the design process would even begin, the owners, with their distinct naturalist backgrounds, would regularly visit the site, take photographs and document the natural movement of wildlife. Areas that should be conserved were hence identified and the buildable areas were not only based on natural views, soil characteristics, but also, the presence of wildlife or its movement patterns on the site. And thus started the process of intensive site studies, demarcating the most buildable areas on the site while protecting the vulnerable areas. The site consisted of flat agricultural land abutted by densely vegetated steep slopes that led to the *Banjar* River, forming the bulk of the site. The flatter portions of the site with no apparent view of the river or the jungle, were utilised for back of house structures; administrative offices, staff quarters, a guest house, kitchen and services. But the unique selling point of the property was its proximity to the *Banjar* River and with the plot's larger edge along the river, it accorded unparalleled views throughout. Certain difficult design decisions had to be taken. Siting the guest cottages along the river was an obvious choice; but this siting would

Figure 1: Outpost 12, a forest-first bio lodge while preserves, also enriches.
Source: Sinali Experiences Pvt Ltd.

have required clearing land of trees and natural vegetation and massive alterations of the existing natural water drainage channels. Consequently, seven of the nine cottages were pushed back along the slope towards the flatter portions of the site. These may have missed out on the river view, but framed admirable jungle views. The move ensured that the objects are placed lightly on the site, with minimal interventions to either the topography, or the natural ecosphere of the site.

The rest of the ensemble, consisting of the reception, the public areas of dining and recreation and the spa, were placed in accordance to the hillside profile; sustainability as a milieu of the architectural ideation. While protecting the existing eco-system was of prime concern, the plan was also to enhance the natural biome. A large lake was dug out on the flat agricultural land to create an ecosystem that would soon be habited by fishes, birds and small animals. The water from the surrounding land drains into this man-made lake, which when overflows during heavy monsoons, leads the water out into the existing natural drainage channels that have been carefully preserved on the site, towards the river. To ensure that the drainage channels that exist almost throughout the site are left undisturbed, the access to the major buildings of the site is through bridges (called the *Setu*). The decking and structural system of the bridges consumed about a massive 25 percent of the total construction cost and yet, it was given a go-ahead, with an intent to protect the scrub forest, the natural valleys and ridges and the natural eco-systems that existed on the site. It is not just the trees that were protected, but the entire biosphere has been conserved. The viewing decks on the *Setu* are positioned based on the mapped bird activity in the area.

The creation of a man-made lake had its own challenges, especially with the lining, to prevent water from seeping into the ground, ensuring the lake remains functional and sustainable. The site soil inspection discovered the presence of black cotton soil on the site. Due to its high clay content, black cotton soil forms a dense, low-permeability barrier, ideal for lining a man-made lake. Also, naturally occurring soil is non-toxic, doesn't pose a risk of leaching harmful chemicals into the water and is completely safe for aquatic life, when compared to synthetic liners. The success of the lake is evident during the monsoons when the *Banjar* River is brimming with water, reverse migration of fishes has been discovered into this man-made lake.

Apart from enhancing the landscape aesthetics, this human made aquatic system, christened the *Majhtal*, is an attempt to restore the natural ecosystem of the area. By planting native species, stocking the lake with fishes and creating artificial habitats, the area has already become home to birds like *Red vented Bulbul, White browed Wagtail, Scaly breasted Munia, Chestnut shouldered Petronia, Black Drongo, White throated Kingfisher, Indian Pond Heron, Little Cormorant, Common Kingfisher etc.* (Figure 2).

Figure 2: The artificially created Majhtal has become a thriving oasis, proudly brimming with shimmering water and new life.
Source: Sinali Experiences Pvt Ltd.

The *Setu*, or the bridges which connect the various parts of the lodge, represent the intersection between intervention and preservation. Through this approach, the landscape and the built environment enter into an exciting complementing dialogue. The Setu over the slope bestows visibility to the untouched topography of the terrain, as well as places the upper portions of the trees at eye-level, furthering the possibility of bird sightings.

Mutual Revelation

Unlike the tented luxury experience that has become a norm in wildlife resorts in recent times, or the usual village-inspired décor, this project pursues the complexities of precisely carving contemporary architecture within a virgin and authentic environment. It seeks to create a fluid and permeable connection, where nature and habitat seamlessly intertwine and illuminate each other. The "surprise" element is at play. The entry into the site leads to the reception through a sinuous curve that gradually brings into view certain elements of the landscape. A mural wall with masks made of black pottery from Mandla on the right (Figure 3), a mound preventing the view of the *Majhtal* on the left, till the reception appears. The reception is a simple building, divided into two parts by a focal central element: a circular cut-out into the roof, with steel chains suspended below. The roof cut-out is echoed in the floor, with a circular pond with fishes and aquatic landscape. On one side, is the check-in and the souvenir shop; on the other, semi-open seating. The focus remains on the central element or the outward views and one is unaware of what lies next (Figure 4).

Figure 3: The eco-lodge is replete with local arts and crafts works. Seen here is the mural wall with black pottery masks brought in from Mandla.
Source: Sinali Experiences Pvt Ltd.

Figure 4: A simple yet inviting reception echoes minimalist designs lightly placed on the site.
Source: Sinali Experiences Pvt Ltd.

While moving forward, tree trunks come into vision and the *Setu* welcomes the visitor (Figure 5). This is when, one realises the change in terrain and the focus shifts onto the trees, the land profile below and the landscape gradually reveals the dining area. The solid dining area façade effectively hides what lies beyond. Once into it, the focus shifts back again to the landscape, through the floor to roof glass, as the river comes into sight, with the infinity pool and the *kusum* tree in the foreground. The flow of spaces from outdoor to indoor and then outdoor again, creates a gentle and open dialogue, where nature and the built form interact, revealing and highlighting each other's quality. The dining area is laid out comprehensively from one roof, which remains on one plane, while the floor corresponds to the changing terrain. As a result, the *Maikal* (or the all-day dining) is at one level, but *Brander's 12* (The bar and the lounge) is at a lower level, as the terrain falls below it.

Figure 5: The Setu ensures connection with minimal disruption.
Source: Sinali Experiences Pvt Ltd.

The treatment of the guest cottages blends modern living with wildscape authenticity (Figure 6). Yet again, the reciprocal unveiling of nature and the habitat is displayed. The cottages are introduced tucked in the natural setting, with a slight view of the retrieved mine-cast stone merging the built form in the surrounding landscape; and then, as one progresses inward, the built form introduces nature again through the large picture windows that frame a spectacular jungle view. The architectural intervention introduces a compelling juxtaposition. Openness is further heightened by employing generous ceiling heights and strategically placing skylights that not only bathe the rooms in sunlight but also sculpt dynamic environments through their geometric design. An added bonus is provided by the excellent views of the branches of trees, on which a bird may be seen fluttering every now and then. The use of glass in the otherwise Gray-themed interiors offers an exciting contrast between the rugged wilderness beyond and the delicate manicured contained fabric of the cottages. The topography of the plot offered opportunities for deck areas hanging into the terrain.

Figure 6: Carefully preserved natural scrub and vegetation lends a wilderness vibe to the entire experience. (L) The guest cottage with its retrieved mine-cast stone façade. (R)
Source: Sinali Experiences Pvt Ltd.

The chosen artifacts and artwork seek to refer to the place where the building is located; a contemporary interpretation of the *Baiga* necklace or a portrait of the *Baiga* women, dried bottle gourd art work, *Gond* paintings, make references to the vernacular and traditional ethos of the region. Traditional necklaces of *Baigas* often incorporate silver, frequently combined with beads and, notably, old silver coins. These pieces are a significant part of their adornment, reflecting their cultural heritage and connection to nature, alongside other materials like brass and cowrie shells. A contemporary interpretation of the *Baiga* necklace is the highlight of the cottage interior. *Baiga* tattoos (*Godna*) hold deep cultural significance, representing a woman's tribal identity, serving as permanent adornment, offering believed protection, marking important life stages and thought to accompany them after death. A portrait of a *Baiga* woman, superimposed with the tattoo symbology that the tribe uses, adorns another wall (Figure 7).

Figure 7: The guest cottages: Contemporary yet seeking references to the place.
Source: Sinali Experiences Pvt Ltd.

Dried bottle gourds, hollowed out generally for storage of liquids or used as an aid to drink water or Mahua, have been inscribed with patterns from *Gond* paintings. *Gond* painting is a tribal art from Central India by the *Gond* community. It's known for intricate dot and line patterns, vivid colors from natural sources and themes inspired by nature, mythology and daily life. Surely, more than art, the artifacts in the guest cottage are a way of storytelling and preserving the local community's cultural heritage and spiritual beliefs. The newly built structure is unobtrusive in intent, while remaining visible and bringing about the sense of awe and surprise. Every space thus created frames the natural beauty of the site.

Furthering the immersive jungle experience, the *Captain's Lookout* is an elevated Star Bed tower nestled above the forest canopy, featuring a circular open-air platform designed for sleeping and dining under the stars. It offers guests a private, panoramic experience of the surrounding nature at sunrise and throughout the night (Figure 8).

Figure 8: The Captain's Lookout allows visitors to dine and sleep under the stars, for a unique jungle night experience.
Source: Sinali Experiences Pvt Ltd.

The estate follows a circular economy, with rainwater harvesting, waste water recycling and the use of solar energy. Every drop of water, whether from the kitchen or from the flushing of the toilets goes through a natural and sustainable wastewater treatment system that uses a bio-digestor, a reed bed filter and UV disinfection to treat and purify waste water before leaving it into the *Majhtal.* Grease interceptors have been installed to intercept and separate fats, oils and grease (FOG) from wastewater before it enters the sewer system. Every effort is made to ensure the water entering the *Majhtal* is harmless to its aquatic flora and fauna. A water cycle has been created on site. During the dry periods, as the Banjar River slumbers in its dry bed, the *Majhtal* proudly cradles its shimmering waters.

A solar plant which caters to 100% of the property's requirement with four levels of backup which includes solar, falling back to lithium-ion batteries and the grid before the DGs kick in. The resort boosts to be a net zero development. The architect has consciously avoided the use of R.C.C due to its high carbon footprint and resource-intensive production. Wherever possible, the same has been substituted with metal frameworks and structural systems.

Preserving the Sanctity of the Local

A key objective of this project is to improve the lives of those in the surrounding communities. While providing employment to the locals, Sinali Experiences, the parent company, has been conducting training sessions of the locals to polish their skills as local flora and fauna guides. "We

Figure 9: The site plan and aerial view of Outpost 12.
Source: Sinali Experiences Pvt Ltd.

invited locals to a training session in July of 2024 and found that some of them understand the land and its inhabitants better than us professionals. All they need to learn is how to present this information", Durgesh aka DK, a naturalist himself, suggested. Subsequently, Dharmu bhaiya, a local villager, is already a part of the inhouse naturalist team.

The local community has also realised the importance of preserving the ecosystem in its entirety. Within two years of its inception, the area around the lodge, which was frequently foraged for wood and forest produce, has been left untouched, leading to better growth of the trees.

While the lodge provides an array of international cuisines, it focuses on the regional food and has curated a local millet diet. The menus have been engineered from what is seasonally available, foraged, bred on Kanha's adjunct farms or growing wildly in their natural habitat. The lodge sources many ingredients from the local villages, fostering their economy.

One of the oldest indigenous tribal communities of Kanha, the *Baigas*, were relocated out of the 'core' zones of the Kanha National Park, as early as in the 1960s. The displacement was to protect the dwindling numbers of *barasingha*, a hard ground swamp deer, whose population had dipped to a mere 66 at that time. This displacement was further exacerbated by Project Tiger (1973) which aimed to bolster the conservation of tigers, a species that featured in the IUCN Red List of threatened species. Today, the *Baigas* live in the buffer zones. Working with local communities, the lodge has introduced a "Timeless *Baiga* experience" in its list of to-do activities. As a part of the experience, guests are taken to a nearby *Baiga* hamlet, where they are introduced to the indigenous customs and lifestyle of the *Baigas*. The *Baigas* have traditionally been hunter gatherers and against the tilling of land. From worshipping trees, to weaving baskets for fishing, working with plants for their medicinal use, the *Baigas* are true representatives of those living a zero-waste lifestyle. The guests get an insight into the traditional hunting methods, information about traditional musical instruments, dance forms, jewellery etc. The *Baiga* cultural experience is an attempt towards responsible community tourism that would support the continuation of the *Baiga* culture, while also providing them a source of income.

In Sync with Madhya Pradesh's Tourism Policy

The lodge is in sync with the state's tourism policy by aligning its business model with the government's objectives of sustainable development, community empowerment, with a strong emphasis on eco-tourism and responsible tourism. Simply rejecting the trend of resorts as wedding destinations in forest reserve areas, Outpost 12 has ensured that loud music, late night parties are not a part of its visitor experience. Naturalist-led "forest first" bio-lodge is what the Outpost 12 claims itself to be and it surely delivers. The lodge is a testament to what is possible in sustainable design, when the response to the site and its context is sensitively handled. The project demonstrates that architecture can be both beautiful and beneficial to the planet and its people. While the design of the lodge seeks to generate a symbiosis between architecture, the forest, the river and the relationship they have with the user, through views; the project seeks to contribute to the growth and well-being of the local communities.

This eco-lodge walks the talk.

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P.O.A. of Design

By Ar. Harshad Bhatia

People often ask 'What is POA?' It is a short term of different, yet distinct references, like *Plan of Action* in management jargon and 'Power of Attorney' in legal circles. But in the context of Design, how does POA read?

Well, with all our five keen senses, we perceive design. We see it in our everyday lives. We are yet seeing it in the course of reading this text. We are touching the paper and comparing its importance by that tactile embrace. We are tasting the last course of the latest meal while pondering on the contents of this line. We smell the odor of fresh papyrus and gum of a newly bound item which offers more literary revelations.

We hear either the cacophonic screeching of automobiles which make this piece of text hi-fi or the gentle breeze puffing and brushing the glossy green leaves which make it poetic. And while doing so, we are also absorbing design in the encyclopaedia of our minds. Hence, at first instance it is *Power of Absorption*.

The second stage commences immediately afterwards. Architects have, time and again, given examples of inspirational images which show in their own work. This approach is often adopted by designers who excel in the power of absorption. It is hence important to develop those latent skills of observation which come along with the human body. It is never too late to learn about the designer who had no knowledge about art till he learnt the art of perception.

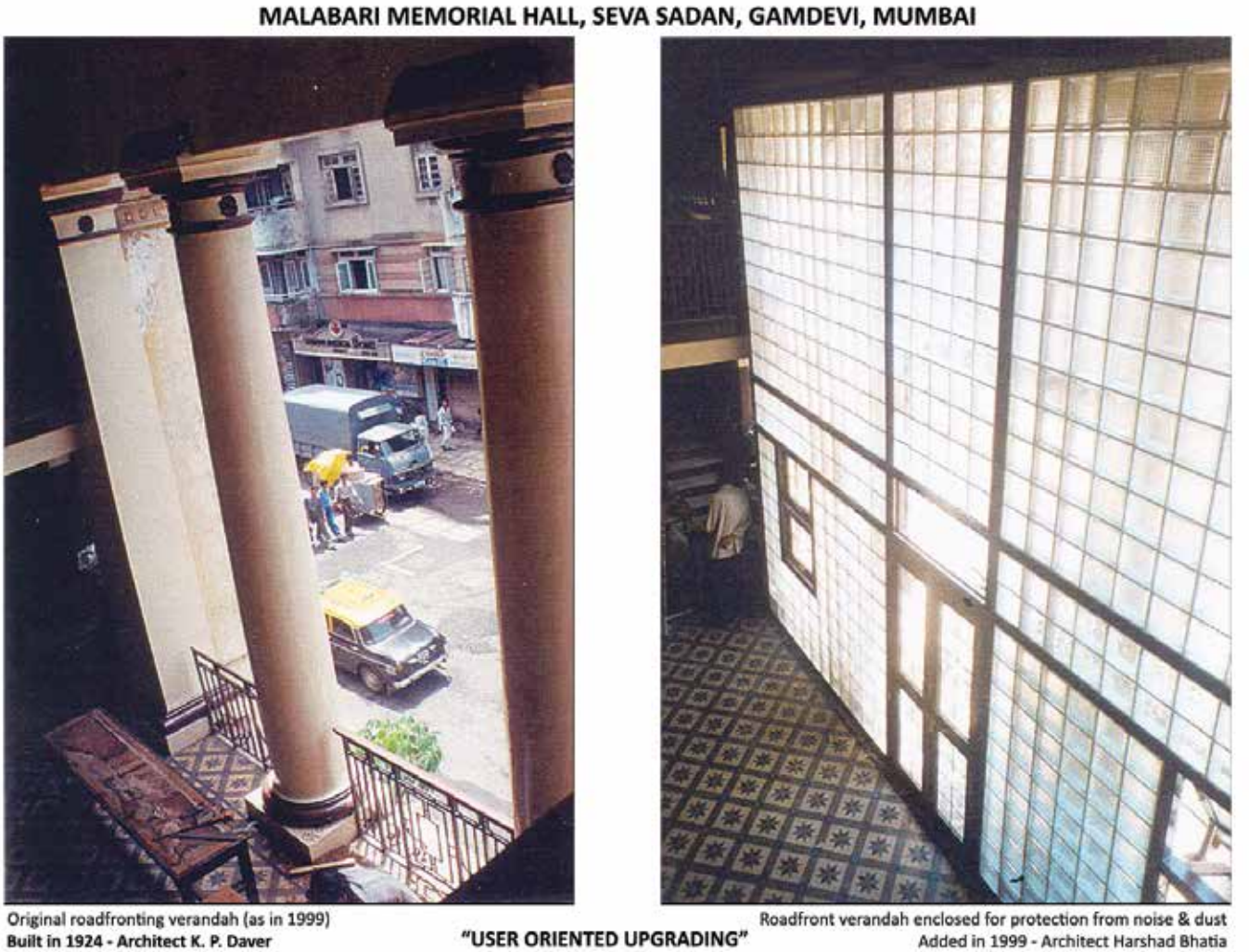
Thereafter, the design process is markedly esoteric. This individuality makes our works different from those of our neighbors. One site many options, is therefore but natural. So, the second gesture about POA is *Putting Options Across*. This step is also very evident in the professional designer's approach to proposal approval. For example, the very many historically noted architectural styles themselves are producing differing design possibilities.

All said and done, the designer then finalizes a suitable proposal. This is where the architect shall be tested for his expert professional output. It is hence, the *Proposal on Anvil*. The cutting edge of which relies heavily on its final making and completion. Unfortunately, however, there have not been many projects which actually passed this stage in public life. By 'public life' what is meant is the media - the press, television, films and the you-name-it acceptable modes of public messaging and exposure.

Designers have always been known by their project output, to the large public at only two stages in their life - the first being at the paper stage of a proposed design yet not built, and the next at the just or recently completed stage. Most, if not all the projects, have been covered by the very many media modes at either of these two stages only.

The important part to note is that the *Power of Absorption* and *Putting Options Across* are often cited by the designers in what made the projects take their present line of design in the form of design concept and context - physical, social, economical and sometimes (though incorrect) mythological. But, once the output becomes a *Proposal on Anvil*, there are no takers. Hence, while POAs are important in their own right, the most wanted POA is never questioned with honesty and integrity towards providing a user-oriented design.

Hence, if Architecture is an Art + Science or Art +Technology or 'Functional Art', the designed product made by an architect is meant for a specific purpose. It serves as 'shelter' in the mundane sense. The abode for a living, mobile species of intellectual being. Therefore, in the true sense of Architectural Design, are mere concepts and contexts justifiable for its success? Is it not of utmost importance that



our products serve their purpose in all respects; that is, of affording long term comfort and use, including durability?

Hence, why have we never visited the projects beyond the 'just completed' stage? After all, the projects were designed for a use as the primary purpose of their existence. The success of such design can then be measured only after that span of user time, within the created environment. This calls for the actual POA - for *Post Occupancy Assessment* of our architectural design projects.

Often termed as *Post-Occ-Evaluation*, the idea of this type of POA is not to measure the success or failure of the architect personified. It is to enable us in avoiding reinvent the wheel or preventing mistakes in the realm in our constant, unending search for perfection. It also allows us to gauge the generic nature of our creations, particularly in response to the pace of communications worldwide and also their effect on various cultures.

Therefore, in future if we do design another project, let it be with that consciousness of the actual purpose it is meant to serve, the user therein and his functions over time, which may run into years, in the best manner possible. For, with design and architects, it is the people users who matter more than the popularity charts. So, the next time a client's brief is being prepared, it is the user's requirements which should be kept in mind as the POA, what is it that *People Often Ask*.

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Ar. Shaik Basheeruddin Ahmed

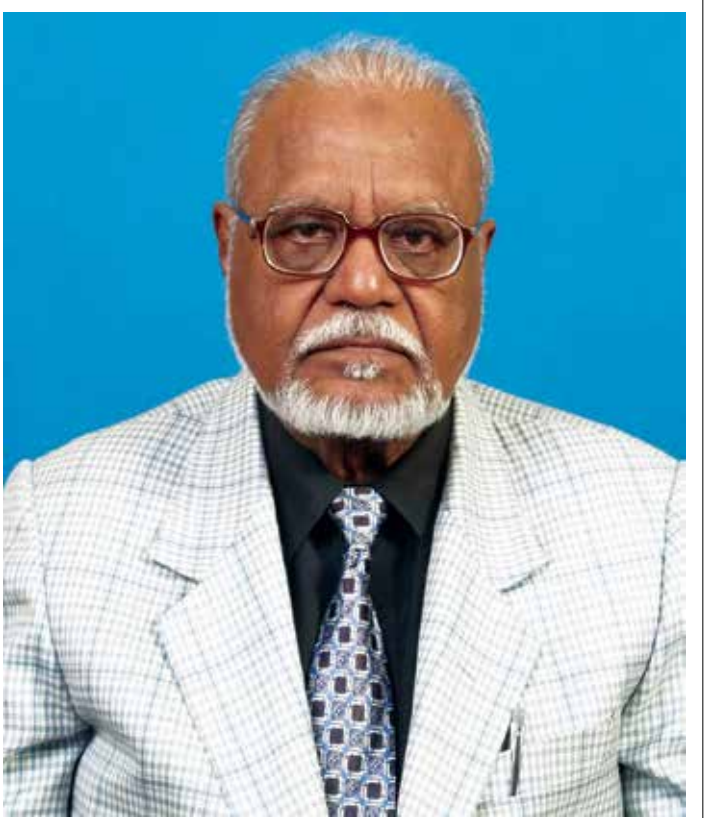
Memorial and Contributions in Architecture

By Ar. Shaheeruddin Rafey and Ar. Taaha Muzaffar Imam

Shaik Basheeruddin Ahmed, a committed architectural practitioner, a Fellow of the Indian Institute of Architects, and a professional of deep integrity, passed away on 20 December 2025 at the age of 89. Born on 26 January 1936 in Hyderabad, he belonged to a family deeply rooted in education. His father served as the headmaster of a local school, instilling in him values of discipline, learning, and service, principles that would later define both his professional conduct and personal life. He pursued his architectural education in Baroda during the 1950s, a formative period when modern architectural thought in India was evolving alongside a strong pedagogical emphasis on drawing, craftsmanship, and spatial understanding. These qualities reflected the solid training he received in his formative years and highlighted his belief that good architecture arises from a careful balance of technical understanding, spatial clarity, and effective visual communication.

Upon completing his studies, Shaik Basheeruddin Ahmed returned to Hyderabad and began his professional journey working with Architect Mohammed Fayazuddin, a celebrated architect associated with the Town Planning Department of the then State of Andhra Pradesh. During this phase, he gained valuable exposure to public and institutional architecture and was involved in projects that contributed significantly to Hyderabad's civic and cultural landscape. He was involved in notable projects like Ravindra Bharathi auditorium.

Following this period, he entered into a professional partnership with Architect Taruj Ahmed Khan, practicing together in their own firm in Hyderabad. This collaboration marked an important phase in his career, during which he contributed to notable



Portrait photograph of Shaik Basheeruddin Ahmed (F 01012)

projects such as the Members' Pavilion at the Malakpet Race Course and the Dwarka Hotel along with many residential projects. These works reflected a mature architectural sensibility, combining functional planning with contextual responsiveness and clarity of form.

Subsequently, Shaik Basheeruddin Ahmed relocated to Bangalore (Figure 1), where he established his independent practice, Basheeruddin and Associates. Through this firm, he undertook a wide

Figure 1: Shaik Basheeruddin Ahmed drafting in his Bangalore Studio

range of residential, commercial, and religious projects, contributing meaningfully to the region's-built environment during a period of rapid urban growth. Notable works from this phase include the Shopping Centre and Office Complex for Dargah Hazrath Hameed Shah, the Williams Town Mosque in Bangalore, and several projects in Mysore, most notably the Masjid-e-Murad Shah Bibi, which stands as a significant example of his sensitivity to religious architecture and community context.

In the later stage of his career, Shaik Basheeruddin Ahmed moved to Saudi Arabia (Figure 2), where he practiced architecture for nearly four decades. During his tenure there, he worked with several well-known firms, including Saleh and Menkabo Associates and Al-Samman Engineers and Contractors. His work in Saudi Arabia encompassed residential, religious, and commercial projects, requiring adaptation to diverse cultural, climatic, and regulatory frameworks. His long and sustained professional presence in the region stands as testimony to his versatility, resilience, and enduring relevance as a practitioner.

Shaik Basheeruddin Ahmed was particularly distinguished for his mastery of manual architectural drawing. He possessed an exceptional ability to produce hand-drawn presentation perspectives, often rendered in watercolours with remarkable finesse. These drawings were not merely representational tools but expressive works that conveyed architectural intent with clarity and artistic sensitivity. As the profession transitioned from manual drafting to computer-aided design, he demonstrated notable openness to change. Rather than resisting new technology, he actively engaged a young engineer to learn AutoCAD, later sharing this knowledge with others. This willingness to adapt exemplified his commitment to continuous learning and professional relevance, even in the later stages of his career.

His influence extended beyond professional practice into his family life, with both his son and grandson choosing architecture as their vocation—an enduring testament to the values he embodied and the example he set. Throughout his life, he upheld the profession with integrity, perseverance, humility, and quiet excellence.

Shaik Basheeruddin Ahmed will be remembered as an architect whose career bridged generations of architectural practice, from hand-drawn watercolour perspectives to the digital age, leaving behind a legacy defined not only by buildings, but by unwavering dedication to the discipline.

Building: Shopping centre and office complex for Dargah Hazarth Hameed shah

Location: Bangalore, India

Architect: Shaik Basheeruddin Ahmed

The commercial complex (Figure 3) was originally built in 1976 with a ground and first floor, and a second floor was added in 2002, though the complex remains partially incomplete. It currently comprises 67 shops on the ground floor, 31 offices on the first floor, and 55 shops on the second floor. The complex was commissioned by the Administrator of the Karnataka Board of Wakf. Designed by Basheeruddin Ahmed

Figure 2: Still of Shaik Basheeruddin Ahmed from office in Saudi Arabia

Figure 3: Hand drafted Elevation of Shopping Center and Office Complex in the premises of Dargah Hazrath Syed Hameed Shah, Bangalore

during his practice in Bengaluru, the Dargah Hazrath Syed Hameed Shah Complex integrates traditional motifs such as geometric jaalis within a modernist and climate-responsive architectural framework.

Building: Members Pavillion Entrance in Malakpet Race Course
Location: Malakpet, Hyderabad, India

Architects: Shaik Basheeruddin Ahmed and Taruj Ahmed Khan

A striking vision of mid-century modernism, the Members Pavilion at Malakpet Race Course (Figure 4) was designed by Shaik Basheeruddin Ahmed and Taruj Ahmed Khan in 1968. The composition creates a dynamic interplay between a vertical, glass-clad anchor and a sweeping, curved viewing gallery. Views Elevated on sculptural Star-shaped pilotis, the structure achieves a sense of floating elegance, perfectly merging high-society function with the architectural International Style, the building also balances a commanding vertical tower with a fluid, horizontal wing optimised for panoramic race views. The pavilion was an extension to the existing Race course in malakpet which itself was shifted from Secunderabad in 1886 by Mir Mahboob Ali Khan.

Figure 4: Hand drafted View of Members Pavillion entrance in Malakpet Race Course, Hyderabad

Building: Refah Commercial Complex
Location: Mysore, India

Architect: Shaik Basheeruddin Ahmed

The Refah Commercial Complex (Figure 5) in Mysore, designed by Shaik Basheeruddin Ahmed of Basheeruddin & Associates, is a striking exercise in "Vertical Modernism" that seamlessly integrates traditional geometry with a bold, mid-century silhouette. Dated January 31, 1976, this proposal for the Majlis-e-Refah-ul-Muslimeen presents a sophisticated multi-use structure consisting of a ground floor plus ten levels. The building is anchored

Figure 5: Hand drafted View of Refah Commercial Complex, Mysore

by a two-story horizontal podium. The ground floor features a continuous rhythmic arcade of pointed, "Saracenic" arches, providing a shaded pedestrian precinct for retail activity.

Building: Dwaraka Hotel
Location: Hyderabad, India

Architects: Shaik Basheeruddin Ahmed and Taruj Ahmed Khan

The Hotel Dwarka in Lakdikapul (Figure 6), Hyderabad, designed by Shaik Basheeruddin Ahmed and Taruj Ahmed Khan in the late 1960s, is a quintessential landmark of mid-century urban modernism in the city. Its design is a masterful response to its prominent corner site, blending functional commercial requirements with a bold, rhythmic aesthetic. The most defining feature of the building is its expansive, multi-story curved wing that elegantly follows the sweep of the road at the Lakdikapul intersection. This curve not only maximises the building's street presence but also provides panoramic views for the hotel guests. The horizontal flow of the curved wing is punctuated by a stark, vertical rectangular tower. A series of slender columns support the upper floors,

Figure 6: Photograph of Dwaraka Hotel, Lakdi-ka-Pul

creating a shaded pedestrian walkway that houses various shops, including the iconic hotel entrance and retail spaces like "NYCO Fabrics". Although the building has been modified over the decades due to Urban Development and road widening in the Lakdikapul area, it remains a functional part of Hyderabad's hospitality landscape.

Building: Masjid-e-Murad Shah Bibi
Location: Mysore, India

Architect: Shaik Basheeruddin Ahmed

The Masjid-e-Murad Shah Bibi (Figure 7) in Mysore is a profound example of Shaik Basheeruddin Ahmed's ability to synthesize historic Islamic precedents with modern construction efficiency. Completed in a remarkably short span of just 14 months, the design gained national acclaim for its departure from traditional Indian mosque archetypes, favouring a cleaner, more structural aesthetic inspired by Masjid-e-Quba (the first mosque in Islam) and the grandeur of Mughal architecture. The Minaret and Verticality: The exterior is defined by a stout, square-based minaret that eschews the typical circular tower for a more modernist, blocky form. It is topped with a tiered capital featuring a bold, zig-zag (chevron) pattern and a small, elegant dome, creating a silhouette that is both ancient and contemporary.

Figure 7: Photograph of Masjid-e-Murad Shah Bibi, Mysore

Figure 8 : Photograph of Interiors of Masjid-e-Murad Shah Bibi, Mysore

The main entrance features a large, recessed pointed arch. Within this arch, a secondary circular form creates a "keyhole" effect, while the side of the tower is adorned with an intricate vertical strip of geometric jaali work, providing texture and light filtration. The interior (Figure 8) is characterised by a series of repetitive white pointed arches supported by sturdy square pillars. The spandrels (the space between the arches) are decorated with delicate floral medallions, a clear nod to Mughal decorative arts, while the polished stone floors reflect the light to create a sense of vast, tranquil space. Unlike the often-cluttered contemporary mosques of the time, this design uses "negative space" and clean lines to create a spiritual atmosphere. The 1980 Indian Express feature specifically highlighted this "uniqueness," noting how it successfully brought a new architectural vocabulary to the Indian landscape.

All Images Courtesy: Author

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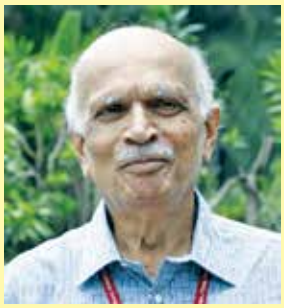
OBITUARY



Prof. Ranjit T. Ghogale
(13 February 1941 - 14 March 2026)

Pole star

Eyes, a deep brown hue, a sea of wisdom
Heart, a bright warm gold, a well of empathy
Mind, silver razor sharp, a dictionary of memories.

A weaver of magical stories, his comical timing
coupled with his mischievous smile . . .
An angel of peace, the troubled waters calm and
problems vanish into thin air . . .
His love silent, unsaid, complete, and warm . . .
Baba, Abba, Sir, our pole star,
guiding us to the path of light.

Dr. Archana Kadam

Born to a father who served as District Judge, Ar. Ranjit Tularam Ghogale studied in various schools across Maharashtra before he enrolled at Sir J.J. College of Architecture, Bombay. He wished to join the Indian Army like his two brothers, but was encouraged to join Architecture. After completing his graduation successfully in 1963, Ar. R.T. Ghogale worked with Government and private firms in Bombay, until he came to Pune to construct his father's house in Shivajinagar area in 1964.

He started his own architectural practice in Pune and started teaching in 1966 at BKPS College of Architecture. In 1990, Prof. R.T. Ghogale was appointed as the Principal of Marathwada Mitra Mandal's College of Architecture and in 1999 as Principal of MCES's Allana College of Architecture. MCES's President Dr. P. A. Inamdar awarded him as 'Professor Emeritus' in 2011, where he continued his academic contribution and guidance till the end. During his academic career, he worked as Chairman of Board of Studies, Member of Academic Council and Senate of Pune University.

As a practicing architect for over 50 years in Pune, Ar. Ghogale worked on projects for MSFC, MHADA, Krishi Utpanna Bazaar Samiti, ADCC Bank & other institutional projects. He was the Chairman of Indian Institute of Architects – Pune Chapter 1994-98 and later Member of the National Council, Member of Examination & Education Board and Chairman of Research & Doctoral Board of IIA, Mumbai. He was a Member of the Building Works' Committee of Gokhale Institute, ICMR's NIV & NARI, National Naturopathy Centre, Dr. Babasaheb Ambedkar Technological University, Pune University & Maharashtra State Marketing Federation. Furthermore, he was invited as a Jury Member for Architectural Competitions by Commissioner of Police, NCL, PCMC, Pune University, Chairman of Committee of Assessors and others.

During his architectural career in both profession and education, Prof. R.T. Ghogale received several prestigious awards viz. the MASA Gold Medal for 50 years of contribution to the Profession and Academics in 2015, the IIA Lifetime Achievement Award at IIA MahaCon 2017 and the AESA Lifetime Achievement Award at AESA Awards 2019. The highest honour of the IIA Madhav Achwal Gold Medal was conferred upon him at IIA NatCon 2025 in Bhopal.

Known for his discipline, punctuality, and deep knowledge in architectural practice and academics, his warmth and unwavering support to students, inspired generations to pursue their careers with integrity. A passionate Architect, dedicated Teacher, inspiring Mentor, nurturing Leader and a fun-loving human being, Prof. R.T. Ghogale will always be remembered for his lifelong commitment to teaching, kind-hearted nature and generosity of spirit by all who had the privilege of being associated with him. One soul who touched so many lives!

IIA MAHARASHTRA CHAPTER

IIA Satara Centre

A cricket match was organised on the occasion of Republic Day. A formal discussion meeting was held with Mr. Tushar Madhane, Town Planner, Satara Municipal Council, regarding the Draft Development Plan of Satara City. Planning provisions, development regulations, and future growth prospects were discussed. As a goodwill and professional gesture, the Centre felicitated the newly-inducted President, Deputy President and Chief Officer of the Satara Municipal Council. A store visit was organized to DMart LLP, Satara, to understand retail planning, space utilization, services coordination and operational aspects of large-format commercial buildings.

IIA Nagpur Centre

An Advisory Committee meeting was conducted where Hon. Treasurer Ar. Rajesh Kakde presented a report informing about the current financial status of IIA Nagpur Centre. Approval of the budget for various expenses of the centre and discussion on Centre Premises also took place.

IIA Solapur Centre

A factory visit was organised at Kothari Pipes, Mohol in February. It was was well-attended by the members. The EC members with the Office Bearers visited the SSS College of Architecture and appreciated the work done by the students that was presented in their exhibition.

IIA Kalyan-Dombivli Centre

In association with MCHI CREDAI, the IIA Kalyan-Dombivli Centre organised a meeting with the Hon. Commissioner and KDMC department heads to sort out the issues faced by architects due to integration of BPMS along with KD-SWIFT single window system for availing NOCs of various departments. Many decisions were taken to help solve the issues. Detailed minutes of meeting were submitted to the Hon. Commissioner for information and take necessary action.

IIA Kolhapur Centre

The IIA Kolhapur Centre facilitated the Institutional Membership application of School of Architecture, D. Y. Patil College of Engineering & Technology and Shri Prince Shivaji Maratha Boarding House's College of Architecture. Both institutions have received the Institutional Membership Certificates from the IIA Head Office, marking the successful completion of the membership process.

IIA Pune Centre

The bowling tournament *Incredible Bowling-Season 2* was conducted from 12 - 14 March 2026 which saw the enthusiastic participation of more than 250 architects and designers. A condolence meeting was organised at the Pune Centre office in the memory of Late Professor Ranjit Ghogale on 26 March, 2026 in the presence of his wife and daughter. Senior IIA members who were his students shared their memories about Prof. Ghogale. He had been instrumental in setting the foundation of IIA Pune Centre. It was a warm meeting where various facets of this great personality were discussed and memories were rekindled.

IIA and IAI Sign Historic MoU

March 30, 2026 marked a historic occasion with the signing of a Memorandum of Understanding between The Indian Institute of Architects (IIA) and The Indonesian Institute of Architects (IAI) at the IAI Office in Jakarta.

The MoU was signed by IIA President Ar. Vilas Avachat and IAI President Ar. G. Budi Yulianto. It focuses on collaboration in heritage architecture, conservation practices, and professional development, strengthening ties and promoting knowledge exchange between the two institutions.

The MoU focuses on fostering collaboration in the areas of heritage architecture, conservation practices, and professional development. Through this partnership, both institutions aim to promote the exchange of knowledge, expertise, and best practices, thereby strengthening the architectural profession in both countries.

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