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# IMPACT OF GEO-AESTHETICS AND GEOLOGICAL INFLUENCE ON VERNACULAR AND VICTORIAN ARCHITECTURE: A BIOPHILIC APPROACH FOR SUSTAINABILITY

Aadya Budhiraja<sup>1\*</sup>, Pratik Godbole<sup>2,3</sup>, Krutika Jangale<sup>4</sup> and Kirtikumar Randive<sup>5</sup>

<sup>1\*</sup>Scholar, Shiv Nadar School, Noida, 201305

<sup>2</sup> Research Scholar, Post Graduate Department of Geology, RTM Nagpur University, Nagpur, India, 440001

<sup>3</sup>Fellow, Pangea Society, Mumbai, 400013

<sup>4</sup>Research Scholar, Post Graduate Department of Geology, RTM Nagpur University, Nagpur, India, 440001

<sup>5</sup>Professor and Head, Post Graduate Department of Geology, RTM Nagpur University, Nagpur, India, 440001

\*Corresponding author: [Aadya Budhiraja, <sup>1</sup>Student, Shiv Nadar School, Noida, 201305]

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### Keywords

Geo-aesthetics,  
Vernacular, Biophilic,  
Sustainability,  
Victorian, Indo-  
Saracenic, Geology

### Abstract

This paper takes a closer look at how traditional construction practices, the use of locally available natural materials, and design strategies inspired by nature can lead to buildings that are not only environmentally friendly but also more comfortable across different climates. The focus is on Indo-Saracenic architecture, which blends elements of British Victorian design with Indian aesthetics. What stands out is that Indian craftsmen and architects did not simply adopt British architectural models. Instead, they reinterpreted them, adjusting the designs to better suit local weather conditions and cultural preferences. They incorporated thoughtful features such as central



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courtyards, intricately carved stone screens known as *jalis*, and wide, shaded verandahs. These elements helped keep interiors cooler and more pleasant, especially in hot climates. In contrast, many contemporary buildings rely heavily on cement and steel, which are not always ideal in terms of heat regulation and often come with a larger environmental footprint. Traditional materials like stone, clay, and lime, on the other hand, have proven to be more sustainable and climate-responsive. They naturally insulate spaces and have a longer lifespan. The concept introduced here is *Synthetic Vernacular Architecture*. It is about creatively merging time-tested architectural traditions with modern building technologies. This hybrid approach can lower environmental impact while also preserving local identity. The paper recommends that urban planners and architects consider weaving these traditional ideas into today's construction guidelines. By revisiting older methods, using region-specific materials, and designing with nature in mind, it is possible to create modern urban spaces that are not just energy-efficient, but also culturally and climatically in tune with their surroundings.

## 1. INTRODUCTION

Vernacular architecture is referred to the buildings which are characteristic of the particular region, which are deeply influenced by the local geography, available materials, climate, traditions, and culture. These buildings are built by the non-expert 'common-people' with the help of available traditional knowledge transferred and enriched time to time from one generation to another. Therefore, vernacular architecture can also be termed as "Architecture without Architects". These building are constructed with the help of locally easily available material such as clay, wood, stone, and forest derived materials (Pardo, 2023). They are more than just houses because they also show the culture and history of the region. Today, new materials like plastics, ash bricks, and geopolymers are being used to reduce industrial waste and pollution. Even though these modern materials are helpful, traditional vernacular methods are still important because they help lower carbon emissions and support sustainable building practices (Ferrigni, 2015).

The principles of vernacular architecture focus on working with nature, saving energy, and reducing environmental impact. These ideas are still important in modern cities. Culture and traditions are not fixed, they change over time through mixing, adapting, or preserving different influences. Vernacular architecture is strongly linked to local customs and shaped by the geography of a place. The word "native" refers not only to the people but also to the materials they use. Oliver (1987) called vernacular architecture "the architecture of the people, by the people, but not for the people," to show that it grows naturally from communities. On the other hand, Rapoport (1969) said that while it



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may not follow strict theories, vernacular architecture fits well with the environment, meets social needs, and changes as needed (Srivastava and Das, 2023). This ability to adapt makes it a valuable model for sustainable and locally appropriate design today. Most research on vernacular architecture has focused on its cultural and social meaning. However, its links to geology, sustainable use of materials, and nature-based (biophilic) design are not studied much (Lamzah, 2025). Many studies also look at these buildings separately, without considering their use of local geological materials, their design changes based on climate, or their potential for sustainable building today (Sharma, 2024).

On the other hand, research on Victorian or colonial architecture has often focused on colonial influence, ignoring how local people changed, resisted, or blended Western designs into vernacular styles (Hamsjah et al. 2023). The adaptation of Victorian architectural style into vernacular architecture displays a unique interplay of aesthetic transposition, cultural identity, and contextual practicality across different geographical locations. For instance, Italian migrant builders from Australia, migrated during World War II, display a reinterpretation of classic Palladian villas, exemplifying Victorian romanticism and symmetry into suburban Brisbane homes. These buildings are constructed by combining local construction methods with symbolic architectural forms retained from their Italian heritage (Faggion and Furlon, 2017). Such blending of vernacular architecture with modern colonial architecture created a unique architectural typology which is both culturally resonant and functionally customized to local climates (Zhao and Greenop, 2019). Additionally, such adaptive architectural principles highlight the importance of vernacular design elements, enhancing durability and comfort, strengthening the concept of adaptation is not only about aesthetic lineage but also environmental integration (Kashyap, 2023). Therefore, Victorian features in vernacular architecture not only depict decorative relics but also reflect as an adaptable framework, facilitating both identity preservation and modernization. The transformation is deeply context-specific, where climatic, aesthetic, and cultural requirements intersect to shape sustainable built environments that display the past while, supporting the present.

Present study aims to explore these links by:

- [I] Examining the importance of local geological materials such as stone, clay, and natural pigments in vernacular buildings, and their support in long-term sustainability.
- [II] Understanding the nature-based (biophilic) design principles of vernacular architecture, and their implications towards energy savings, natural cooling, and better response to environmental changes.



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[III] Observing the adaptation of Victorian architectural elements within in Indian architecture, focusing on blending of these styles by local communities with their own traditions according to the climate and culture.

[IV] Suggesting policy directions to adapt vernacular design ideas into current urban planning and sustainable development efforts.

## 2. GEOLOGICAL INFLUENCE ON ART & ARCHITECTURE

Geology of the area influences the architecture, along with the designing and engineering, by controlling the choice of building material, location of the building, shape of the buildings, techniques used for construction of building etc. This approach shows close relationship between geology of the area and building, creating a concept of geologic architecture (Mileto et al. 2019). Geological material present in the area is utilized as a construction material due to their abundance, and their good workability complementing local conditions affecting phenomenon such as weathering (Morra et al. 2010). Natural rocks such as granite, limestone, sandstone, and marble are widely utilized in construction due to their durability and aesthetic appeal (Fort et al. 2013). Clay is another important geologic material used to produce bricks and as a supplementary cementitious material in concrete (Singh, 2022). Additionally, limestone powders are added to improve the geotechnical properties of high-plasticity clay in construction projects (Ibrahim et al. 2020). Overall, the selection of geologic materials for architectural use has evolved from being primarily based on proximity and ease of quarrying to considerations of quality, durability, and specific material properties. The use of these materials in construction continues to be an important area of research, with efforts focused on improving sustainability and performance in modern building practices (Kanavaris et al. 2023).

## 3. USE OF GEOLOGICAL MATERIALS FOR SUSTAINABLE ARCHITECTURE

Geological knowledge is essential for the effective use of geological materials in sustainable architecture. It allows the optimization of material properties, informs material selection, and facilitates the development of innovative, eco-friendly building solutions. Base of geological knowledge is crucial for advancing sustainable construction practices and reducing environmental impact of the built environment (Dunama et al. 2023) Earth derived materials are mostly utilized as construction materials by humans. Use of these materials depend on the accessibility, workability, and serviceability of the material. Accessibility refers to the occurrence, extraction, and processing of the material. Durability refers to the resistive power of the material towards the natural agents and their work. Serviceability refers to the property of material to the ability of material to adapt surrounding environment and capacity to withstand in polluted environment (Přikryl et al. 2016). Word ‘sustainable’ refers to the ‘meeting of present needs with the help of resources with considering the needs of future generations. Sustainable architecture helps in reducing pollution,



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conserving natural resources, and prevent environmental degradation. Sustainable architecture mainly relies on durability and use of minimally processed, abundant or renewable resources, which will help in producing healthy living environment for human being. While, relying on naturally available materials for construction, architectural design is also an important component in building sustainable architecture (Ragheb et al. 2016). Therefore, in pursuing sustainable architecture, environmental professionals have developed a range of innovative design methodologies. These approaches not only aim to reduce ecological footprint of constructions but also increase the functionality and well-being of the human (Mba et al. 2024). Materials such as aggregates (eg, natural and lightweight), concrete and cement replacement materials, geopolymers, timber, bituminous materials, metals, glass, natural fibres, fibre composites, raw sewage sludge, gypsum, industrial by-products, de-sulphurised waste, wastepaper, and waste rubber, along with the traditional construction materials such as available masonry material, stones, rammed earth etc., can be employed in the construction of sustainable architectural design (Khatib, 2016). Naturally sourced material such as stones and clay-based materials not only support durability issues but also contribute as thermal insulators and passive coolers (Pisello and Rosso, 2015). As highlighted by Brocx and Semeniuk, (2017), naturally sourced materials such as stones may contain important geological features, providing valuable resources for education, research, and public awareness. Understanding the geological characteristics of building stones in heritage buildings allows architect to make decision about material selection, considering both aesthetic and scientific value (Brocx and Semeniuk, 2017). For instance, yellow coloured rock which is used in construction of numerous historical buildings in South Mumbai is a trachyte rock, which was quarried from Kharodiwadi in Malad West (TOI, 2016). Trachyte is used as a construction due to its compactness, homogeneity, colour, and because of its easy workability. It is generally, utilised as flooring, covering, blocks for open-face constructions and buildings as well as for architectural and street furnishing elements (Careddu and Grillo, 2019). Earthen architecture can also be referred to the architecture which is constructed using clay as a binder. It is often also referred as traditional and/or conventional method for construction. In modern era of construction, some earthen building techniques such as compressed earth blocks were developed few decades ago whereas, vernacular techniques received a architectural interpretation such as rammed earth method (Ben-Alon et al. 2019). Lime-based mortars were used until the second half of 19th century, which can be a good natural alternative to synthetic material such as portland cement, in mild environmental conditions. Addition of pozzolanic material such as clay filler, meta-kaolin, silica fume, glass residue can offer a durable alternative in extreme environmental conditions also (Veiga et al. 2010). Traditional architecture in India utilizes effective use of locally sourced geomaterials according to the climatic response. For instance, mud along with straw, thatch, and bamboo is used in central and south India to construct high thermal resistant and affordable homes. Stone and wood are combined in North Indian states such as



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Himachal Pradesh and Uttarakhand for construction of composite systems like Kath kuni and Koti banal architecture. Rammed earth blocks are used in regions such as Ladakh for providing excellent insulation and thermal comfort (Srivastava and Das, 2023). Latest technologically advanced materials such as wood, bamboo, straw bales, fly ash concrete, Autoclaved Aerated Concrete (AAC), Ground Granulated Blast Furnace Slag (GGBFS), recycled plastics and rubber, and different bio-composites from agricultural residues like sugarcane bagasse, coconut coir, and kenaf fibres are either earth-derived or originate from natural geological or agricultural sources. Even innovative technologies such as phosphorescent cement or Martian concrete rely on minerals and geological inputs, emphasizing the dependence of sustainable construction on earth-sourced materials (Tazmeen and Mir, 2024).

#### 4. ROLE OF GEO-AESTHETICS IN ARCHITECTURE

Geo-aesthetic refers to the appreciation of natural geological materials used in art and architecture. Geo-aesthetics include various formations, structures, and cleavages of rocks, minerals and outcrops, natural monuments, and landscapes. Most of these elements are utilized in decoration, and architecture, displaying in land or earth art. Geo-aesthetics is the appreciation of natural geological materials in art and architecture. Especially in the fields of sculpture and installation we can observe this link between earth and art (Kim, 2015). Such approach recognizes the importance of integrating architecture with its surroundings, both in terms of visual harmony and cultural relevance. For instance, visual patterns are observed as artistic and emotionally engaging, often resembling man-made sculptures or abstract art, which enhances the cultural and visual value of natural landscape. Blending of geological feature with architectural and design practices could prioritize visual and experiential values (Mikhailenko et al. 2017). Vernacular buildings often utilize locally available natural materials such as volcanic stone and clay tile. For instance, volcanic stone is utilized as a material for outer walls and floors. As compared to the material used in modern house, volcanic stone can take advantage of thermal conductivity, hard texture, moisture-proof, noise reduction, glare refraining etc. (Sun et al. 2021). Therefore, by studying local geological, geographical, climatic, and morphological conditions, architects can design buildings which can resonate with the land, climate, and culture of the area, helping in creating more sustainable designs (Mileto et al. 2019).

#### 5. CULTURAL SIGNIFICANCE OF VERNACULAR ARCHITECTURE IN INDIA

Vernacular architecture in India holds significant cultural importance, which shows the diverse heritage and traditions of the country (Tiwari and Vij, 2024). Traditional construction, like the Wada houses courtyard houses in Maharashtra, are designed to meet both functional and cultural needs. They include spaces for religious practices such as performance of 16 sanskaras, private spaces for women and children, prevention from threats of wild animals, and as provision of light and ventilation to interior spaces. Such houses are termed as Havelis in Rajasthan, Rajbari in West



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Bengal, Chaturmukham in Tamil Nadu, Nalukettu in Kerala. Similarly, verandahs are also incorporated in traditional Indian architecture which provide shaded transitional spaces, help in regulating indoor temperatures, and enhance ventilation (Srivastava and Das, 2023). This verandah feature was adopted by the britishers for construction of their abode which is named as Bungalow. Bungalow is a typical example of blending of british architectural elements such as distinct rooms, and European porticos at entrances along with the Indian vernacular architectural elements such as verandahs for ventilation in tropical climates and roof style adopted from Bengali vernacular architecture (Bhardwaj and Garg, 2016). Such approach underscores the importance of vernacular architecture which has adaptability towards the regional climates (Srivastava and Das, 2023).

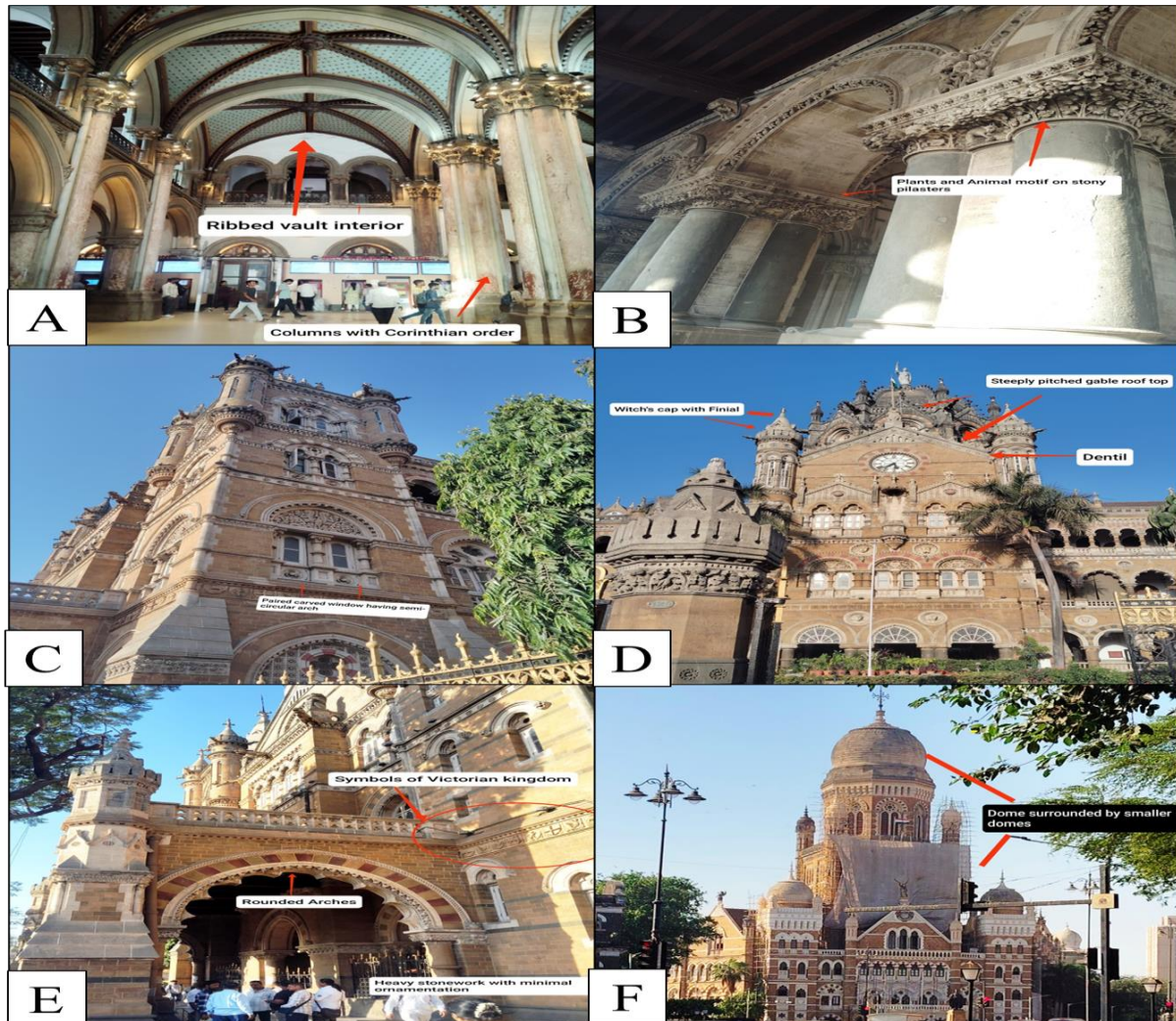
## 6. BIOPHILIC DESIGN IN VERNACULAR ARCHITECTURE

Biophilic design refers to the integration of natural elements into the built environment, observed to have significant positive impacts human health, well-being, and productivity (Mollazadeh and Zhu, 2021). Biophilic elements such as natural materials, ventilation, greenery, and daylighting are included in Indian traditional or vernacular architecture which help occupant inherently promoting physical and emotional wellness (Wadhwa and Piparsania, 2024). Biophilic architectural designs not only include daylight, fresh air, plants, and green spaces but also, includes geometrical characteristics of biological forms such as fractals, scale-invariance, selected concepts related to symmetry, self-similarity, and complex hierarchy (Contreras et al.2023). For instance, Saracenic and Indian architecture inherently includes biophilic characters into constructions including nature's forms and patterns. Saracenic designs include muqarnas, tree like columns, and courtyards which provide visual complexity, natural light, airflow, and refuge. Domes surrounded by smaller domes create a strong spatial centres and hierarchical symmetry, invoking harmony and sensory engagement. On the other hand, Indian architecture includes fractal geometry and organic ornamentation, reflecting nature's self-similarity. Use of flower-motifs, foliage carvings, and dynamic symmetry enhances the spatial and emotional connection to nature (Ramzy, 2015). These designs help in improving mood, and enhance cognitive functioning. On the sustainability front, biophilic design supports green building practices by incorporating low-impact natural materials and passive environmental systems. Furthermore, biophilic principles promote the global sustainability frameworks like the WELL Building Standards and the Living Building Challenge, reinforcing their role in both human wellbeing and ecological stewardship (Gillis and Gatersleben, 2015). For instance, houses built from mud and bricks helps in thermally adjusting and noise resistive construction offering comfort for the occupant (Sheweka, 2011). Vernacular architecture often uses natural ventilation strategies, such as verandahs, promote airflow and passive cooling, supporting the tropical climatic conditions (Bhardwaj and Garg, 2016). Local materials like lime-stabilized materials, and terracotta tiles significantly reduce energy consumption and carbon emission



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compared to modern cement-based systems (Reddy, 2009).



**Fig 1:** Showing biophilic designs in Indo-Saracenic architecture (A to E: Chhatrapati Shivaji Maharaj Terminus, formerly Victoria Terminus. F: Bruhanmumbai Municipal Corporation)

## 7. CHALLENGES OF URBANIZATION AND MODERNIZATION

Rapid urbanization and modernization have posed several challenges in-front of traditional construction methods (Li et al. 2023). Growing urbanization has created conflict between rapid modernization and cultural preservation. This conflict is more pronounced in underdeveloped rural areas, where balancing cultural preservation with modern revitalization has become research priority (Xie et al. 2024). Rapidly growing population has stressed urban infrastructure, which underscores



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the necessity of development of intelligent urban planning and construction techniques for addressing these challenges (Huang et al. 2021). Traditional construction methods are struggling to keep the pace with demand for rapid and efficient construction techniques supporting rapid urbanization and population growth worldwide (Subramanya et al. 2020). The transition towards modernization is compromising the climate adaptability of traditional vernacular dwellings, which are observed to be more adaptable towards the climate change scenarios compared to modern structure (Henna et al. 2021). Therefore, Urbanization and modernization has led to the loss of passive climate regulation techniques, reduced climate resilience, and posed a potential harm to cultural heritage of vernacular construction methods (Diwan and Kumar, 2024). These challenges can be addressed with the help of green design strategies that encompass traditional building techniques along with modern sustainability principles (Ayoobi et al. 2024).

## 8. MODERN APPLICATIONS AND POLICY IMPLICATIONS

Vernacular architecture principles provide enhanced sustainability and reduced environmental impact by integrating into modern construction (Jahanara et al. 2014). Traditional building materials and techniques such as adobe, rammed earth, and cob can be incorporated as low carbon alternatives contributing minimizing waste and promoting circular economy in the building industry (Hu, 2023). These materials are generally locally available, which reduces transportation cost and emissions. Along with this, alignment of vernacular design strategies with circular economy principles, can inspire contemporary circular practices in construction (Dabaieh et al. 2021). Effective application of vernacular architectural principles in the modern world requires policies emphasizing interdisciplinary research, preservation, and adaptation (Carlos et al. 2022). Research should focus on incorporation of modern materials and solutions into old vernacular buildings to meet current comfort standards without compromising their essential features (Pardo, 2023). Policies should also focus on rehabilitation of vernacular constructions (Rong and Bahauddin, 2023), and field work should be promoted in such vernacular constructions (Pardo, 2023). Additionally, policymakers should also consider adoption of assessment tools like the Social Criteria of Green Building Assessment Tool (SCGBAT) for evaluation of the social sustainability aspects of vernacular architecture and inform modern applications (Olukoya and Atanda, 2024).

## 9. THE INFLUENCE OF VICTORIAN ARCHITECTURE ON INDIAN VERNACULAR ARCHITECTURE

Introduction of Victorian architectural style, during British colonial rule in India, to local Indian and Islamic design traditions took the form of Indo-Saracenic architecture. Neo-classical and Victorian gothic features such as grand scale, domes, minarets, and ornate detailing combined with the architectural elements from Mughal and Hindu temple architectures, creating hybrid structures that



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were both functional and symbolically powerful. Such hybridization not only represent architectural innovation but also a colonial synthesis that reshaped public buildings, palaces, and railway constructions across the India (Sheeba and Dhas, 2020).

### ***Indo-Saracenic Style: A Blend of Cultures***

Key features of Indo-Saracenic architecture include, Onion (bulbous) domes, overhanging eaves, pointed, cusped, or scalloped arches, vaulted roofs, domed kiosks and miniature domes, chhatris, pinnacles and towers or minarets, harem windows, open or bangala-roofed pavilions, pierced open arcading. These elements reflect the blend of Indian, Islamic, and Gothic architectural traditions, creating a hybrid style promoted during British Raj for public buildings. Structural elements such as Bangala roof was employed in open pavilions for facilitating effective rainwater drainage and thermal comfort in hot and humid climates whereas, verandahs were incorporated for offering transitional spaces, for shade, natural ventilation, and protection from monsoon rain. (Sheeba and Das, 2020).

### ***Important Architects and Buildings***

Several architects played a key role in creating Indo-Saracenic architecture:

**Robert Chisholm:** He designed the Laxmi Vilas Palace and Khanderao Market in Vadodara, blending Victorian style with traditional Indian elements (Jain, 2022).

**Sir William Emerson:** He designed the Victoria Memorial Hall in Kolkata, which is a well-known example of Indo-Saracenic architecture, featuring a large dome and intricate marble details (SenHirak, 2021).

### ***Lasting Impact of Victorian Influence***

The combination of Victorian engineering techniques and Indian building methods created more durable and climate-friendly buildings. The Indo-Saracenic style has had a lasting influence on Indian architecture, especially in public buildings and stations. Over time, this style has been embraced in both heritage conservation and modern architecture across India, adapting to today's needs while maintaining its historical significance (Jain, 2022; Shuja and Junejo, 2020).

**Table 1:** Showing architecture with its key features and design influences

| Building/ Architecture | Key features and influences | References |
|------------------------|-----------------------------|------------|
|                        |                             |            |



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|                                                   |                                                                                             |                |
|---------------------------------------------------|---------------------------------------------------------------------------------------------|----------------|
| Victoria Memorial Hall, Kolkata                   | Indo-Saracenic style, grand dome, intricate marble work                                     | SenHirak, 2021 |
| Laxmivilas palace, Vadodara                       | Blend of Victorian and Indian motifs, intricate stone carvings                              | Jain, 2022     |
| Gateway of India, Mumbai                          | Indo-saracenic style, basalt and yellow Kharodi sandstone                                   | Parlewar, 2022 |
| Bangalore bungalows                               | Adaptation of Victorian styles to local climate, use of verandas and courtyards             | Kramer, 2006   |
| Chhatrapati Shivaji Terminus (CST), Mumbai        | Victorian Gothic Revival design, pointed arches, stained glass windows, large central domes | Sharma, 2023   |
| Punjabrao Deshmukh Agriculture university, Nagpur | Brick walls, Porches, Bay windows, Pitched roofs, Gables, Bargeboard                        | -              |



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**Fig 2:** Showing Indo- Saracenic architecture (A): Building of Punjabrao Deshmukh Agricultural university, Nagpur, (B): Nagpur Central Museum, Nagpur, (C): Gateway of India, Mumbai

## 10. THE AGENCY OF LOCAL INHABITANTS

The influence of Victorian architecture on Indian vernacular styles was not just one-sided; it was a two-way process. Local people actively adapted, resisted, or combined European elements to suit their own cultural, climatic, and practical needs (Kramer, 2006). In colonial Bombay, for example, builders mixed Victorian features like cast-iron balconies and neoclassical facades with traditional Indian designs such as wooden jharokhas (overhanging balconies), chhatris (elevated, dome-shaped pavilions), and courtyards (Hedrick, 2016). This blending, known as transculturation, allowed the local people to reinterpret European styles while keeping ties to their regional traditions (Barzotto and Bonnici, 2009). Elements like shaded verandahs and jali screens were added to the construction



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for improved airflow and thermal modification (Pawar and Hangergekar, 2016). These adaptations displayed the deep understanding of local environmental conditions (Bhardwaj and Garg, 2016). Therefore, a new architectural style was developed which was blend of traditional Indian and Victorian architecture. This architecture was employed in construction of public buildings such as railway stations, market places etc., showing long term architectural effect on Indian cities. Influence of these buildings is still ongoing in Indian architecture and preservation. In conclusion, Indo-Saracenic architecture demonstrates the role of local communities in shaping their buildings, suggesting the changes were not imposed but, adapted to meet cultural identity and practical needs (Jain, 2022).

## 11. CLIMATIC AND CULTURAL ADAPTATION

Blending of Victorian architecture with Indian styles was unprecedented due to climatic and cultural needs. Walls with substantial thickness for resisting the heat, absence of vertical features such as buttress which might impede the flow of air, pilasters for casting shade, frequent and abundant openings, piers and columns, balconies, flat and/or domical roofs as per requirement, were adopted for tackling the tropical heat (Metcalf, 1984). Structural advances such as iron, steel, and concrete along with the local available material was utilized in construction of Indo-Saracenic buildings. Public buildings such as railway stations, museums, and courthouses were constructed in this magnificent style to reflect the might and moral authority of the empire, incorporating a synthesis of imperial grandeur and local cultural identity (Sheeba and Dhas, 2020). There were political reasons along with the climatic reasons, in development of Indo-Saracenic architecture. Verandahs in bungalows, which were adopted for air inflow was also incorporated for social distancing from the hostile world outside. Sense of superiority was reinforced by the placement of the bungalow in large compound, with a magnificent entry drive (Metcalf, 1989). Therefore, Britishers did not only considered climatic needs but also conveyed the imperial authority while resonating with local traditions (Jain, 2022).

## 12. SUMMARY AND RECOMMENDATIONS

In present scenario, cement and steel, are mainly utilized as construction materials whereas, locally available natural materials such as rocks, clay, lime etc., are mostly discarded although they offer long lasting cooling effect for buildings. Although sustainability is being adopted in architectural designing and material but, vernacular architecture which is adaptive towards the climate is still ignored. While, popularity of biophilic designs in sustainable construction is increasing but, traditional designs such as courtyards, verandahs, shaded walls, and decorative screens are ignored.

This study suggests a new approach to sustainable architecture by:



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[I] Using Natural Materials: We should include materials like stone, clay, and earth-based pigments in buildings to make them last longer and look better.

[II] Bringing Back Traditional Cooling Methods: Instead of only focusing on plants and open spaces, cities should also use traditional features like natural airflow, thick walls, and local materials to save energy.

[III] Mixing Old and New Building Methods: A mix of traditional building techniques and modern technology can help reduce carbon footprints while keeping cultural traditions alive.

[IV] Encouraging Policies for Local Materials: Many green building rules focus on saving energy, but they don't promote the use of local materials. This study suggests creating policies to encourage using regional materials in eco-friendly buildings.

### 13. CONCLUSION

Present study shows how natural materials, traditional building methods, and nature-friendly design can help make buildings more sustainable. The main conclusions drawn from this study are as follows:

[I] Traditional materials like stone, clay, and lime help keep buildings cooler, last longer, and produce less pollution than cement and steel. Future research should measure how these materials can be used in modern construction.

[II] Old cooling methods such as open courtyards, ventilated walls, and thick building materials can save energy. These should be used more in today's city planning.

[III] Indo-Saracenic architecture was not simply copied from Europe. It was changed to fit local needs. When we protect these buildings, we should respect both their cultural importance and how well they work in hot climates.

[IV] A mix of old and new methods, such as using natural materials with modern tools like 3D printing or geopolymers, can help us build eco-friendly and culturally meaningful buildings.

[V] City laws and green building rules should support the use of local materials and traditional designs that work well in different climates.

### 14. AUTHOR(S) CONTRIBUTION

The writers affirm that they have no connections to, or engagement with, any group or body that



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The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## 16. PLAGIARISM POLICY

All authors declare that any kind of violation of plagiarism, copyright and ethical matters will taken care by all authors. Journal and editors are not liable for aforesaid matters.

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