

INDIA'S HEAT WAVE MAY BE DEFEATED BY SUSTAINABLE ARCHITECTURE

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ABSTRACT

This paper emphasizes on constructional sustainability and will also acknowledge its misconceptions which will help in focusing on the fundamental ideas and values of sustainability. The country has to pay a huge price for these sophisticated structures. Currently this April, sweltering heatwaves have affected numerous areas of India, with New Delhi seeing temperatures as high as over 120 degrees Fahrenheit. This occurs before the nation's summer season officially begins in a few weeks. The usage of air conditioning to beat the heat feeds the vicious cycle since it uses more energy and generates more heat while doing so. Numerous blackouts during the day and night have occurred in numerous Indian cities as a result of using more electricity. An urban island heat effect is produced by the excess heat the AC units emit. According to experts, India's contemporary architecture would make it more difficult for citizens to adjust to heatwaves that may become more frequent and prolonged. A rising number of environmentalists and young architects who are concerned with sustainability are urging a return to traditional design in response to the warning signs.

Keywords— Sustainable Construction, Traditional Architecture, Heat Wave, Environment Sustainability

1. Introduction

The concept "sustainable construction" refers to the balancing of environmental, social, and economic challenges to ensure a healthy and worthwhile industry for future generations. The environment is greatly impacted by the construction sector. How building might be sustainable is often in conflict with actions like the exploitation of natural resources, land clearing, and waste creation. The response is that environmentally friendly building practises apply to all project phases, from design through operation and demolition, and have far more to do with building management, material selection, and building design than simply a building's energy efficiency.

In the 1990s, when India's economy shifted to a market-based one, traditional Indian architecture started to disappear. As development grew, globalised, Western designs became the standard, with developers favouring the glassy, angular structures common in Western nations. The land size suitable for gardens or courtyards decreased as the demand for skyscrapers grew. Instead of employing clay bricks, which are inappropriate for high-rise constructions, developers discovered that it was simpler and quicker to construct towering structures out of steel and concrete. Buildings become less resistant to India's customarily high temperatures as a result of the one-size-fits-all strategy.

2. Literature Review

By 2050, it is predicted that there will be 9.6 billion people on the planet, a 33 percent increase in population, which will drive up building development activity. Our resources and the environment are being impacted by the population growth. Building construction and demolition account for 32% of landfill garbage. As future managers, there will be an increased emphasis on sustainable

construction in the years to come. Understanding sustainability and learning how to use it in current and future construction projects are crucial.



Figure 1-Modern Architecture

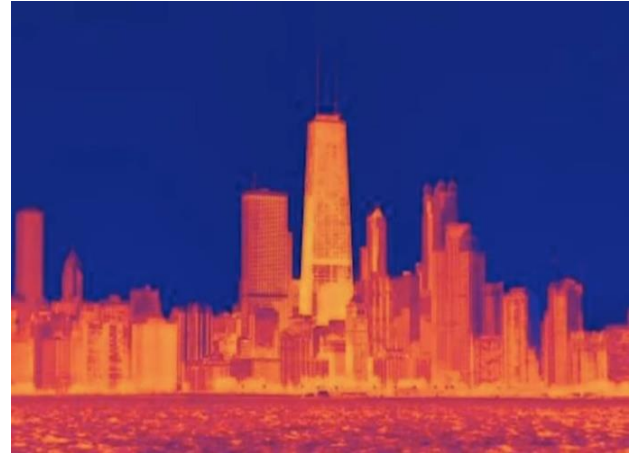


Figure 2- Structure Affected with Heat Wave

Shubham S. (2020), an Indian scientist, found that a kilogramme of vernacular materials required between 0.11 and 18 MJ to produce, as contrast to 2.6 to 360 MJ for the production of modern materials. Even conventional architectural characteristics, such as sloping roofs and elaborate window treatments, are too expensive for homeowners to consider when building their homes, even though it would be impossible to replace all modern materials with their vernacular equivalents. Building verandas and courtyards is difficult due to the high cost of land.

In light of these difficulties, Benny Kuriakose (2022) believes that Indian architecture's future does not lie in just copying what people accomplished fifty years ago but rather in fusing the knowledge system that has been passed down through the ages with the most recent technology.

Sustainability is not a formula, according to Ahmedabad-based architect Yatin Pandya (2019). He believes that before coming up with a solution, architects, like doctors, must comprehend the patient's symptoms and circumstances. Pandya's business employs precise alignment and overhanging roofs and walls to shade buildings from the sun in Ahmedabad, a dry, northern city. Homes constructed in the traditional style only needed 20 KW/m² to 40 KW/m² of energy for cooling, according to Ahmedabad-based architect Yatin Pandya (2018), but the majority of commercial structures needed at least 15 times that amount. In order to help people sleep at night, air conditioning units are switched on. However, this causes them to leak extra heat into the streets, perhaps raising the local temperature by 2⁰ F. Additionally, he said that throughout the day, buildings' glassy façade reflect sunlight straight onto the streets. He believed that contemporary architectural trends were leading to issues everywhere.

Vernacular architecture is viewed as potentially making a comeback as there is a current trend to revive more regionally distinctive architectural styles and combine them with the use of contemporary technology. Only in the past ten years have thousands of architects on Tamil Nadu's east coast pushed for the usage of clay walls and roofing. The capacity to use the material to build larger and more complex structures is made possible by the availability of more stable compacted blocks. Chitra Vishwanath, an architect from Bangalore, believes that the sector is turning around. Vishwanath has employed earthen materials to construct hundreds of structures, including her own house. She believes that institutions are now educating students on how to plan and construct in

accordance with local climates. She continues by saying that today's younger architects are more concerned with climate adaptation. Vishwanath predicts that fewer structures in the West will be constructed during the next 5 to 10 years. She claims that the energy needed to cool buildings would be drastically reduced if climate-sensitive design were more widely used. In 2018, just 8% of Indians have air conditioning in their houses; by 2038, that percentage is predicted to reach 40%. In the absence of the development and adoption of cleaner cooling technology, India's greenhouse gas emissions would be severely impacted.

Emissions in India's large construction sector will also be decreased through increased use of conventional materials. Vernacular design occasionally uses more locally obtained, natural elements like earth or lumber in place of concrete and steel, which are manufactured through carbon-intensive industrial processes and delivered from thousands of kilometres away.

According to Indian Institute for Human Settlements (IIHS) director Aromar Revi, even the tiny construction crews in India that built the majority of the country's homes were moving away from traditional design. These teams almost never work under a qualified architect or designer, instead drawing their ideas from what they observe. International design frequently serves as inspiration for these building teams, especially in urban areas. In response, the Indian government declared in February that it will update the rules for urban planning and teach planners to create cities more effectively. Aromar Revi said that reforms must affect all facets of urban planning because progress has been gradual. He noted that the nation was only in its edge of cycle change.

Marques Bruno (2013), explained about the goal of sustainability in architecture is to employ various tactics that will lower the energy consumption of structures and the accompanying pollutants. The management of building materials is perhaps the most important problem relating to sustainability in construction. Management of building materials should therefore not be limited to the construction process alone in order to ensure its efficacy. The entire manufacturing process for the material must be fully understood.

The term "sustainable architecture" is defined by M. Sirija (2013), who also discusses the necessity for, features of, and benefits of sustainable architecture in general. It highlights the significance of sustainable design for environmentally friendly growth.

3. India's Climatic Condition In 2022

India saw its warmest March in 2022. From March through May of this year, various regions in North, Central, and East India saw an early assault of heat waves due to this. From March 11 through May 18, 2022, the nation registered 280 heat wave days, the most in 12 years. The Centre for Science and Environment (CSE), a non-profit organisation with headquarters in Delhi, published its yearly publication via Down To Earth magazine after analysing information made available by the India Meteorological Department (IMD).

According to IMD, a heat wave occurs when the temperature rises beyond 40 degrees Celsius in the plains, 37 degrees Celsius in the coastal regions, and 30 degrees Celsius in the hills. When a region has temperatures that are 4.5–6.4°C above average, a heat wave is proclaimed. According to IMD, a heat wave is considered to be present when temperatures exceed 6.4°C above average.

In this year, there were 54 percent of heat waves in five states. According to SoE data from 2022, they were Rajasthan, Madhya Pradesh, Himachal Pradesh, Gujarat, and Haryana. The Himalayan states of Himachal Pradesh, Uttarakhand, and Jammu & Kashmir have all had exceptionally mild weather this year. Rajasthan had 39 heat wave days, Madhya Pradesh had 38, and HP had 27.

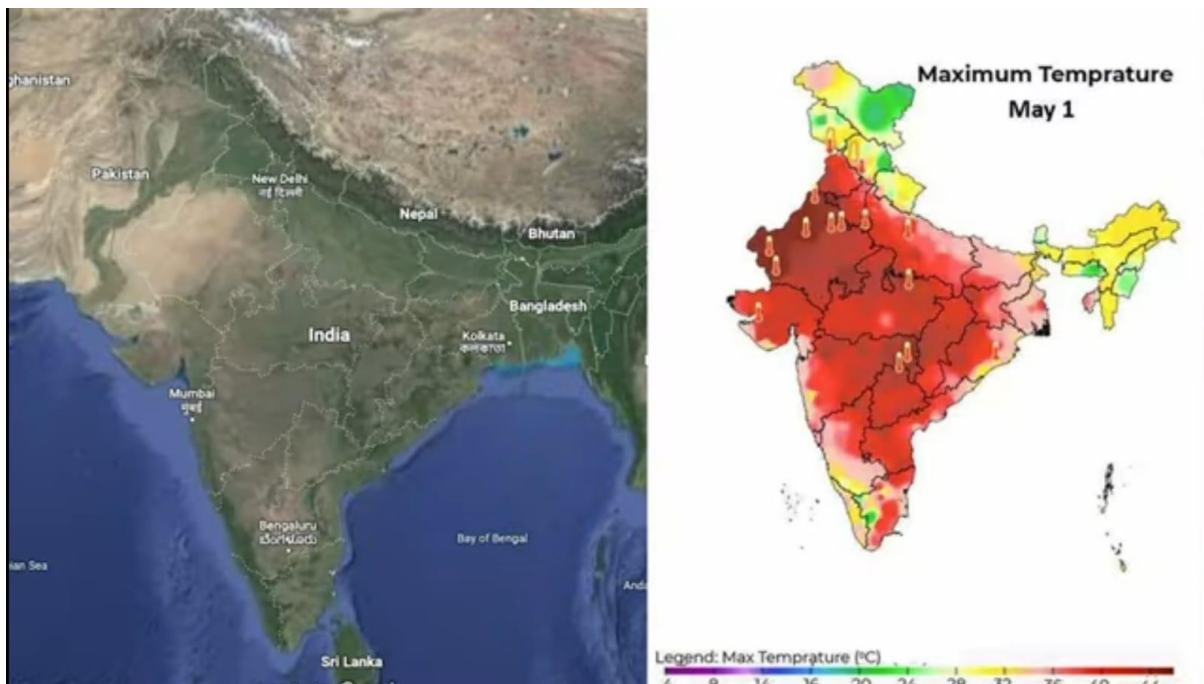


Figure 3- India's Map Vs India Suffering Heat Wave In 2022

4. Heat Wave

A heatwave occurs when a system of high atmospheric pressure moves through an area and lasts for at least two days. In such a high-pressure situation, air from higher elevations of our atmosphere is dragged toward the ground, where it is compressed and heated. According to WWAN, heat-related mortality are frequently underreported globally for a variety of reasons, which is why heatwaves are known as the "silent tragedy." According to IMD's analysis, April was the third-warmest April the nation has seen in the previous 122 years (1901 to 2022) and the hottest month for northwest and central India. Our recommendations for further empirical study centre on the influence of the scientific heat wave discourse on social networks and the funding of fundamental heat wave research on issues that are the subject of political pressure.

Common Factors affecting heat wave worldwide are Deforestation, Industrial pollution, Vehicle pollution, Food habits and over all these problems, one major issue is Modern Architecture. Concrete is used in modern building, which absorbs heat on the north side. When ACs are used to remove heat from homes, heat is also released outside, which raises the temperature of the surrounding area and perpetuates the cycle.

In traditional houses, 30–40 kwh of energy is needed to cool a 1 km² space. The energy needs of contemporary homes are 15 times more than those of traditional homes, which is why the city's temperature is 2 degrees higher than the ambient temperature. In addition, the production, processing, and transportation of building materials results in significant CO₂ emissions, which contribute to global warming.

5. Traditional/Sustainable Architecture in Different States

In early years, our vernacular architecture was used to differ city wise as it is done according to local climatic condition. As one type of architecture could not justify the diversified country like India. Traditional architecture has changed over the years in response to the local climate, geography, culture, and environment. It uses locally accessible natural materials and traditional building methods. As a result, it is environmentally friendly, economical, and very attractive.

Following Are Some of The Basic Components of Traditional Architecture-

5.1 Local and natural materials- Traditional design makes use of locally sourced natural materials since they are more easily accessible, more reasonably priced, and more suited to the local climate. Additionally, they have a relatively small carbon footprint because of its cheap transportation. These materials blend very nicely with the area's natural surroundings as well. Depending on what was readily available in a given area, stone, bricks, mud, wood, lime, and thatch were the most often utilised materials.

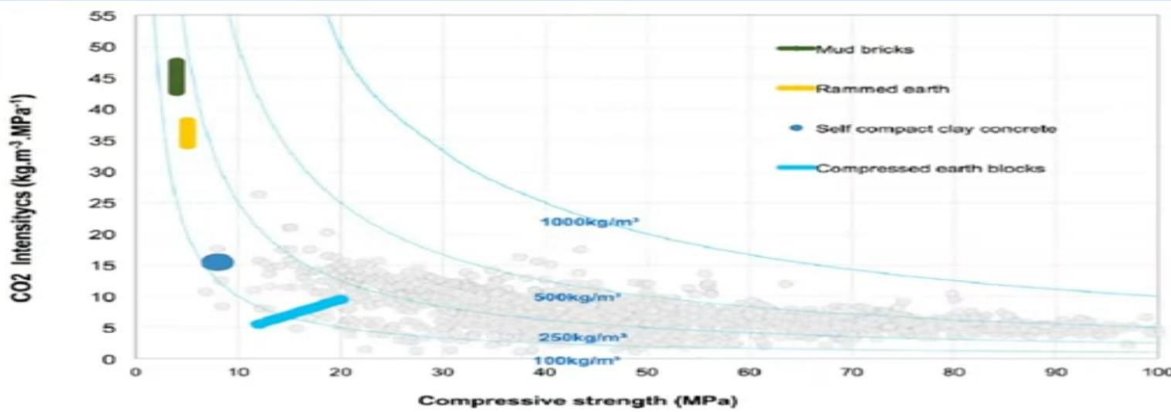


Figure 4- Less Carbon Footprint of different materials which are locally used

5.2 Courtyard- Many residences had access to the different rooms from the verandas and hallways that lined the courtyard. The rain was deflected by them and shade was created. Multiple courtyards were present in some houses. In order to keep the rooms thermally comfortable and ventilated naturally, the courtyard was crucial. The house was shielded from temperature extremes by it acting as a convective thermostat. The effects of dust storms on the house were minimal. By bringing nature indoors, it also assisted in fostering a comfortable atmosphere.



Figure 5,6 – Traditional Jallies In Vernacular Based Architecture In Houses

5.3 Jaalies- Jaalies, or lattice screens, have been extensively employed in ancient Indian architecture for ventilation, diffused light, shade, and seclusion due to the country's hot environment. These screens let the pleasant wind in while keeping the dust and harsh sun out. With light and shadow, they create intriguing patterns. The Hawa Mahal in Jaipur was constructed so that the royal family's female members could observe street activity, particularly ceremonial processions, in total seclusion and luxury.

5.4 Veranda- It is a building that is attached to a home that is partially enclosed and covered. Traditional houses typically had a veranda where guests may be greeted. These offer protection from the sun's rays and block off rain. The veranda serves as a transitional zone between the inside of the

house and the outside world, bridging the gap between man-made structures and natural surroundings. The verandas on the sides of a typical Keralan residence, which are often referred to as chutes verandas, are in addition to the front poomukham veranda. These shield the home from the sweltering summer sun and torrential monsoon rains. For numerous family activities and social contact, verandas close to the courtyards provided a pleasant, shaded area. A set of elegantly carved wood or stone columns served as the foundation for the verandas' roof.



Figure 7,8- Showing Veranda, Courtyard, Chajjas, Corridors, Arches in Traditional Architecture

5.5 Chhajjas- Chhajjas are protrusions placed above window and door openings to shield them from the sun and rain. These might be level or sloping, or they could create a barrier around the doorway like a Jharokha in Rajasthani architecture. The Chhajjas on the apertures create shade, which lowers the amount of heat that enters the home's interior. Sloping overhangs have traditionally been used in tropical climates to block out the intense monsoon rain. Similar to that, sloped Chhajjas are utilised in snowy regions.

5.6 Arches- Even though arches are lovely design elements, modern dwellings rarely incorporate them. Due to its gentle curves, which are a pleasant departure from straight lines and perfect angles, arches have a wonderful appeal. Due to its shape, arches also have the benefit of being structurally stable. As a result, arches can be built without the lintel that is often required to cover door and window openings. The quantity of concrete needed in the lintels can be reduced by making them out of stone or brick. In hallways and on verandas, arches appear quite attractive.

5.7 Sloping roofs- In places that receive a lot of rain and snow, sloping roofs have long been used. However, these sloping roofs are now being swiftly replaced in our towns and villages by the widespread flat concrete slabs. Sloping roofs were constructed in the Southern states to channel the torrential monsoon rain.

5.8 Built-in furniture- In traditional Indian architecture, some furniture was made as the home was being built. The front veranda of Keralan homes used to have built-in seats called charupaddi. The members of the family utilised it to amuse visitors. South Indian households also have a few wooden swings on their verandas.

6. Suggestions for Sustainable Construction-

1. Efficient Use of Energy & Water - This refers to the use of low-consumption toilet fixtures, sustainable urban drainage systems, rainwater harvesting, greywater recycling, solar photovoltaic (PV) panels, and gas-powered trigeneration plants.
2. Management of Waste - Recycling of wood, concrete, bricks, tiles, and steel prefabrication or POD structures is one way to accomplish sustainability throughout construction operations and deconstruction.

3. Use of Recycled Materials - The use of products that reduce waste, such as dental and logic wall systems that reuse concrete, recycle backfill material, recycle hardwood timber, and recycle plastics like plastic lumber that contains fly ash or CND wood.
4. Planning and design in economical Manner- The process of planning and designing in order to maximise natural light, passive ventilation, and the use of long-lasting, renewable materials.
5. Vastu Shashtra- Vastu is an ancient discipline of design and construction that assists in creating a home or place of business in the most scientific manner possible while maintaining the finest possible balance between nature and human existence.

Conclusion

We have been obediently adopting fashion trends that are swanky and appealing to the nation's populace. As a fraternity, we all agree that being fancy means pointing toward traditional aspects that can be simply reinterpreted and incorporated into freshly constructed structures. The comprehension of the requirements of climate, terrain, and culture has surely improved through the centuries, but it has not yet attained the status that is due to it. Although it is discussed, it isn't being put into effect on a broader scale. A revolution in architecture would occur with the advent of the age of locally sourced materials and traditional building methods. Even the "homes" will have their moment when they can breathe. It is very important for the upcoming generation to understand the traditional knowledge and use it as mix or fusion culture which could led the surrounding sustainable.

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