

INDIAN VERNACULAR PLANNING

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ABSTRACT

This paper is a concise discussion on the classical Indian Architecture. The history of architecture in India is defined by the strong and deep rooted history, traditions, religion and culture. India, over the years has seen riches beyond imagination as well as destruction like no other country. India is the only country to have such a varied picture of annexations by such a diverse list of dynasties ruling and assimilating their cultures with the traditions of India. A mixture of cultures, dynasties and kingdoms defined the architecture of India. The western influence of the British raj further contributed to the diversity of the Classical Architectural style. Moulded and nurtured by time, Indian Architecture has evolved into the vast style of architecture it is today.

What has redefined Indian Architecture in modern times is the use of Indigenous materials and construction techniques.

KEYWORDS

Vernacular Planning, Indian Architecture, Vernacular, Indigenous materials, Vastu Shastra, Building factors

1.INTRODUCTION

At the spin of the 21st century, the style of Indian Architecture took a sharp turn towards a new contemporary mode with the century. The nation saw a drastic change in the modern built environment. The foremost element of our ancient history of architecture that characterizes our traditional Indian architecture and planning is the use of Vernacular material and construction techniques and planning strategies.

Vernacular architecture is the style of architecture which takes into account all the needs and requirements of the residents, nature, construction materials and also mirrors the traditions and culture. It develops over time to resonate the culture, traditions, history, environment, resident's desires and needs and economy of the locality. Though diverse from the popular outlook towards the built environment, use of indigenous materials, designing and construction techniques plays a pivotal role in design and architecture of the society.

The term vernacular as we know is derived from the Latin vernaculus, meaning "domestic, native, and indigenous"; from Verna, meaning "native slave" or "home-born slave". When expressing in terms of language, vernacular refers to a time, place or group [1]. In terms of architecture, it refers to the style which is indigenous to a specific place or time. It is most commonly applied to residential buildings in particular [1-3].

Structures designed by professional architects are not considered as vernacular architecture. The main concept of vernacular architecture is architecture that is not intentionally or knowingly planned. It is designed specifically for the local environment, using local environment. Architect Paul Oliver stated that vernacular architecture is "the architecture of the people, and by the people, but not for the people" [4]. Frank Lloyd Wright depicted vernacular architecture as "Folk

building growing in response to actual needs, fitted into environment by people who knew no better than to fit them with native feeling" suggesting that it is a primitive form of design, having no intelligence, but he also stated that it was "for us better worth study than all the highly self-conscious academic attempts at the beautiful throughout Europe"[5].

There are many young architects who are specially learning about vernacular architects. Since the appearance of the term in the 1970s, the use of vernacular principles has played a rising part in architectural designs. Though individual architects have a widely diverse school of thoughts on vernacular architecture. In India B.V.Dhoshi, Laurie Baker and Charles Correa are the pioneers of integrating Vernacular Architecture in Contemporary architecture.

2. INDIAN VERNACULAR PLANNING

Indian vernacular planning involves planning and designing a built environment with the informal, functional design of structures. It is mostly found in rural areas of India, with structures built using local materials and designed and planned to meet up with all the needs and requirements of the local residents. The structures built are not just made by using vernacular materials but even the planning is done keeping in mind the necessities of native society and culture. The builders and planners of these structures are untrained in formal architectural design. This is reflected in their work which reflects the rich diversity of India's climate, the local building materials, and the elaborate variations in the social customs and craftsmanship.

The rich vernacular tradition of India starts from the natural settings of the site, and responds to metaphysical concerns, climate, local skills, construction materials and appropriate technology.

3. INDIAN CLIMATES

The climates in India are divided in 5 climatic zones.

3.1 Hot & Dry climate

This zone lies in western and central India, namely Jaisalmer, Jodhpur etc. This region is flat, sandy, and rocky and sparsely vegetated with cacti thorny bushes. Due to low humidity the climate is dry. During summers, winds blowing are very hot and sand storms are also common. Due to low water level and meagre vegetation, the houses are commonly made using twigs, mud, clay and stone.

3.2 Warm & humid climate

The warm and humid region covers the coastal region of India. Cities like Mumbai, Chennai, and Kolkata all lay in this region. The high humidity encourages abundant vegetation. The main criterion of designing in this region is to reduce heat gain and provide shading.

3.3 Composite climate

The composite zone envelopes the entire central part of India. Allahabad, Kanpur and New Delhi are some of the cities that experience this type of climate.

3.4 Moderate climate

The moderate climate region experiences mild to warm summer and cool winters. The need for home heating in winters is greater than summer cooling. Few openings on external side other than doors are a must. Most of the time cooking and sleeping in rural India is done outdoors during the summers. The mountains of Great Diving range keep the winters cold and summers pleasantly warm.

3.5 Cold climate

The cold climate is characterized as 2 classes: cold and sunny and cold and cloudy. Ladakh experiences cold and sunny type of climate. This region enjoys very little vegetation and is considered as a cold desert. The structures are innovative in design uses materials like stone, mud and clay. The houses are very close to each other. Cities like Kashmir, Sikkim, Shimla and upper part of Assam hill station from south India all experience cold and cloudy climate. This kind of climate requires buildings to be heated throughout the year. Thin mud and bamboo are used for walls on the upper floor and brick or bamboo for upper floors. Roof is made using stone slabs or country tiles. The roofs hang from all sides, providing protection of core spaces from all sides.

4. PRINCIPAL ASPECTS

There are several aspects of planning and building structures according to the classic vernacular architecture. Out of all the significant other principals there are five aspects which are the primary elements or principle aspects of vernacular architecture and planning that are considered while planning a vernacular structure. The following briefly explain the aspects.

- **VAASTU SHASTRA-** is the science of construction and architecture that is found in Indian subcontinent, these survive as manuals on design, layout, measurements, ground preparation, space arrangement and spatial geometry. It incorporates traditional Hindu and Buddhist beliefs. The designs are based on integrating architecture with nature and ancient Indian beliefs utilizing perfect geometric patterns (yantra), symmetry and directional alignments [6].
- **VAASTU PURUSHA MANDALA-** is a part of Vaastu Shastra and constitutes of mathematical design. It is the metaphysical plan of a building that incorporates the supernatural forces. Mandala is the specific name given to a plan which symbolically represents the cosmos [6].



Figure 1: Vaastu Purusha Mandala

- **MANDALAS** - all functions are assigned special spaces. For example: Northeast for the home shrine, southeast for the kitchen, master bedrooms in southwest and the cowshed in the northwest and grain storage. All other spaces are use for multi purposes [6].
- **MANDALAS FOR CITY PLANNING** – the technique of mandala was also used for city planning. The first of its kind was Jaipur, designed in 1700s. It covered the natural features as well as other functional aspects like military needs, pre- existing infrastructure and modified the grid according to the topography [6].

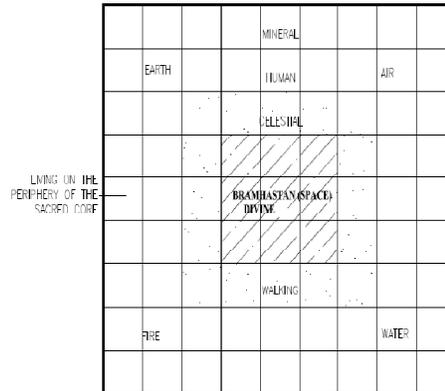


Figure 2: Grid planning according to Mandala

5.INFLUENCING FACTORS

5.1 Building plan

Building layout is an essential factor that influences and drives the planning of vernacular structures. The archetypal shape of a building plan is correlated to many cultural, historical, and urban planning traditions. Three main types of shapes that has been identified for plans in traditional buildings:

- Circular plan is most preferred in case of earthquake resistance, for example the Bhonga Houses
- Rectangular plan
- Linear plan

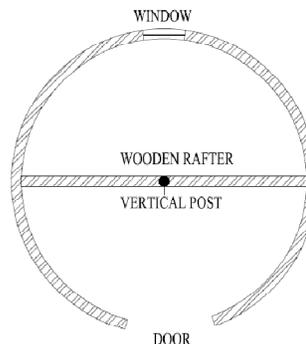


Figure 3: A typical circular plan for vernacular Bhonga house

5.2 Building Sizes

The second facet of Indian vernacular architecture is the size of the Building. The size of the building is ruled by its particular use. Based on the size of a building, they can be classified as:

- Single story
- Multi-story buildings

The mixed-use buildings necessitate construction of an additional floor, which calls for increased wall load-bearing capacity, especially if these walls also need to withstand earthquake effects. It should be noted that the building size is also related to the population pattern and housing density in a given area [7].

5.3 Indigenous Materials

The third aspect influencing the development of vernacular construction practices is the availability of local building materials. In many areas, the local resources have governed the use of the following constituent materials for walls:

- Adobe (mud blocks or whole walls)
- Masonry (stone, clay, or concrete blocks)
- Timber

6. MATERIALS

Vernacular Architecture is all about using locally available materials for construction. The most common materials to be used are:

- Timber – is one of the most frequently available and natural yet native building materials. Of the various advantages, it is non-toxic, does not leak chemical vapour into the building and is safe to handle and touch. It is quite easy to work with, renewable, a very good insulator and readily available.
- Adobe - is a natural building construction material that is made from clay, sand, water, and a kind of fibrous or organic material (sticks, straw or manure), usually shaped into bricks using moulds and dried in the sun.
- Stone- Stone is another one of the major building materials that is indigenous for Indian architecture. It is a versatile material and it can be used from the foundation to the parapet in a building.
- Clay- Clay is used for buildings sustainable, traditional buildings. These buildings are of 2 types: one when the walls are made directly with the mud mixture and the other being walls built by stacking air-dried building blocks called mud bricks.
- Rammed earth – type of building construction which utilises natural raw materials such as earth, chalk, lime or gravel. Rammed-earth walls are simple to construct. They are non-combustible, thermally massive, durable and very strong.
- Fly-ash-Sand-lime-Gypsum Bricks – used for residential housing walls and all other types of building construction as well as boundary walls. They are environment friendly, excellent strength, dry quickly, and have reduced water absorption and shrinkage.
- Compressed Earth Blocks - energy efficient, eco-friendly with excellent surface finish. It is a cost effective material with good thermal insulation.
- Clay Fly-ash Burnt bricks – environment friendly, energy efficient and locally manufactured material.

- Micro concrete Roofing Tiles - MCR tiles are a cost-effective and extremely versatile roofing material. MCR tiles can be used to make attractive roofs on villa houses, farm houses, pavilions and gazebos and also used in highway constructions. In regions with heavy rainfall, these tiles are used at length for cladding material as it offers both waterproofing and aesthetic appeal. It has been used expansively in cost effective housing schemes, poultry farms, restaurants and workplaces.

7. CONSTRUCTION MATERIALS

7.1 Timber Construction

The advantages in case of timber construction grow from the use of timber, a lightweight and ductile building material. A significant issue in case of timber construction is associated with the connections (column-beam, floor-beam and panel-beam) and their aptitude to transfer the forces from one building member to another and then finally all the way down to the foundation. It is well known that the wood is quite susceptible to the effects of humidity and insects. The use of timber construction is restricted by the local availability of suitable wood materials [7].

7.2 Earth Construction

India is one of the oldest countries which have very old earth buildings: for example the Shey palace in Ladakh. It was built in the 17th century and also the Tabo monastery in Spiti Valley – Himachal Pradesh which was built with adobe blocks in 996 AD and which has withstood 1010 Himalayan winters.[8] Earthen housing units utilize mud walls or adobe block walls.. Adobe construction offers very restricted seismic resistance. However, there are a few strategies for better earthquake resistance of these structures. Timber reinforcement can be added to increase ductility and lock the connections. Such reinforcement must be adequately protected against humidity and insects in order to ensure long-term structural integrity.

7.3 Brick masonry and stone construction

The most prevalent vernacular construction technique involves the use of masonry walls as the load-bearing structures. The simplest technique of construction is the use of sun-baked blocks, generally classified as adobe. The use of burnt clay bricks is very common where wood or coal fuel is available [7]. Clay brick is an old, traditional building material used in many parts of the world for centuries. Stone is a material that is locally available in many regions. For many centuries, unshaped stone blocks mainly in the form of un-coursed (random) stone-rubble construction have been used for house that has been collected in the field. In some cases, hand tools have been used to shape the stones. Such construction is called “dressed-stone masonry” [7].

8. STRATEGIES FOR EARTH QUAKE RESISTANT STRUCTURES

The vernacular structures due to their materials and planning are often earthquake resistant. The modern Indian built environment has undergone a lot of challenges and changes since globalization. However, it is of utmost importance to recognize and identify the main features that will enhance seismic performance of traditional buildings. There are some very general strategies for seismic feat of vernacular planning.

8.1 Construction with ductile materials

- Walls have ductile reinforcements (wood or steel) to avoid out-of plane collapse

- To prevent decay of wooden materials a lot of maintenance is required
- Selected materials to be used (brick-mortar-wood) [7]
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8.2 Construction with robust architectural forms

- Floor plan should be regular (shape-distribution of walls)
- Should have uniform openings (small and well-spaced)[7]

8.3 Construction with resilient structural configuration

- Connections should be efficient (wall-wall, floor-wall, wall-foundation, etc.)
- Accurately built wall textures that provide bracing and shear resistance
- Continuous foundation that avoids settlement and cracking from below
- Good workmanship is a must (manufacturers, builders)[7]

8.4 Construction that reduces seismic forces

- Rood should be light in weight.
- Houses should be low-rise (one- or two-stories high)[7]

9.ORIGINAL VERNACULAR HOUSE CATEGORIES

9.1 Kachcha

It is a type of building that is made up of natural materials like mud, grass, bamboo, thatch and sticks. It does not provide much strength or durability and requires continuous and heavy maintenance. The realistic constraints of the building materials that are available dictate the specific form which can have a simple beauty. The construction materials are all cheap and very easily available. Construction of such a house requires relatively very little labour.

9.2 Pakka

A pakka structure is made of resistant materials such as stone, timber, brick, clay, metals and sometimes mortar is used to bind the structure. It is more durable and does not require constant maintenance. These structures are more expensive because of all the labour and materials that go into it.

9.1 Semi-Pakka

The semi-pakka is a combination of the kachcha and pakka styles. It has grown as the knowledge of villagers has evolved and has acquired the resources required to add elements durable materials characteristic of a pakka house.

10. INDIAN VERNACULAR CITIES

10.1 Jaipur

The city of kings, Jaipur in state of Rajasthan is planned according to the Grid Mandala system in 1700s. The city has a stepwise progression. The planning of the city was done around a central axis. The city progressed as:

- Between the existing entries of east and west gates, a central axis was laid out.
- 2 vertical roads crossed the axis dividing the city into 9 squares, which was further subdivided to form a hierarchy of road networks.
- The northwest square extended forward and touched the ranges which had formed parts of the natural defence and hence was dropped.
- Instead a square was extended towards the south east direction [10]

10.2 Gujarat cities

The cities of Gujarat have houses which are tightly packed and respond well to climate in the hot dry climate. These houses have common walls (like row houses); they are generally ground plus two/three structures approached by narrow streets. This ensures shade and coolness on the streets as well as minimum exposure to the hot and dry climate. The courtyard is a climatic device that gets in light and ventilation as the building depth gets too deep [11].

10.3 Auroville

The Auroville Earth Institute was created in 1989, and started a new era in earth and indigenous architecture. The value of earth and other indigenous materials as building materials has been accepted for its economic worth, as well as for its comfort and quality, which endorses vernacular development [12].

Maximum of the projects in Auroville are designed and built with compressed stabilised earth blocks (CSEB), as this technology has a lot of benefits. Stabilised rammed earth has started gaining prominence and a few projects have already implemented this technique [12].

11 INDIAN VERNACULAR HOUSES

11.1 Warli house

It is a traditional house of Maharashtra. It is created using local materials like is mud plastered on a framework of branches for “karvi” walls. It is a climate responsive structure. It loses heat quite quickly and allows air to move in hot and humid climate because of light external envelope. The seamless mingling between the use of local materials and skills picked by the residents in building is evident and is the reason for maintaining their own homes in such a good manner. Locally available materials are manipulated to go with their lifestyle and climate without impacting the surroundings much [13].

11.2 Bhonga

It is a traditional house of Rajasthan. It is built so strong it can even withstand earthquakes. These structures have a circular form which ensures minimum exposure to the extreme hot and dry

desert climate. They are all planned around atriums or open courtyards forming little clusters. Smaller openings control entry of light, heat and winds. The structure is built using materials like mud for the walls and thatch for the roof. The interiors are aesthetically decorated with local mirror t work patterns [11].

11.3 Padmanabhapuram palace

This is the superlative instance of vernacular architecture in Kerala. It delegates the native architectural style in Kerala in its more lavish avatar. It is well suited to the climate with multiple courtyards to allow air movement across the complex. It is planned and constructed to be durable as well as with no maintenance. The flooring was done using a fusion of different types of materials such as burnt coconut shells, egg whites, plant juices etc. The glare has been reduced through painstaking fenestration detailing [14].

11.4 Laterite structures

These structures are found in Goa. These structures are plastered with lime or a mix of lime and earth. Sometimes they are even left un-plastered with huge sloping roof overhangs. These sloping roofs battle the rain and the strong sun. When such a house gets rundown it actually crumbles down to earth and brings the building materials back to their organic and natural state, thus completing the loop. The most common type of wood used is the local jackfruit wood. Example is the Chapel of St Catherine, Goa originally from the time period of 16 century, but rebuilt again in 1952 [15].

11.5 Sri Aurobindo ashram Dormitory

It was the first of its kind to have cast in situ poured concrete building in India. It was built by the local residents using local materials. It has a protective skin of manually operable louvers. The roof system comprises concrete tiles with an insulating cavity between the concrete deck and the semi circular tiles. It has sliding doors of woven teak-wood that permit the passing of breeze without compromising visual privacy. It has a system of pools and gardens that also cool the air [16].

11.6 Torrent laboratories

This building is located in Ahmedabad. It is designed and built on the contemporary Vernacular principles. It uses a technology called Pdec-passive down draft evaporative cooling. It is located in the hot dry zones. The fine spray of water at the entry point of the inlet towers cools the air entering in. The outlet towers are located on both sides of the external walls at regular intervals. This arrangement helps to cool down the internal spaces using minimal amount of mechanical aids like fans and pumps. This reduces the internal temperature and hence the energy demands for space cooling [11].

12 VERNACULAR ELEMENTS

12.1 Water

Water is a very scant resource; so there is a strong need to utilize this resource as cautiously as possible. For this reason there are two major strategies employed:

- Water harvesting

- Recycling.

It is evident in the rock cut architecture built decades ago too. These structures took these issues into consideration. This is evident in the architecture of Kanheri caves in Mumbai. These caves show the presence of channels cut across the external face of the structure. These channels are used to carry down water into storage tanks underground. One of the most recent and relevant examples is the underground tanks ("Tanka") found in most of the traditional Gujarati houses. These tanks have a cover and it can supply clean potable water for any mid-sized family for almost a year. It is a major advantage in a typical hot and dry zone. Water to be used is first collected through a pipe made of copper. It is stored in the stone or lime tank (about 15 by 15 ft and 25 ft deep.) Recycling of used water was a practice from the past way back in which places facing water scarcity would use previously used water like the water used for cooking and washing vegetables etc. would then be used for washing the courtyard, clean the toilets and so on [17].

12.2 Light & Ventilation

Most of the traditional and modern buildings built as vernacular buildings are well lit and well ventilated/climate responsive to reduce the use of artificial lighting and air condition systems. There was a strong use of microclimatic management of making use of water bodies in forms of canals, pools or fountains etc in open spaces like the courtyards. This helped to modify the unfavourable climatic impacts of hot and dry climate. The thick walls were used to introduce time lags in the fluctuating diurnal cycle [18].

12.2.1 Light

It is one of the most important aspects of architecture both in terms of quantity as well as in terms of its qualitative aspects like glare. Most of our buildings had grills and fenestration/façade work done to control and manipulate light by means of strategies like Jalis or double windows with wooden Louvers etc. Many religious buildings such as mosques or masjids and temples also used similar strategies to control light and air movement [18].

12.2.2 Ventilation

Wind scoops used to allow the entry of cool breeze in the hot desert zones. Micro climatic modifications included the beginning of the system of dripping cool water. This was made possible by the installation of a pot at the top of the scoop.

Lavish and prolific buildings like palaces and forts made inventive use of water to cool the edifice envelope. The walls used to have water pipes entrenched inside the walls covered to cool down the masonry walls; the water was cooled in a natural manner. This was done by making it run over surfaces and exposing it to the atmosphere ex. Hawa Mahal, Jaipur [18].

12.3 Structure Longevity

The choice we make regarding the materials used, decides the life cycle of the building. The buildings which are built of low cost materials give higher returns as the operating charges are low. Materials that are seemingly high cost and more energy and resource intensive in their manufacturing etc can be used to generate more benefits over their entire lifestyle as well as disposal and recycling potentials. This is the lifecycle approach where the project is looked at from the point of view of its entire life from inception, construction phase, operations all the way unto disposal [18].

12.4 Technology

The technology used are devices like jalis, (trellises) fountains, water to cool building fabrics etc can add more sustainable measures at a micro scale. Technology could be both; high on energy (and then optimized) or even passive justified by the demands of the context [18].

13 ISSUES IN MODERN TIME

13.1 Population

The population in our country has grown at a phenomenal rate. That has placed great strain on the non renewable resources. The ecological footprint has increased tremendously. It is putting the built environment under great pressure.

13.2 Consumption

The consumption of the people has increased by a 100 folds. The aspirations of human beings know no bounds. People seek for a lifestyle like the developed world. Energy required to run the equipments of the modern man's need are extremely high and in on a constant rise.

13.3 Urbanization

Urbanization is the relocation of people from rural to urban areas, and the ways in which society adapts to the change. It is the next biggest thing today and the trend denotes more urbanization in the days to come.

13.3 Contemporary Materials

There are so many newer and modern construction materials and technologies that are continuously being invented and improvised. These are marketed very well and have proved to be a strong challenge to the vernacular architecture in India.

14 CONCLUSION

With the world evolving, everybody and everything is changing, it is important to keep up with the tides of time. However, keeping up with the modern time does not mean forgetting our past and traditions. Traditional Architecture using the indigenous, vernacular materials and construction techniques not only keeps our traditions alive but also contributes to the economy and environment. Vernacular architecture is also sustainable architecture because it uses natural, easily available materials. Using local materials is also economical as these materials are locally available, hence no transportation cost. From purely aesthetical point of view, Indian vernacular architecture is the world's one of the most beautiful styles of architecture. It is shaped by a vast variety of elements from history and our rich vibrant culture. It is important to adopt the vernacular style of architecture for future as it will not only glorify India's rich culture and traditions but also contribute to the environment around us.

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