

Role of Vernacular Architecture of India in Green Building Design – A Case Study of Pauni

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Abstract

Sustainability in Indian settlements is static and is based on the living practices. India has got diversified climatic, topological and vast socio conditions due to which each region has its own unique identity with climate base responsive building designs and its knowledge in the form of vernacular architecture. This traditional wisdom of building human habitats is known to be tested by time for its sustainability in various settlements. This paper talks about one such 14th century settlement located in Pauni, achieving sustainability through planning, orientation, materials and architectural practices evolved from long time due to socio, economic and environmental factors. Factors results in two levels i.e. macro and micro level. Macro level broadly focuses on planning & architecture aspects .Micro level describes art, architectural details and socio practice affecting built habitat. Trained designers of modern era have mostly ignored it .The study of local vernacular architecture and lessons about climate responsive planning, techniques can be helpful to generate an approach towards green building design

Index Terms: - Vernacular architecture, Green building, Sustainability

1. INTRODUCTION

If the roots are alive.....it gives rise to new shoots.....

Patrick Geddes

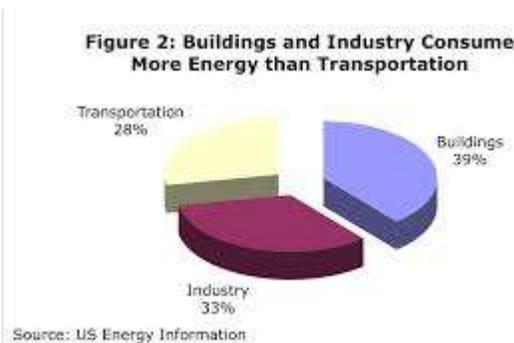
A wake up call for architects, builders, designers and for all of us came in 1990's when we realised that the building industry consumes nearly 50% major part of energy produced in the world. It was also contributing majorly to worlds green house gas emissions and became a threat towards sustainability.

impact on human health and environment by construction, operation and maintenance. It has become a marketing tool and most of the time is superficial practice approach based on westernised adoption .LEED a green rating system is fully based on western. TERI GRIHA and ECBC are being devised but not practices very seriously. It is well known that energy efficiency and sustainability are very well interwoven and well rooted in Indian traditional architecture and Indian culture. India is a country of diversified climatic, topological and socio Cultural conditions. Each region has its own identity with climate responsive building design in the form of vernacular architecture .Lot of experimentation and local knowledge base evolution has took place and being tested by time. Vernacular tradition recognised and encouraged, supported and serviced, complemented may prove to be the only realistic and sustainable solution for the future. (Paul, 2006).Today, the designers have ignored principles and importance of vernacular architecture. Vernacular architecture gives us the lessons about climate responsive planning techniques which can be helpful to generate green building design.

2. Vernacular Architecture

Vernacular architecture is a continuing dialogue between generations. Vernacular architecture is the source of references in the social cultural and sustainable studies. It refers to the architecture that makes use of common regional forms and materials at a particular place and time; sometimes includes ethnic influences of an important population; usually modest, unassuming, unpretentious, often a

materials , regional climatic conditions and local building



Sustainable development can be achieved by architects, engineers, town planners by working together to produce green buildings that are designed, built, renovated, operated or again used in ecological and resource efficient manner. Green building is the call of mother earth .Green building is an approach that emphasizes the place of buildings within both local ecosystems and in global environmental also. Green building increases energy efficiency while reducing building Mixture of traditional and modern style , familiarity with local

customs and techniques. The word vernacular came from Latin word 'vernaculus' means domestic, native, indigenous. (Vernacular architecture (2013).In a simple language, it is -

"Architecture without architects"

Vernacular architecture is tried and tested practices which have actually sustained the ravages of time and passed on through generations. Basis of vernacular is that it responds to many aspects like climate, places, culture, materials, and local skills. The traditional bank of wisdom is our legacy today and aims to see how it can be taken forward in today's climate change and building context.

3. Vidarbha Region- Pauni

Maharashtra has got different regions, due to this peculiar climates different zones tends to have a specific crop pattern which directly reflects a distinguished socio-economical-cultural and political conditions. Vidarbha lies on the northern part of Deccan plateau. Vidarbha is having many districts, under that Pauni is a city and a municipal council categorized in Bhandara district in the Indian state of Maharashtra. Pauni, during its settlement time followed pattern of river bank settlement of Wainganga River at 20.78°N 79.63°E. It connects the smaller villages to cities like Nagpur, Chandrapur, Gondia and also Bhandara and spread over an area of 621.25sq km .Pauni has its own history and also well known as –Vidarbhas Kashi also Buddhist city. In ancient time, its primary source to generate economy was handloom textile industry. Pauni- the name came in existence when king Pawan ruled this town for several years. Climatic data states that rains are mostly received during June to September from south-west monsoon. Annual rainfall is nearly upto 1298mm and it becomes scanty after mid-september and stops by the head of October. Pauni experiences sub-humid to humid conditions in monsoon season. Semi-arid in winter season and arid in summer season. It has got extreme hot summer .Hence, the prima requirements of buildings is to reduce heat gain in harsh summers and ventilations in monsoons Content here.

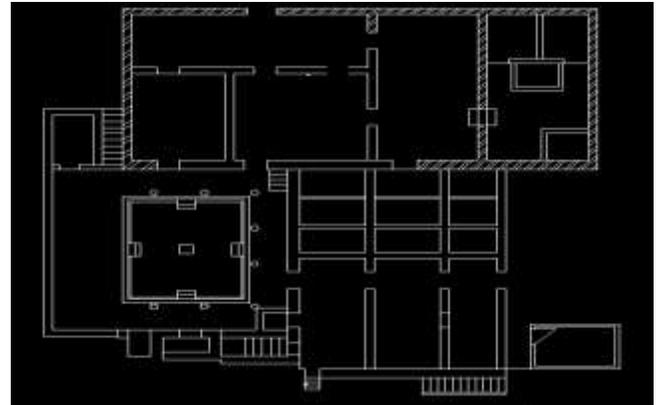
4. Vernacular Architecture of Pauni

The vernacular houses of local weavers , farmers and landlords in rural and urban areas built during last years. These houses of landlords military officials (subhedars) with limited area over hinterland are called as “wadas”. It is a typical housing typology focusing central courtyard with separate private and public zones. The courtyard addresses number of social privacy issues including the climate. The organization of spaces accommodates different levels of privacy with controlled accessibility and visibility. The grand entrances of wadas represents the symbol of ‘power’ and also the Garud stambha represents the mark of victory.

The analysis tries to find out some of vernacular principles for climate responsive built form design which can become the mark of green design approach for that region. This Wada belongs to Shri.B.Tulwarakar which was established nearly

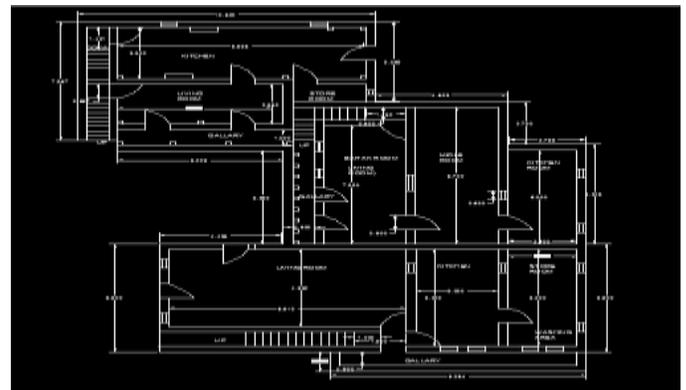
600years back when their forefathers were posted as subhedars devoted to the royal family and still existing with its full glory.

Planning of Wada -



Ground Floor Plan

Tulwarakar wada covers an area of about 1684sq.mts. This wada is having introvert planning .The enclosure is divided broadly in three different spaces built, semi open and open spaces .Built verses open space ratio stands as 1:2 and 1:3 . Entry is through narrow corridors with double door system which is locked inside the wall by a thick wooden block for security purpose. Beside these public courts are the secondary courtyards where cattle's and horses are kept. These courts also accommodate servant's quarters also. A semi open verandah i.e. sopa surrounds open courtyard i.e. prangana purely meant for Public spaces.



First Floor Plan

a) Orientation and spatial organization

Building form, plan layout and orientation contribute to the creation of climatically sensitive buildings. Orientation is based as longer axis in north-south .All the windows open in verandah to avoid heat gain due to exposure to direct

sunlight. In the centre of courtyard is placed vrindavan (tulsi plant). Devasthan is a small close place at the centre. Toilets are placed in North-West following prevailing wind direction so as to throw out odour. Swayampak is at extreme right of this side to carry away smoke. Private internal rooms are placed around the courtyard. As secondary economical activity was agriculture, so each and every house has its own grainery store. Every house has basement subways well known as "Talghar" or "bhooyar" in order to keep arms and ammunition



Entrance of Wada



Vrindavan in courtyard

b) Courtyard

Internal courtyards are generally square and rectilinear as well as sunken at about 3 feet deep. It act as a source of light and ventilation. A house consists of 2-3 courtyards maintaining the hierarchy in itself.



Central courtyard

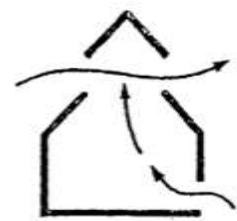
Public courtyards are bigger as to inner courtyards. These inner courtyards act as service courtyard also. Height verses width ratio follows wind flow pattern for courtyard standing as 1:1 to 1:2. Beside these courtyards, next is semi-open verandahs majorly useful in summer. Public courtyards due to their big size are never covered but the built form surrounded it provides shading on it. It should be noted that the size of the courtyard is essential to achieve an optimum level of both cooling and heating efficiency, which is important in hot summers and cold winters.

c) Openings

Windows covers area of about 9 to 12% of floor area facing internal courtyards and 0 to 6% area on the exterior walls. Windows have high sill level on exterior side. Small openings reduces heat gain and avoids dry hot winds in summer by compressing air at the entry level and suddenly expands after getting inside providing cooler air by the principle of venturi effect. This ultimately balances the thermal comfort and results in less use of energy. Some of the windows serve dual purpose window as well as balcony, with opening from floor to lintel level. Upper portion without mullion bars to peep out and lower portion with mullion bars for kids with separate shutters.



Use of wind pressure on building



Use of venturi effect

Doors are small with wooden lintels and wooden blocks to be placed on the middle part of door to secure it properly. Door frame are also made out of wood which are richly carved by placing ventilators above it to admit light and ventilation.



Entrance door



window

Double roof system was adopted i.e. a attic place was created so as to hold up storage as well as providing primary thought for ventilation by the passage for hot air. Timber pitched roof with country tiles created an interesting skyline. Country tiles half round in some places and eaves board was extensively used with variety in their designs.



Roof Pattern

d) Materials and Technology

Footings are stone stepped footings protecting and taking load of superstructure made out of 1-2mt thk mud walls. The mud walls are strengthened with teak wood twin columns. Stone base is provided to wooden columns to protect them from moisture.



Drainage and footings



Roof Pattern

Floors at upper are timber floors with mud flooring and stone slab placed on it at the size of 1'1/2" x 1'1/2" which in results provides insulating effect.

Walls are made out of mud, thick bamboo mats and lime to make it strong .These are then finished with natural paints Walls were made thick of size approximately 0.6mts. With the addition of floors wall thickness decreases in stepped manner



Timber floor



Detail of walls

Entire wall was strengthened with the help of thick wooden columns placed in the ring of stone base. Column to column was further joined by the help of bamboo logs and bamboo mats were fixed in between these logs and covered up by mixture of mud and lime.

Plinth was made out of stone, these peculiar stone has got the property that it becomes more durable as the time passes and its capillary action maintains the temperature and keeps it cool with the best result for sustainable material. M.S.rings were inserted at the plinth level mainly to tie up horses. This material asks no maintenance, hence gives a thought of green design.

Drainage system follows the natural slope and also collects the water due to rain by the sump which was positioned at the end of the slope here. Judicious efficient use of water and adoption of various water harvesting techniques is another feature of green building design.



Geometric designs on door frame and on were found. Riveting done on shutters by brass giving rich look.



Stone Plinth

Vegetation generally defines a particular soil, but by placing tulsi in courts and surrounding helps to purify air and also satisfies religious activities. Neem trees and other trees are found in kitchen garden, this tree also helps for shading and improving oxygen here.

d) Ornamentation

It was found that each and every wada was highly ornamented which represents rich culture in the form of carved wooden columns, beams, door, door frames, brackets, etc. Soft babul, moha and sagwan were used for such building elements.



Detail of wooden eaves



Detail of wooden column



Column Details

Floral designs are carved on the wooden beams and on the columns, eaves, lintels, shelves etc.

Typical torana style was carved out below the beams, iron clamps were used to give strength to these elements.

Intricate wooden hanger (khunti) is common in all types of buildings. Wooden railings were very simple, beautiful and bold.



Carvings on Eaves and canopies

e) Plaster and Lime washing

Plaster is a final finish in the building procedure, in most of the traditional buildings plaster was applied to protect the wall and to reduce the temperature inside the building .It is made out of lime mixed with brick dust, sand and ashes. Limewashing or whitewash was part to enhance the decorating and protecting the plaster with the application of natural colour; and to let the building breathing and to keep the inner environment cool in summer and warm during winter season.

5) Findings

After the analysis, some of the findings been listed down here .Adapting to local conditions and local requirements (climate, topography, social aspects, environmental conditions) these

buildings offers a number of advantage.

Planning-

Natural thermal insulation achieved by orientation, shading elements, compactness, bright colours etc.

Energy efficiency-

Less energy due to good natural ventilation and natural lighting by open spaces, clear storey windows, cross ventilation.

Indoor environmental quality--

Walls with thickness of 80cm-100cm act as thermal masses.verandahs act as semi - open space permits natural ventilation.

Resources, Reused and recycled materials--

Vernacular architecture is a product of its environment .Use of natural material -lime, mud, adobe or stone, straw are relatively low energy content building materials with excellent efficiency while in use.

Techniques-

Most of the techniques are energy efficient, inexpensive, and easy to build.

CONCLUSIONS

In spite of extreme hot and dry climate, Pauni has its own unique methods of building comfortable dwellings. As social conditions have changed with the changing lifestyle, public and private zones have also changed drastically, but the climatic condition remains unchanged of a region. It becomes mandatory to understand the age old methods and also to use them in today's context. Simple climate responsive planning principles from vernacular architecture which are tried and tested practices can bring up major changes.

What dictates vernacular architecture is not necessarily what is built rather how it is built and it has withstood the test of time and also been carried through in buildings or in community. To the vernacular architecture, sustainability was necessity and it was 'a way of life ' not merely a concept.

In a nutshell, learning from folk-architects, we should go beyond the level of geometrical and other calculations, notions of form and symbols .we should focus on the harmonious relationship between man and land , issues of environmental protection . Vernacular elements can be well integrated in today's new buildings with the aim of improving energy efficiency i.e. green building design.

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BIOGRAPHIES

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