

Sustainable Strategies for Living Architecture of West–Maharashtra Context : Climatic Responses & Sustainable Insertions



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Abstract :

The environment like our bodies can metabolize nutrients and waste. Living Architecture focuses on these processes, integrating ecological functions into the buildings to catch, store, and filter water, purify air, and process other nutrients. Living Architecture also addresses biophilia, the documented health benefits associated with being in touch with living systems in the built environment. Living with sustainable a life is a need of a time now. In specific Architecture of West –Maharashtra w.r.t. Residential is a blend of Traditional aspects with modern thoughts. This study offers a classification of vernacular environmental design traditions based on West Maharashtra climatic regions and a detailed study of thermal comfort in traditional and modern dwellings using environmental performance modeling. The results show that traditional passive techniques provide a high degree of comfort for a longer part of the day while potentially minimizing energy use. Some problems were identified specifically in West Maharashtra region in adopting the passive strategies to the present context. For example, there are limitations in the use of traditional building materials, such as earth, but suitable alternatives with similar properties can be readily adapted to the same effect.

This traditional wisdom of building human habitats is known to be tested by time for its sustainability in various settlements. This paper talks about West Maharashtra settlement, 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 passive design traditional strategies with local vernacular architecture and lessons about climate responsive planning, techniques can be helpful to generate an approach towards energy reduce and climate responsive building design in West Maharashtra corridor. This paper represents study of Climatic Responses and Sustainable Insertions to Identify Climate responsive buildings. And analyze them based on Design strategies.

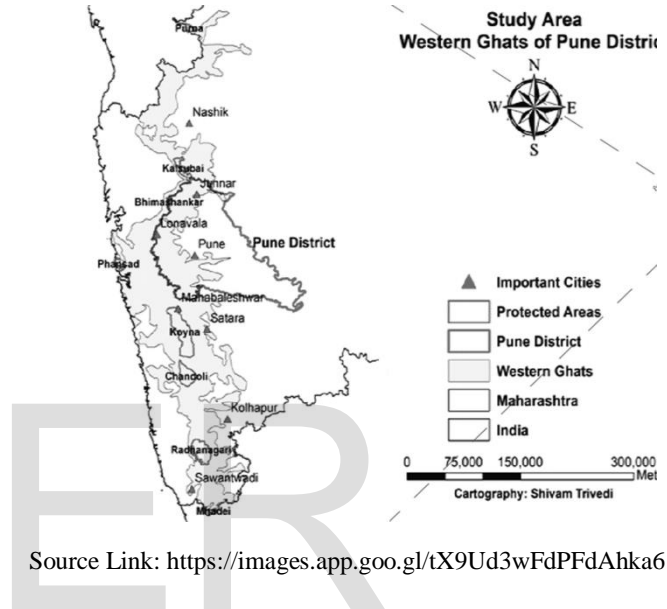
Keywords : Living Architecture, Active & Passive Design Strategies, Sustainable Insertions, Environmental & Climatic Responses .

Indian Traditional aspects of Living Architecture :

Living with the nature , in the Nature , for the nature is a long term philosophy of Indian House form .Living with Traditional wisdom and sustainable life is a backbone approach of Indian human. The Genius Loci that is retaining the spirit of Culture intact within the site and house itself. The architecture of centuries of trial and error was abandoned in a moment. Not only modernism but globalization as well has much influenced the Indian building industry. The last few decades have seen an incredible increase in the amount of mass housing and glass towers, in a climate where the sun is not an asset but an inconvenience. Tall apartment blocks, with concrete structure and thin filler walls, generously adorned with glazing and an array of air-conditioning units sticking out of the windows blot the landscape.

In West Maharashtra context, this study is an attempt to rediscover those vanishing passive design strategies that were the architectural statement of the West Maharashtra regions for centuries and served the purpose well and to see if they can be employed in the current architectural statement that completely lacks the empathy to environment. It should be emphasized that this study does not advocate reverting back to the traditional vernacular architecture of West Maharashtra , but to acknowledge the ingenious traditional architecture that was a result of centuries of trial and error to find that harmony with the forces of nature. It cannot be denied that the changed scenario does not permit one to go back to the traditional vernacular. The lifestyles, the needs of the people, the material use, and the aesthetic expectations have all changed and thus, need a different approach in residential design. But the passive design solutions that the traditional vernacular architecture offered cannot be ignored, considering the potential they offer. Hence, there arises a need to explore these traditional design strategies and reinterpret the knowledge of the past to suit the energy needs of the present and the future.

The climate of West Maharashtra corridor is very Vitruvian. The belt has mixture of Different climatic variation because of the terrain. The geography its self challenges for the living. It carries four different climatic track to observe. It starts with the Hot & dry ,Composite , Moderate and end with Hot & Humid. This is because of Terrain modulation of Mountains & close proximity of sea .Taking about cultural transmissions and revamp of human behavior in modern context, is a key factor to decide Hose form character. Changing life style, adaptation of modern characters effects the Architecture within West – Maharashtra region.

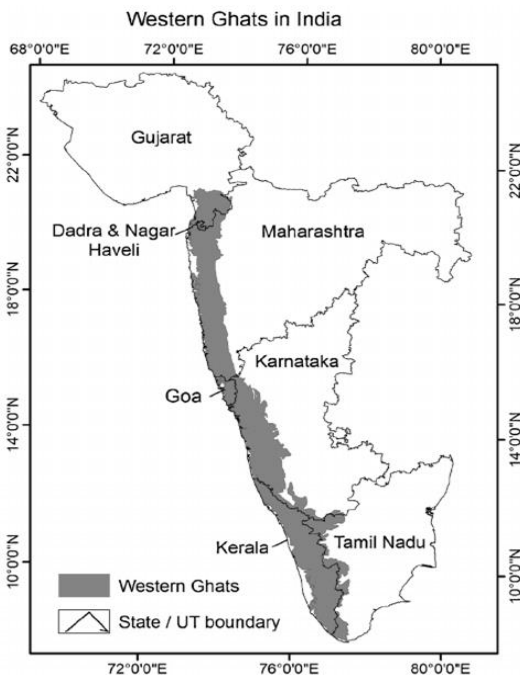


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Moreover, these developments may have had some negative effects. That is the reason why the building process should be discussed in a holistic way. In other words, climatically responsive design, selection of materials and building techniques must be evaluated together and the final product should perform well during its whole service life. Sustainability, which is presented as past decades in Maharashtrian courtyard houses concept, has been in fact applied since long culture and was realized spontaneously in traditional architecture

When sustainable design and construction strategies of West Maharashtra traditional architecture are under observation, then it is possible to observe how traditional buildings and settlements in this region were designed in harmony with the local cultural, topographical and climatic conditions and how their design and construction could be integrate in today’s design practices.

This study is based on research strategies, which has been carried out on passive building techniques used in the hot-dry areas West Maharashtra .The study first aims to show the similarities and the differences of the traditional housing principles in climate responsive design point of view. Secondly, contemporary buildings it aims to put forward the basic principles and their meaningful changes in usage that can be used for sustainable housing designs of the West Maharashtra region . In this study, design strategies in hot and dry climate were examined and

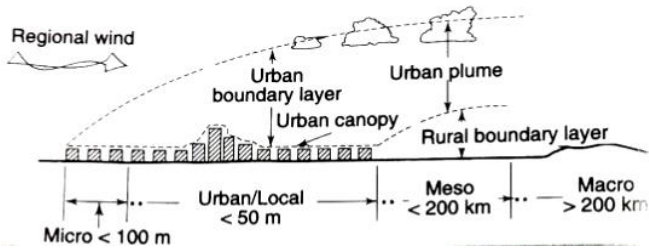


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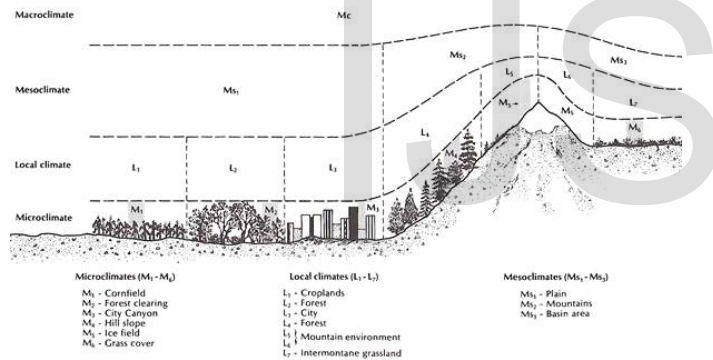
modern and traditional houses were evaluated in terms of design strategies, such as selection of the area of the dwelling, distance between buildings, orientation, building envelope and building form ending with passive design principles.

West Maharashtra (4 Quadrant Climate Variation)

Climate had a major effect on the performance of the traditional building architecture and its energy consumption in hot dry area of Iran. Lack of water and energy sources in these areas forced people to build their houses with some strategies based on minimum energy consumption specific in drought zone area of Semi Arid climate.. Heating and cooling usually use largest portion of energy in buildings. Therefore, builders tried to use natural climatic strategies for coping with harsh conditions. These strategies include: layout orientation, distance between buildings, building orientation & form, climatic elements .



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Strategies at Planning level comprises following scale.

- a) Macro scale
- b) Medium scale
- c) Micro scale

Strategies at Design level comprises following scale in response to climatic condition at respective zone level.

- a) Site Scale
 - 1: Layout and form
 - 2: Topography
 - 3: Water
 - 4: Ground Surface
- b) Building Scale
 - 1: Orientation
 - 2: Rooms spaces
 - 3: Out door areas.

c) Component Scale

- 1: Walls
- 2: Windows & Ventilation
- 3: Shades
- 4: Opening for day light
- 5: Roofs
- 6: Surfaces.

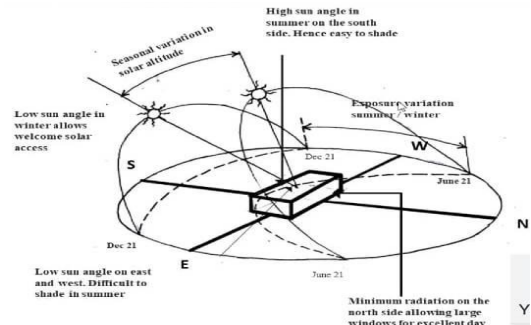
All this Micro & Macro influences (Strategies) of climate on building and comfort conditions.

In addition, the mentioned strategies will be explained in their level of performance and the relevant elements in other levels. Furthermore, this aims to put forward basic principles and changes in their usage that may be of benefit in sustainable housing designs in the future. In this study, the cited design strategies will be examined and modern and traditional houses will be evaluated in terms of design criteria - such as, selection of the area, distance between buildings, orientation, building envelope and building form. Its a simplified evaluation and comparison of a traditional house with a contemporary house will be given.

The most important design parameters affecting indoor thermal comfort and energy conservation in building scale are distances between buildings, building form, building envelope design, self efficiency in building materials and optical and thermo-physical properties of the building envelope. Among these parameters, building envelope design, as it separates the outdoor and indoor environment, is the most important. All of these parameters are related to each other and the optimum values of each should be determined depending on the values of the others and their optimum combination should be determined according to the climatic characteristics of the West Maharashtra region.

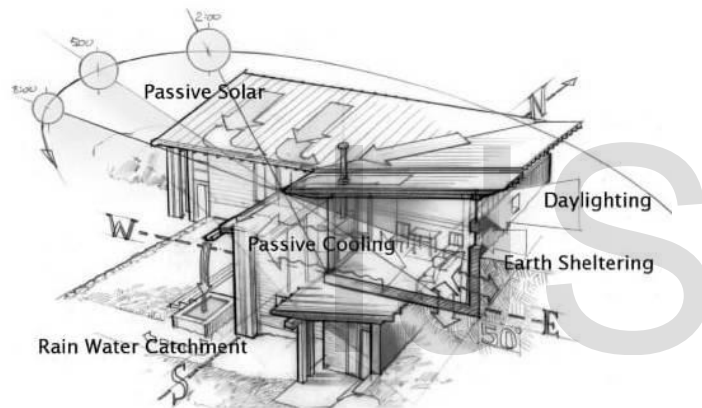
A) Responses based on Literature (Theoretical Insertions)

- a) Orientation and urban form
- b) Typology (Courtyard / Non courtyard)
- c) Building form
- d) Evaporative cooling
- e) Shading / Jali work windows
- f) Fenestration design
- g) Building envelope
- h) Optical and thermo-physical properties of the building envelope
- i) Stack effect openings/wind towers
- j) Carved exposed surfaces/ Self shading ornamentation.
- k) Roof design
- l) Materials
- m) Vegetation / Landscape



B) Sustainable Insertions for case study evaluation.

- Understand the traditional Architecture of the site.
- Analyze contemporary climate responsive buildings of the site.
- Traditional approach towards Sustainability Settlements Patterns and Genius Loci of Site Planning Elements of sustainable habitat.
- Study of Bio-climatic factor affecting in sustainable Architecture.
- Active and Passive design strategies to reduce energy loss.
- Natural Ventilation and day lighting systems.
- Passive Heating and cooling systems .
- Embodied energy / Heat gain and Heat Loss
- Sustainable form /shape Grammar analysis
- Green Architecture as a concept of sustainability
- Green Building strategies to reduce energy efficiency
- Ecology and stabilize caring capacity of the bldg and site
- Minimizing environment impact on buildings
- Energy management through passive & advanced tools
- Optimizing construction & re adaptive use of resources



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C) Passive Design Responses (Active / Passive Insertions)

- Solar passive features
- Shape and form of buildings.(Roof pattern)
- Orientation of the facades
- Building layer / envelop.
- Design of Building plan and section.
- Thermal insulation and thermal storage of roof.
- Thermal Insulation and thermal storage of the exterior walls
- Active Energy Appliance & Installations.
- Low energy profile materials & aesthetics.

D) Responses based on Performance Appraisal (Green Rating Insertions)

- Physical/ Native vegetation , reduce exposed surfaces
- Passive Architectural Design measures and systems
- Fenestration designs
- Efficient artificial lighting system
- Thermal efficiency of the building
- Energy efficient appliances

- use of renewable energy on site
- Reduction of water demand
- Rainwater harvesting
- Generate resources from waste
- Reduce embodied energy of buildings
- Use of low energy materials in Interiors
- Adaptation of green life style
- innovation green ideas/ concept

E) Localized Indigenous Knowledge (IK)

Apart from the modern technicalities the native localize knowledge is also taken under consideration .The vernacular aspects is also act as an effective insertion for climate responsive design strategies.

Conclusion :

Living Architecture is a logistic approach of a any human being who wants to live a sustainable life within nature as a envelop. As per study record .West –Maharashtra region has a identical variations in climate due to topography. To understand the culture and house form ,we need to evaluate all the underline responses w.r.t. climatic Insertions. It can be concluded that the traditional passive strategies can be effectively adapted to modern design conditions and benefit the comfort conditions in dwellings. Most of the design-based strategies are easy to adapt and the material-based strategies have alternative solutions that can be used to make the buildings more energy-efficient in the ways identified in this study. Further exploration is required to understand the other strategies apart from the thermal performance of materials, layout and shading; in order to fully comprehend the combined effect of these strategies. An exploration into finding different combination of these responses and strategies (Sustainable Insertions) in modern design act a catalyst solution for a completely passive design approach in West Maharashtra region.

References :

- Peel MC, Finlayson BL, McMahon TA. Updated World Map of the Koppen-Geiger Climate Classification. Hydrology and Earth System Sciences
- Cooper I, Dawson B. Traditional Buildings of India. Thames and Hudson, London, 1998.
- Mathur VK, Chand I. Climatic design for energy efficiency in buildings. IE Journal 2003;84:33–9.
- Schoenauer N. 6000 Years of Housing. W.W. Norton, New York, 2000
- Alexander DK, Lannon S. HTB2 Release 2.01a, Software and Documentation. Welsh School of Architecture, UWCC, 1996,
- Alexander DK. HTB2 Release 2.00. BEPAC Conference on Advanced Simulation Models, BEPAC, Leicester, 1996.
- Sharma MR, Ali S. Tropical Summer Index: a study of thermal comfort in Indian subjects. Building Environment
- Azami, A., "Badgir in traditional Iranian architecture". 5th international conference on Passive and Low Energy Cooling for the Built Environment, Santorini, Greece, 2005
- Hajighasemi, K. 1999. Houses of Kashan. Shahid Beheshti University Press, Tehran: Iran.
- Dr.Sheeba Valsson presentation Webinar organized by DYPCOA,Pune