

Analysing Sustainability Issues Related to Various Construction Techniques Practiced in Himalayas

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Abstract:

India is a country of great geographical disparity with varied climatic and environmental conditions. Different vernacular architectural styles have evolved here through ages with locally available building materials and indigenous constructional techniques, which fulfils the need of people living in different parts of country.

A sustainable development is the result of the design philosophy which focuses on increasing the efficiency of resources used like energy, water, and materials, while reducing the impact of buildings on human and the environment. It is necessary to maintain the ecological balance and reduce the impact of climatic change.

Role of reinforced cement concrete needs to be questioned for development in the region as it has very low carrying capacity. So do turning to vernacular architecture practices is the only way the dream of perfect world where humans and nature coexist in harmony with each other can be realised? Rapid decline of locally available building materials and steep construction economics related to these vernacular practices has further led us to the question “What integral changes needs to be incorporated in traditional architecture styles to make them viable in contemporary time”.

Keywords:

Analysing Sustainability, Construction Techniques, Construction Techniques Practiced in Himalayas,

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Introduction:

Through this paper I will try to explore the sustainability of various construction styles practiced in the Himalayas that will lead to UTOPIA of ecological balance where humans will live in harmony with nature and try to find the solutions of following problems:

- Is going vernacular the only way for establishing UTOPIA in The Himalayas?
- What are the various traditional construction practices prevalent in the region?
- What is the relevance of these construction practices in present day scenario?
- What integral changes needs to be incorporated in these practices to make them sustainable?

According to a World Watch Paper entitled 'A Building Revolution' (March 1995), the building industry is responsible for:

- 40% of world's total energy
- 30% of consumption of raw materials
- 25% of timber harvest
- 35% of world's CO₂ emissions
- 16% of fresh water withdrawal
- 40% of municipal solid wastes
- 50% ozone-depleting CFCs still in use
- 55% of timber cut for non-fuel uses, and
- 30% of the residents having sick building syndrome.

Construction industry is one of the fastest growing industries globally and in India, it is the second largest after agriculture. It makes significant contribution to the national economy and also provides large scale employment. But, it also is amongst the most energy consuming, natural resources guzzling, waste generating and polluting industries in the world today. With the consumption and generation in various sectors rising at an alarming rate, it becomes very important to design buildings that are sustainable in both planning and structural aspects. The prime factors considered here are: energy that goes into making of various materials, the constantly depleting natural resources – both renewable and non-renewable, the waste that these industries generate and the inhabitable environment – both indoor and outdoor that they create. This becomes ever so much more unavoidable when the region under consideration is The Himalayas due to its susceptibility to natural hazards (Earthquake Guidelines, 1968).

In Himalayas, the architectural design and construction practices were largely dictated by climatological parameters such as solar condition and amount of snowfall but topography also played a major role. Traditional houses and their surroundings were a total habitat in them, and were built based on optimum climate responsiveness, and then came reinforced cement concrete. Newer development policies then resulted in rapid urbanization and the forces of change were so overpowering that there was hardly any reflection of the traditional construction and technology. It was a period of just 30-35 years that the change came about and much of the construction since then, turned to materials alien to the region.

Analysis and Discussion

Response of these contemporary construction practices to the climatic factors is average at best but when we check their energy consumption and their sustainability coefficient it cuts out a sorry figure. Now is the traditional way more suitable to the context and can it cater to present day demands. Before reaching to any judgement it should be considered that carrying capacity of mountains are very less than plains (Earthquake guidelines, 1968). They are not suitable for high rise development; infact according to bylaws a maximum of 9m high structure is allowed. Whereas vernacular architecture, by definition and practices is sustainable. It has been developed through centuries in harmony with nature. In every manner imaginable it is much more coherent to nature than reinforced cement concrete construction.

Following are the major traditional construction styles identified in Himalayas:

➤ Thathara Style:

This building style has been identified in Himachal Pradesh, a northern state in India. Nowadays, this type of construction practice can be seen for houses and temples, however, earlier photographs suggest that the same style was adopted to build palaces, bridges as well as various other structures. The construction style is named “Thathara” as this term is locally used for wooden planks that make the vertical load-carrying members (columns) locally known as thola(s). Tholas (a peculiar combination of timber and stone) and wood are primarily used for the vertical and horizontal frame elements, respectively. The region where this building typology is found is



characterized by cold climate and witnesses heavy rainfall during the rainy season (from June to July) as well as snowfalls in winter (from October to March). These effects have been considered well in the construction style, like e.g. small openings, a verandah to take sun but prevent from rain and snow, wooden and mud interiors which are good insulators and keep the interiors warm, sloping roofs with adequate projections as well as other features. Being located in the Himalayan region, the area has experienced numerous strong earthquakes and this construction technique has evolved eventually to withstand seismic action.

The wall system is framed structure in which the columns (tholas) are in ‘thathara’ style. Beams are of deodar or kail wood, sometimes of the tree trunk itself. The partition walls are a variety of construction types either of stone, wood or both. In some cases it was observed that the walls of the lower storey are entirely made of stone and hence are load bearing, while the upper storey(s) have tholas with partitions of wooden planks.

In some constructions tholas can be seen in the upper storey directly above the posts of the verandah which is considered to be a poor construction practice. Thathara houses usually have gable roofs with a slope of about 17 degrees. Over the

verandah, the roof slope becomes a bit gradual in order to have adequate headroom.

Today the construction of these buildings would be too inefficient due to the high timber prices and unavailability of necessary construction skills. It is supposed that several tens of workers had been required to build these structures. Obviously, the erection of these structures had been a community effort.

➤ Mud wall construction

The style too has been identified in Himachal Pradesh. It is concentrated in the upper reaches of the state in the Lahaul and Spiti districts, which are located in a cold-desert area with very hot days and chilling nights. Precipitation usually only occurs in the form of snowfall with almost no to very little rainfall. This dryness of the local climate is reflected in the architecture of this construction typology which consists of thick mud walls with small openings in order to insulate the interior from the harsh outside climate. This style of construction which is predominantly used for residential houses and temples is still being practiced today.

The houses in Spitian architecture have load bearing wall system. The 300 or 500mm thick mud walls take up the entire load. Walls up to 600 to 900 mm height are made of local available field stones. Above this base, the walls are entirely constructed of rammed earth. As the area has very little or no rainfall, the roofs are flat and constructed by laying horizontal wooden beams which are covered by plaster of mud over reed leaves. To make

the parapets, a 300 mm thick and 300 mm high course of mud is laid at the periphery of the terrace. On top of it, dried bushes are packed densely. These bushes are projecting to the outside and hence also act as a sunshade.

The construction of these buildings is the only efficient option in the valley as the main building material mud is easily available and also suits to the harsh weather conditions.

➤ Dry stone construction

The building type has been identified in Himachal Pradesh and Uttarakhand. Nowadays, this type of construction practice can be seen prevalent in the areas where people have been forced to leave



their traditional construction practices due to scarcity of wood. Thus, this construction style is nothing but the



traditional housing style while omitting the wooden elements. Be it Kath Kuni style or Thathara style, the reason why people did not opt mud which is another easily available material, is this region's

heavy precipitation both in terms of rainfall (June to July) as well as snowfall (October to March).

The stone walls are load bearing with a thickness of 500 mm and a height of 2.5 m. Both external and internal walls are of the same thickness. These are made of locally available undressed stones of varying sizes, packed together without any mortar. Sometimes the size of a single stone is large enough to cover the entire opening as a lintel beam. Kail or deodar wood is used for frames and panels of doors and windows. As the area receives rain in monsoon and heavy snow in winters, the houses have sloping roofs, i.e. gable or hipped roofs. These are covered with slate stones which are locally available while deodar or kail wood is used for beams, rafters and purlins.

Response of this construction technique during earthquake is excellent and construction economics also favours it thus making it a viable option in present day scenario.

➤ KaathKuni

Buildings of this construction type can be found in the northern part of Uttarakhand and the southern part of Himachal Pradesh. Investigations suggest that the region had evolved this elaborate and magnificent earthquake-safe construction style as early as 1,000 years before present. This architectural style further demonstrates the existence of elaborate construction procedures based on principles somewhat akin to that of blockhouse construction. Many features of these buildings are considered as the basics of modern earthquake-resistant design. Generally, ornate multi-storeyed houses with abundant use of wooden beams are characteristic of this style. For

buildings of the KaathKuni architecture, locally available building materials such as long thick wooden logs, stones and slates were judiciously used. The height of these structures varies between 7 and 12 m above the base platform which consists of dry stones. These structures are observed to have four (Chaukhat) to five (Panchapura) stories. It is reported that especially buildings of the KaathKuni architecture withstood and performed well during many past damaging earthquakes in the region.

The construction process of Kaath Kuni architecture consists of two steps. First the wooden construction was erected before filling up the intervening voids with dressed stones. However, this may only be true for the lower part where the stones were only used to fill up the voids. The construction of this type of housing takes place in a single phase.

A suitable substitute needs to be identified for timber in this style of construction as wood is scarce nowadays. If the due replacement is found it is one of the most suitable construction technique for the region with minimum environmental impact and maximum earthquake resistance.



Conclusions

To conclude if vernacular architecture of a place is not sustainable, it should not be suitable for its local context, and would not had be developed and adopted from centuries. In order to achieve sustainability in development we have to re-revive our architectural practices/ style to vernacular which by virtue of its characteristics is sustainable. It has helped in maintaining the ecological balance in that region through ages and became beneficial in reducing the impact of climate change. It's true that it cant be adopted in its earlier form but after some minor necessary modifications it is the way forward to achieve harmony between

human and nature and establish UTOPIA. In Laurie Baker's own words "Every place has its own traditions and by, trial and error, over thousands of years, people have learned how to use and to cope with, all the many factors which are involved in Architecture: the Site the Topography and Geology, the climate and vegetation, the available local materials the religious and cultural patterns of living, and the main local occupants. Unsatisfactory items have long since been discarded and alternatives have been tried until a satisfactory solution has been found. It seems foolish, therefore, to abandon the tested findings of centuries of Science & Technology".

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