

# Understanding the Bioclimatic Features of Vernacular Architecture

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**Abstract**—Vernacular architecture is crude in nature, which is developed from nature and per the needs of the local people for shelter. Therefore essentially vernacular architecture corresponds to the specific geography and climate of the area. Vernacular architecture encompasses many bioclimatic features like spatial planning, designing and layout, building orientation, provision of gathering spaces as per the cultural requirements, effective use of different building construction techniques to enhance indoor comfort. The present study is a research conducted on 30 number vernacular houses with in-depth field observations of different vernacular features facilitating the daily life and fulfilling the requirement of low-cost housing for poor rural people of district Hamirpur. The study briefly showcases the analysis and result of the pilot survey conducted for selected vernacular houses.

## 1. INTRODUCTION

Vernacular architecture is best known for its bioclimatic features that is essentially climate responsive features, which makes it sustainable, energy efficient and low cost architecture. It is therefore developed from the nature by the people as per their specific needs which suit to their daily lifestyle and cultural requirements. Materials and technology involved in vernacular architecture corresponds to nature in its most crude form. Therefore vernacular building techniques have the advantages over the modern construction systems in terms of sustainability, providing better indoor thermal environment, involving use of green, eco-friendly, energy efficient materials [1-6] and most importantly promoting self-help tendency among rural people. Research studies have shown that these materials consume minimum energy as embodied energy during their construction phase [7]. Vernacular architecture is propagating use of bamboo and mud and is increasingly being looked upon as better alternative for achieving both sustainability and energy efficiency at minimal costs in modern houses as well. For this purpose bio climatic features as layout, planning and designing features of vernacular house have been studied in order to highlight their advantages which can be successfully clubbed up in modern houses.

## 2. VERNACULAR ARCHITECTURE OF HAMIRPUR

Hamirpur is located at an altitude of about 765 meters and has 30°41' 00" North latitude and 76°31' 00" East Longitude in Indian state of Himachal Pradesh in western Himalayas. Hamirpur has sub-tropical climate with average yearly rainfall of about 124.8cms. [8]. State of Himachal Pradesh has four bio-climatic zones namely: 1) sub-montane and low hills subtropical, 2) Mid hills sub humid, 3) high hills temperate wet, 4) high hills temperate dry. The area of study Hamirpur falls in sub-montane and low hills subtropical bio-climatic zone and has warm humid climate. Hamirpur district was studied with the help of Revised Development Plan Hamirpur and 30 vernacular houses were selected with adobe and bamboo/wood construction. Out of these 30 houses, three house as representative were taken for discussion in paper. Results were however generalized on the basis of these 30 houses under study.

## 3. BIO-CLIMATIC FEATURES

### Layout of buildings

House are generally laid out along the contours and in south direction to avail maximum winter sun. Preferably habitable room have been oriented along the sun path with provisions of deep verandahs or buffer spaces which allow winter sun to penetrate but cut off the summer sun as well as rain downpours in rainy season thereby keeping comfortable indoor environment.

### Planning and design of rooms

Habitable rooms and spaces are designed on ground floor with maximum two number of rooms at ground floor and kitchen and store etc. are located at first floor also carrying two number rooms. Kitchen being the central space of the house and at higher level is well curtained from outside extreme weather and provides heat to other spaces of the house.

## Openings

Opening in the form of windows are very less in these house and are also small sized in order to allow optimum light and ventilation in the house and the walls and indoor are well guarded against the excess of heat in summers and cold winds in winters.

## Construction materials

Houses are made of adobe and finished with mud mortar mixed with cow dung and green or brown color. Roofs are made of wooden beams or long bamboo lengths used as beams supported on adobe walls. These houses are double storied and elegantly merge with nature on account of their mud plaster finish. The floors are also plastered with mixture of mud-cow dung and bhusa. Staircases are made in small width of flights (of 3') of wood with treads plastered in mud or cow dung. Wooden rafters and battens form the roof top which further support the framework of sloping slates.

## Amenities

Essential amenity includes one small sized detached toilet which is located outside the house. Attic space of the sloping roof is used as store for granary and other household items. While verandah at first floor level is used for sun-drying of household goods. In case of cattle, a separate single or double storied adobe house is made in vicinity of the house complex



Ground Floor Plan

First Floor Plan

Figure 1 Typical plan of vernacular styled house



Figure 2 Roof with slates and adobe walls

## 4. RESULTS AND DISCUSSION

Based on the study of bioclimatic features of vernacular architecture of rural adobe-wooden houses of District Hamirpur some generalizations were made as planning, designing and construction aspects as follows:

Table 1: Features of adobe vernacular houses

Parameter	Features	Remarks
Layout and Planning	House are south oriented and along the contours	This results in proper provision of heat & light
Designing	Habitable rooms on ground floor, kitchen and store on first floor	Design promotes privacy and maintains heat flow within the building
Materials	Adobe for walls, wood and bamboo for roof	Materials are energy efficient, low cost and sustainable in nature
Openings	Small and less number of openings	Guards against excess heat in summers and cold winds in winter
Sunspaces	Verandahs/ buffer spaces in front	Guards against harsh weather in rainy season, winter and summer and leads to heat gain in winters in rooms inside thereby maintains comfortable indoor environment

## 5. CONCLUSION

Present study helps to understand the different climate responsive features of vernacular architecture which were adopted by people long ago and are sustainable, energy efficient. Adoption of these features in modern houses like orientation along the contours, consideration of sun path, wind direction, topography and climate all leads to creation of comfortable indoor environment both in summers and winters. This study therefore puts forward ground work to realize the potential of vernacular architecture in addressing mass housing problem.

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