Vernacular Architecture in Cold & Dry Climate: Ladakh - A Case Study

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Abstract—In the age of globalization and industrialization, the world is proceeding with the new techniques in all the fields. Cultural heritage is the gift of physical artifacts and insubstantial attributes of a group or society that are inherited from past generations, sustained in the present and bestowed for the benefit of future generations. The paper presents on the Vernacular Architecture of Ladakh, which people are forgetting in today’s time and adapting the modern techniques of construction, which is not blending with the local architecture of Ladakh in terms of aesthetics and climate. Moreover, the existing old structures need to be restored and maintained to retain the sanctity of Vernacular Architecture of Ladakh. All effort is done for grading of heritage buildings for effective protection and conservation of heritage monuments.

Key words: Vernacular Architecture, Insulation, Heritage, Monastery

I. INTRODUCTION

Ladakh, the Persian transliteration of the Tibetan societies, is a district which is located in the state of Jammu & Kashmir which presently extends from Kunlun mountain range to the main great Himalayas to the south includes the upper Indus River Valley. The highest plateau of the state of Jammu & Kashmir, Ladakh is inhabited by the people of Indo-Aryan and Tibetan.

II. HISTORICAL BACKGROUND

Ladakh was the part of the Kushan Empire approximately in the 1st century A.D. One century later, Buddhism was spread in the western Ladakh via Kashmir at the time when eastern Ladakh and western Tibet was still practicing the Bon religion.

In 842 A.D after the breakup of the Tibetan empire, Nyime-Gon, who was the member of the Tibetan Royal Family, annexed Ladakh and founded an independent Ladakhi Dynasty which spearheaded the second spreading of Buddhism in Ladakh. The Indian Mahasiddha “Naropa” established the first Buddhist Monastery in Ladakh at Lamagura in the tenth century.

With hundreds of monasteries, the region of Ladakh even today magnetizes thousands of way-farers from all across the world. Deciphered though, Ladakh continues to stand and undaunted an epitome of spiritualism and mysticism.

III. CONSTRUCTION TECHNIQUES

Pertaining to the construction techniques, it is very vital and beneficial to study the vernacular architectural tradition of Ladakh as these present an exact picture of how local folks have been able to counter the inclemency of weather through architecture.

In Ladakh region, most of the houses are built at two levels. The ground level is reserved for animals, wood and fodder storage for winters whereas the upper level has the habitable spaces. In most houses, there is a single large room with an oven in the corner which is used for cooling as well as heating the interior spaces. The houses are made entirely of mud, sometimes reinforced with horizontally placed timber members. The walls are either made of sun dried bricks or rammed earth. Initially, the walls are mud plaster while flooring is either in mud or wood. The ceiling height is low to provide the required insulation in all the areas. Every possible care is taken to trap the heat and maintain the temperature inside for a conductive living. Thus, the houses in Ladakh are essentially utilitarian. The description of some of the materials used in the region are:-

A. Mud Brick

Mud bricks are composite chiefly of clay, silt and sand. Due to high sand contents, the surface water absorption of the brick reduces. Presence of clay and silt helps to bind the brick.

B. Foundations

Earth easily absorbs water which lowers its load bearing capacity. Thus lime is used as a binding material in foundation to provide its strength.

C. Walls

Walls are built upon foundations raising above the ground level. The top of the foundation should not be wider than the bottom of the wall to avoid any structural damage in case of earthquakes. Walls are generally thick at the bottom and taper gradually as they rise.
D. Roof Details
As Ladakh sustains in cold and dry climatic conditions, the ceiling is mainly built in mud and wood due to their insulating properties and easy availability.

E. Mud Plaster
Mud plaster is applied wet 15-25 mm thick. Most mud plasters have to be repaired annually when used externally but adhere well to earth walls.

F. Insulation in Ceiling, Outer walls and Floors
During the day time, the natural heat collected is retained by the insulation. The wood waste produced during the construction is filled in the ceiling to stop the heat loss through the roof.

G. Thermal mass in Walls and Floors
We build our buildings three feet (1 m) or more below ground on the north side. The building benefits from the stability of earth’s temperature at that depth, which is relatively warm in winter and cool in summer. It also helps us get the building material — earth — right on site. The earth we dig out ultimately becomes the walls of the building.

H. Thermal mass in Walls and Floors
The outer walls are insulated by a jacket wall outside the main structural wall. The six inch gap between the two walls is filled with low cost insulation: saw dust, wood shavings or sometimes paper and plastic garbage like bottles and bags. Sometimes we have also used cow dung as an insulating plaster. Mixed with the right amount of earth and clay, it makes a strong and thermally effective plaster.

I. Rammed Earth
The walls are built of rammed earth, a most eco-friendly method as the building material comes right from the site and is not transported hundreds of miles, and when construction is finished, there is no debris to be thrown away: no addition, no subtraction. Earth buildings are the warmest in winter and coolest in summer, and also moderate the humidity of the building.

The technique of rammed earth consists of casting huge bricks in place, in a frame made of planks. Sand and clay are mixed in the right amounts to get a very strong constitution. It is then packed in the frames and rammed with pounders.

The thick earth walls are not just structural (to take load) but also have an essential function as the heat bank (thermal mass). They absorb the excess solar heat during the day and release it to the room at night. The same properties also keep rammed earth buildings cool in summer. Rammed earth is an ancient technique used in monasteries, castles and forts around Ladakh. These structures have survived, unprotected and exposed to the elements, for hundreds of years.
IV. CASE STUDY

Name: - Babu Dorje House
Approach: - The main approach is uphill from the west stupa gate via southern end of the Chutazzranthali Street.
Date / Age: - Early 1900’s, estimated at 1929.
Type: - Residential, unprotected and private owner.
Historical Significance: - The house was built for Babu Dorje and his family. Mr. Dorje was the engineer behind the construction of the airport of Leh in 1948.

Fig. 8: Front Elevation of Dorje House showing Vernacular Architecture of Ladakh

A. Physical/Architectural Description:
The building is a well-planned structure built by Mr. Dorji himself. The plan is staggered and is implemented on ground and two upper levels. The rooms on the left were originally shops. The walls are made of sundried mud bricks. All the structural supports are wooden members. The roof and terrace are plastered with mud. The ground floor was used chiefly for storage and shops while the upper levels were habitable spaces.

B. Decorative Features:
The red wood façade originally covered shops counters. Ornamental columns and beams adorned this part of the house. The lintels locally called “Tsingzak” are present throughout the structure, especially noticeable on the windows series on the southern façade.

Fig. 9: Section of Dorje House having Three Floors

C. Conditional Description:
1) The original red wooden façade is retained through the support structure which has been deteriorated. Multiple columns and beams are broken and shutters are missing. Bricks are damaged on the northern corner and western wall. The roof slab has sagged.
2) Some of the ground floor rooms are occupied by workers. The northern portion is uninhabited and is dumped with unwanted objects and moreover the wooden members in the structure are damaged and cannot be reused.
3) A central staircase leads to the first floor where almost all the rooms are occupied. Several columns and girders are damaged and the walls are cracked at many places due to weathering and settling.
4) The wooden staircase leading to the second floor has also deformed. Structural supports are damaged and major cracks were identified in the stairwell walls also.
5) The second floor housed four rooms that are occupied. The exterior walls lack plaster in many areas and several window panels are damaged or missing.
6) Due to dry weather conditions, no vegetation was identified in the foundation. However, some roof seepage were also the part of structure.
7) Lack of maintenance can be seen through the building.

V. CONCLUSION

The buildings in Ladakh that recollect the aesthetics, historical and cultural values and proper architecture are declared as “Heritage Buildings”. In Ladakh city, there are in-numeral heritage buildings which are not known to public and are deteriorating day by day as it is shown in the case study. All these buildings are required to be conserved and retained keeping their architectural values and a strong history behind.

REFERENCES
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