Investigating the Effects of Moderate-Humid Climate in Vernacular Built Environment: Case Study: Lahidgan Region, North of Iran

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Abstract---Climate is one of the most important factors that produce certain easily observed effects on architectural forms. The resolutions that exist as a result of the effect of climate on architecture differ according to cultures, regions, technology and time. The climate in the Lahidjan Region, Gilan Province region, which lies in the north of Iran along Caspian Sea, plays a fundamental role in the diversity and formation of the vernacular residential buildings in the region. Climatic factors such as sunlight, wind, rain and humidity in the region, which has a moderate-humid climate and which gets excessive rain, have different effects on the form and elements of the vernacular buildings.

In this paper climatic approaches that are evident in the architecture of the vernacular buildings in the Lahidjan region is examined. The initial aim of this paper is to give information about the vernacular architecture in the Lahidjan region and to understand the relationship between climate and the architecture. Therefore, the effects of climatic factors, such as sunlight, wind, rain and humidity, on different parts of vernacular buildings are explained.

Keywords---Climatic Factors, Vernacular Buildings, Built Environment

I. INTRODUCTION

VERNACULAR architecture is a term used to show methods of construction which use locally available traditions and resources to address local requirements and circumstances. Vernacular architecture tends to evolve over time to reflect the cultural, historical and environmental context in which it exists. In the past times, when materials and technology were more limited, climate was the most important factor that shaped vernacular architecture. In fact, Vernacular buildings are the architectural products that emerged as a response to the needs of societies before the industrial period and to the limits created by the climate and region, and as a result of the unique interaction between experience gathered by observing natural phenomena and human mind. Vernacular buildings are the best examples of the harmony among human demands, natural environment and building. While, on the one hand, people prepare their settlements to be used according to the “location”; they challenge the permanent conditions of “climate” with a mixture of foxiness, modesty and courage and on the other. The products that emerge as a result of the reflection of the different climatic effects on vernacular buildings present at the same time on the architectural characteristics of that region (Cultural research association, 2007). The climate in the Lahidjan region along the Caspian Sea plays an important role on the diversity and formation of the vernacular buildings as well.

II. LAHIDJAN REGION IN GILAN PROVINCE

Lahijan is a small city located in Gilan, a province in north of Iran that lies along the Caspian Sea. Lahijan has a climate known as "moderate Caspian." This weather pattern emerged from the influence of the currents of both the Caspian Sea and the Alborz Mountains. The Talesh Mountains are stretched in a north to south direction, and the Alborz Mountains in a west to east direction. These serve as a barrier against the humid Caspian winds and withhold the penetration of wind bearing vapors towards Iran's plateau, causing heavy rainfall in Gilan province during the fall and spring seasons (Ghobadian, 2001). Lahijan with weather more favorable than the other cities in the Gilan has cooler summers and warmer winters. Freezing temperatures are seldom reported in the coastal areas; however it is not odd for Lahijan to experience periods of near blizzard conditions in the winter. In Lahijan, the amount of rainfall depends on the winds bearing vapor that blow from the North West in winter, from the East in spring and from the West in summer and fall. These winds carry the humidity and vapor towards the plains causing prolonged rainfalls. (Kasmaie, 2006)The characteristics of this climate present a typical vernacular architecture in this region (Fig. 1).

III. INVESTIGATING VERNACULAR ARCHITECTURE IN THE LAHIDJAN REGION

A. Site Plan

When the vernacular architecture in the Lahidjan region is in question, the first thing to be seen is the scattered settlement (Fig. 2). The settlements in the Alborz mountain topography are on the upper parts of the mountains, on the mountain slope, in the valleys or at the feet of the mountains, and in some places combinations of two or three of them may be
observed (Fryer, 1963). The scattered settlement in the Lahidjan region is the result of the unsuitable topography and of repelling moisture from surrounding environment. The vernacular buildings are dispersed in the topography as single houses or groups of few houses. Sometimes the distances between buildings may be as long as 500 m (Kasmaie, 2006). This forces the local people to build buildings that meet all their needs and that are self-sufficient.

B. Construction and Building Materials

The mainly used construction type in the region is the wooden-framed structure. Moreover, stone masonry and timber construction systems may also be seen (Hyde, 2000). The main building material in the region is stone and wood, and it is possible to observe the applications of these two materials in various construction techniques. The common characteristics of the wood types used are they are resistant to moisture and heat changes, and long lasting (Handy et al, 2002). Stone is an indispensable building material in the Lahidjan region. A building that is two-storey on the rear or sometimes three-storey rises on a ground floor of rough stones (Mahmoudi & Mofidi, 2008). In Lahidjan region, which has high humidity, stone is the best transition material in connecting the building made from organic materials to the ground. In the buildings, as a result of the accumulation of years of experience, the transition from the damp ground to the stone wall, that is resistant to damp, and from the stone material to the wood, which is not resistant to damp, is realized.

IV. THE EFFECTS OF CLIMATIC FACTORS ON THE LAHIDJAN VERNACULAR ARCHITECTURE

A. Sunlight

The water vapour caused by the density and climate of vegetation in the Lahidjan region from the mountains to the sea receive sunlight at an incline. Sides facing the north receive little sunlight. The buildings on the sides facing the east do not receive direct sunlight in the afternoon, and the buildings on the sides facing the west may not receive direct sunlight in the morning. The measures taken against the sunlight in and around the buildings are as follows (Murakami, 2008).

In a typical vernacular building, the summer rooms are placed in the north and winter rooms are placed in the east side in the plans. Rubble wall systems are used mostly as the wall construction material in the south sides (Parkers, 1852). The level of daytime illumination of the living spaces in the greatest part of the vernacular Buildings is very low. When considering the whole building, the natural illumination is far below the acceptable levels. Windows are used more in the bedroom sections than in other sections (Kasmaie, 2006). The heat averages have an effect on the sizes of the windows in the vernacular buildings. In less warm parts of the region, windows are smaller. It was seen that the warmer sides (south, southeast and east sides) have more windows. In an arrangement of the windows in the walls, it was found that the south and southeast are preferred most. In the vernacular buildings, there are windows built for access to the roof and illumination of the loft (Singer, 1957).

B. Wind

The Lahidjan region usually gets northerly winds. Especially in the coastal areas, the strong winds come from the north and northeast. It is well known that the west and southerly winds do not usually bring rain but reach speeds as to blow the roofs, and that the northerly winds blow fast and also bring rain. The west and southerly winds are usually blow warm air. The northerly winds blow cool air that its cold depending on the season. As a result of their direction, these winds carry moisture from the sea. Because the rain and moisture drops splash on the building surface, the walls facing these directions are damaged soon. For this reason, the strong and rainy northerly winds and warm southerly winds are a determining factor in the buildings in the vernacular settlements. In the vernacular buildings, sometimes there is an entrance on the sides facing the northerly winds but this entrance is kept closed in winter. It has been also seen that there are windows on the opposite walls (north to south) that create desirable conditions by letting north wind to circulate in the building, especially in the spring and summer (Fig. 3).

There are few windows on the walls facing east and west (Stronach, 1973). The windows of some houses have window shutters to keep out the wind and cold.

C. Rain

The most evident characteristics of the Lahidjan region in terms of climate are that it gets more rain than any other region in Iran and that the yearly distribution of rain is mostly regular. The only reason for so much rain is that the mountains in the region are very close to the sea. The rain factor has always affected the plans of vernacular buildings. In order to reduce the damage of rain in places where wood has been used as a main material, the walls at the entrances are pulled towards the inside and half open and covered entrance spaces are constructed here (Lambton, 1953). The repercussion of rain is evident in the selection of outer wall materials in the vernacular buildings. The excessive rain has limited the use of unburnt soil as an outer wall construction material. Waterproof materials are deliberately used on the facades that get rain, and suitable constructions and materials are chosen according to the directions. The infill wall that has the most joints is used on the east side that gets the least amount of rain. The walls on the north and the west sides, where the rain comes with the wind, are made of hard wood or moisture-proof stone (Weaver, 1963). Because of the excessive amount of rain, the roofs of the vernacular buildings in the entire Lahidjan region are very inclined. Among the many types of roofs, the most common ones are the hipped roof. Hipped roofs may have three pitches (Wills, 1981). In some parts of this region, since the buildings may have the risk of taking in water from the rear wall, the roof drainage is forbidden to flow against the upward slope. In many cases, pitched roofs that face two or three directions are used. It was seen that large eaves were used in all residential buildings in the region. The functions of the eaves are to provide temporary protection for different household and agricultural tools from the rain and to protect the wall surface against the rain (Fig. 4) (Tavassoli, 2005).

In order to direct rain water away from the walls, canals were dug around the buildings. These canals have a dual function: they carry the accumulated rain water to the fields and prevent
D. Moisture

The rate of humidity in the Lahidjan region is above the average. The average relative humidity goes as high as 70-80%. Although the humidity contents along the coast look similar, it is a bit higher around Biyepish Region, located at the north-east of Lahidjan. The reason for the difference in the humidity content is the atmospheric movements and mountain topography that is suitable for atmospheric movements. In the coastal parts of Lahidjan region, the highest moisture content is registered in August and September, while the lowest moisture content is seen in January. In the inner parts of the region, the highest humidity content is registered in September, while the lowest humidity content is seen in April and May. Generally, the moisture content in the inner parts of the region is higher than the humidity in the coastal parts. The atmosphere and the ground in the eastern Lahidjan region are more humid than the atmosphere and the ground in the western parts of the region (Stronach, 1973). The opposing entrances used in some vernacular buildings create a good air circulation. In all vernacular buildings, rubble and wood walls have been preferred, which makes the circulation of moisture from the inside to the outside possible. It has been seen that there is an increased use of frame walls in places where the vapor and moisture content is high, whereas stone walls are used in places where the vapor and moisture content is low (Mahmoudi & Mofidi, 2008) . Because of the intense vegetation and excessive amount of rain, the moisture in the soil, especially in the eastern parts of the Lahidjan region, is higher than the average. The great amount of moisture has a decaying effect on the wooden elements that are connected to the soil. So, the walls of the ground floor are made from stone. In all regions, the walls that separate the living space from the ground floor are made from stone. The wooden structure starts after a particular height (Ghobadian, 2001). The high moisture content in both ground and the atmosphere in Lahidjan region have necessitated effective ventilation in the vernacular buildings. Ventilation in these buildings is achieved through a roof parapet in the roof, and through the openings above the windows in the rooms that are protected with wood grids. These openings were used for illuminating the inner space when the window shutters were closed. The grids in the roof parapet not only light up and ventilate the building, also ventilate the loft that functions as storage for dried food. In the plans, these grids are placed on two or more sides of the roof (Wulf, 1966). There are no courts surrounded by walls because of the fact that they grow moss that damp grounds.

V. Conclusion

Iran’s vernacular architecture is designed in proportion to its climatic conditions, and more than often, the unique fabled artistic background of Iran makes up for the seemingly lack of natural resources. Vernacular building techniques are particularly important because they are the result of centuries of development and practice. The Lahidjan region is one of the two sub regions of the Caspian Sea region that lies in the north of Iran and which has a moderate-humid climate. It can be seen that humidity and rain are very important in the Lahidjan region and that the wind factors and solar effects are significant enough to be investigated. The climatic factors influence the architectural characteristic of that region. It is possible to see the effect of these parameters on their directions and settlements, choices and plans of building materials. Buildings that have the most economic, most effective solutions to these effects are compatible to the climatic conditions of this region in which they exist and that accomplish these by using minimum energy. In this sense, the harmony between the vernacular buildings and the climate in the Lahidjan region can be taken as a basic model against the architectural understanding that ignores climatic conditions.

REFERENCES


CAPTIONS

[17] Fig.1: The location of Lahidjan region that lies along the Caspian Sea [Authors]
[18] Fig.2: Scattered settlement in Lahidjan region[Authors]
[19] Fig. 3: The arrangement of the windows that mostly opens to the south and southeast [Authors]
[20] Fig. 4: The formation of natural eaves in the gable roof to protect the wall surface against the rain [Authors]

ANNEXURE