

# Optimal use of Climate in the Construction of Traditional Housing as a Greenhouse in Iran

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**Abstract**—From a long time age, human beings have chosen their place of residence and comfort so that those places would have relatively ideal natural and climatic conditions. For this reason, from the beginning, the civilizations have been formed in the susceptible natural regions such as Mesopotamia in Iran and Nile coasts in Egypt. Also, the core of human density has been made in the form of an oasis in the deserts.

Regarding the formation and combination of the native architecture in different regions of Iran, we find that different properties of these climates have affected frequently the formation of cities and the architectural combinations of these regions. Thus, the precise determinations of climatic areas and attaining the climatic properties of different regions have a great deal of importance in presenting appropriate and compatible-with-climate designs.

**Keywords**—climate and architecture, energy Optimizing, Greenhouse

## I. INTRODUCTION

THE spread of urbanism in the present world has determined the provision of primitive needs of cities such as water, energy, green space, inter-city transportation, creating the maximum degree of urbanism tranquility and urban planning horizon. In each kind of urban planning, the items such as the natural and climatic circumstances of that region have been evaluated. Since different regions of Iran have been considered in this design and the basic topic is residence, which is the outstanding necessity of humans in the present world, the natural and climatic indexes of Iran and their relation with residence part have been considered. Regarding the climatic variety, all of the geographical structures of Iran have made various viewpoints. This climatic heterogeneity has a direct effect on the kind of urban and rural residences in each area. These climatic varieties are so that we can observe in different regions of the country, the residential buildings with air hole in the central desert areas, like Yazd with hot and dry climate, the buildings with muddy arches in the area of Abadeh county, like the buildings in desert areas of central Iran, and the human residences in cold and mountainous regions, like those in Hamedan and Ardebil. Thus, some studies have been done in these climates [1-2-3-4-5], but more researches should be done yet. The importance of climate effect on architecture requires the comprehensive researches and studies in this field.

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## II. MATERIALS AND METHODS

The presence of heterogeneous natural structures in Iran such as lofty regions, low coastal regions, fertile plains of central areas, deserts of central Iran and the deserts in the eastern part of the country, have made different climates which follow the variety of buildings regarding the favorable conditions of every climate in each region. This subject seems to be studied.

In this research, after the theoretical and precise study about different climatic regions of Iran, we consider urbanism and its kind, its location, materials in constructions with use of photographs. Some instances of the cities and houses in different regions of Iran which are different with each other regarding climate and architecture and located in mountainous, dry and warm and warm and humid regions have been considered in this study.

## III. FAMILIARITY WITH ARCHITECTURAL CLIMATIC FACTORS

A general factor which is almost applied to all traditional constructions of Iran is the homogeneity of residential places with climatic factors. Town texture, the form of construction and the kind of material are in complete compatibility with climatic conditions in each of these regions.

The factors affect the climatic conditions of a region:

- The angle of sun radiation
- The latitudes (high or low)
- Wind current intensity and the seasonal wind direction
- The presence of water; dampness
- The presence of plant
- Altitude
- Rockiness of lands

## IV. THE RESIDENCES IN DESERT REGIONS (HOT AND DRY)

The climatic condition of hot and dry weather is relatively cold in winters and relatively hot and dry in summers. Enjoying solar energy, reducing the heat loss of construction and proofing the effect of external hot weather and the intensity of sun radiation on the constructions are the basic aims of climatic design in this area. Wind hole can be considered as an inseparable part of constructions in these regions. The principles of its performance are as follows: it takes the favorable wind and conducts it into the main rooms of the construction, reservoir or cellar. Some air holes make inside the construction cooler through convection and the others do that by both convection and evaporation. The air

holes are usually made according to family consumption and need and certainly the more the entryway dimensions are, the more the bulk of ingoing air will be. The more height is also effective in better performance of air hole. The reason for that is the velocity difference of wind in different heights. In adjacency of the earth, the air velocity is zero and as we go upwards the air velocity will become more and more to reach to its constant measure. On the other hand there is lots of dust in adjacency of the earth which will reduce with increasing the height. Thus, with increasing the height we will reach to the air with much velocity and less dust. The entryway of the air hole is usually placed in the basement to enjoy the coolness of basement and provide the favorable space and appropriate condition. The studies show that Razjouyan (1990), Kaviyani (1993), the presence of yard in summers reduces the required energy for cooling the construction because the presence of pool, flowers and plants in flowerbeds make the air of room cooler.



Fig. 1 The way of yard position in the centre and using the air hole (Yazd, Iran)

The performance of arched-shaped ceilings are in a way that when wind passes from one curved surface, it reaches to its own maximum velocity at the upmost curved point and in contrast the air pressure will be lost. This pressure loss with regard to the air under the ceiling causes an upward power which makes the air to flow from the hole of the ceiling to the outside and ventilates it. Certainly, the arched ceiling does have an important function in reducing the heat transfer into the internal part of the construction.



Fig. 2 the way of using arched-shaped ceiling in the air holes (Yazd, Iran)

#### V. RESIDENCES IN THE COLD REGIONS

The western mountains of Iran which involves the western mountain foots of the range of mountains in the central plateau of Iran and throughout the Zagros Mountains are of the cold regions in Iran. The temperature oscillation during day and night is also more in mountainous regions. The winters are long, cold and hard and the lands are covered with snow in several months of a year. The springs are short and they just separate winter from summer. The precipitation is little in summer and much in winter which is often in the form of snowfall.

*The general climate of this region is as follows:*

- Deep cold in winter and the temperate weather in summer
- The high difference between day and night temperatures
- A heavy fall of snow
- Low humidity
- The mean temperature is 10 degree of centigrade in the hottest month of year in this climate and it is less than -3 degree of centigrade in the coldest month of year.

The high coldness of the weather in large part of a year in cold and mountainous regions makes necessary the maximum use of sun radiation, enjoyment from daily temperature oscillation, thermal preservation and not to allow the cold wind of winter to inter into the residential spaces. Thus, the form of construction is designed and performed in a way that it could resist high coldness. Since in mountainous regions, the weather is cold or very cold in most of the days of year, almost all daily activities have been done in rooms. Therefore, the yard dimensions in these regions are rather smaller than those in central plateau of Iran.

Another point is that the floor of the yards in cold climate constructions is 1 to 1.5 meter lower than the surfaces of the sidewalks. This makes the running water of the streams and creeks to pour down the yard flowerbeds or the reservoir in the basement. On the other hand, land likes a thermal insulator encircles the construction and prevents from heat exchange between construction and the environment and preserves the heat inside the construction. Also, the constructions have plain and dense texture. In order to transfer low heat from outside the construction form should be so that it could decrease its contact surface with the coldness outside the construction. For this reason they use dimensions such as cube or cuboids to decrease the proportion of external surface of the construction to its internal dimension and keep it to its minimum possibility. Therefore, in these regions, they consider the ceilings of the rooms in the lower level of those same rooms in other climatic areas in order to decrease the room dimension and minimize the external surface in proportion of the construction dimension. The low height of ceilings in halls, important rooms, arches and the market chambers of these regions are also famous. In these regions in order to avoiding heat exchange between inside and outside of the construction, the small skylights are used in few numbers. If the windows were big, the use of sunshade would be necessary. The skylights in the southern part are chosen bigger and broader in order to use sun radiation as much as possible. Also, locating these skylights in the direction of cold winds should be avoided. The thick diameters of these walls keep the heat exchange between inside and outside of the construction. The architectural criterion of the cold and mountainous climate is almost looks alike that in dry and hot climate and their only difference is their thermal resources which are from external part of the construction in hot and dry climate and from internal part of the space in cold climate. So, in this climate the diameter of the walls should be thickened with masonry materials so that this septum could be acted as a thermal preservation resource in the construction. The residences in the mountainous regions are often even. The choice of terraced roofs in cold climate does not make any problem because with keeping snow on the roofs, they are used as a thermal insulator against the external high coldness which is some degrees lower than the snow temperature.



Fig. 3 using the stony thick wall in order to make the thermal insulator (Varkaneh village, Hamedan, Iran)



Fig. 4 using the terraced roof and an insulator made of clay and straw (Hamedan, Iran)

#### VI. RESIDENCES IN THE HOT AND HUMID REGIONS

The properties of the hot and humid regions are the oppressive heat and relatively high humidity during almost half of the year. In order to confront this over heat and humidity, the two-side ventilation inside the construction is necessary and because of this reason the constructions in the hot and humid regions in the south of Iran are semi endoscopic and skylights were located on the internal and external surfaces of the construction. Winds in the coasts have an alternation of day and night. The direction and intensity of wind should be considered in the urban design because wind is effective in transference of sound, air pollution and smell. The use of wind should have the determining function in space and construction design and it should be conducted and controlled in a correct way. This is possible using the plants, land wideness, and the

adjacent constructions. The maximum use of cold winds should be done in the hot climate. This work is possible with the correct design of spaces and the forms of constructions.

There were some points which should be observed in order to provide the humans welfare circumstances.

- Forming the lofty ceilings for ascendance and convection of air upward.
- Installing the skylights around the external body of the construction in order to use the two-side draught.
- Locating the wide, long and lofty balconies in the direction of the main seraglio entryway or in three or even in four sides of it.
- Using bright colors; especially white for light and sun heat reflection and reducing the penetration of heat into the construction.
- Not to form basement because of the humid and heavy air that has penetrated into the basement and remain standing, also the high level of ground waters and the moist walls of basements which brings on a manifold causality.

Long windows and the use of day and night breeze between sea and land.



Fig. 5 Locating the wide, long and lofty balconies in the direction of the main seraglio entryway or in three or even in four sides of it

## VII. RESULT

With modern architecture and especially with the use of mechanical installations, the function of climate gradually faded, But from the second half of the previous century in which climate and environment have been considered continually, the use of technology compatible with the natural environment, the industrial wastage recovery and the usage of pure energies such as sun, wind and water becomes important. From that time up to now, regarding an environment and an effort in designing architectural and compatible-with-climate construction have been started.

## VIII. CONCLUSION

The constructions should be made according to the varieties of the climates in each region. Nowadays the technologies and new constructional systems are used in constructions regardless the kind of climate. These technologies should be investigated more and more in order to correspond with architecture and climate and the architects should be used and designed the systems appropriate to construction and the modern technologies and compatible with the social, cultural and climatic conditions of each region.

Thus, the importance of the effect of climate on architecture requires doing the comprehensive researches and studies in this field especially In Iran with the varieties of climatic circumstances, doing the broad researches in this field is unavoidable.

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