Analysis of the Role of Natural Environment in the Compatibility of Human Settlements with it “Emphasizing Application of Climate in Esfahan Rural Architecture, Iran”

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Abstract: Nowadays, consideration of the climate conditions is vivid in building design, especially in traditional building design. This research has been conducted to investigate how climate conditions are used in architecture and housing construction in Esfahan city. To do the research, meteorological data of synoptic station of Esfahan and a 30-year mean (1980-2010) have been used. In order to use climate in architecture, structural bioclimatic conditions of Esfahan have been obtained monthly based on Giovanni method. The research results show that in Esfahan city, the buildings in the months of January, February, and December have bioclimatic conditions outside H, H’ region, and in order to provide thermal comfort, heating mechanical equipment are required. In the month of July, bioclimatic conditions falls in V region and to provide comfort, an appropriate air conditioner in houses suffices. In general, in Esfahan city, we could provide thermal comfort with observance of authentic principles of architecture and using natural energy resources.

Key worlds: Architecture Climate, Natural Ventilation, Sun’s Radiation, Esfahan.

INTRODUCTION

Nowadays, human bioclimatic studies is a basis and foundation of so many regional development planning specially in the area of urban and settlement issues, and the results of such studies are utilized in human settlement in new regions and also development of the present settlements (Jahanbakhsh, 1998).

Nowadays, taking into consideration climatic conditions is vivid in building design especially traditional building design. Through changing outdoor environment, houses and buildings are considered as places for human comfort and safety (Kasmaei, 1984).

Climatic design is a method for reducing overall energy cost of a building. Building design is the first defense lines against outdoor climatic factors. Climatic design is looking after providing thermal comfort for human in houses. American Society of Heating, Refrigeration & Air-Conditioning Engineering (ASHRE) knows thermal comfort as mental conditions which expresses satisfaction from environment heat (Lin, 2008). In all climates, the buildings constructed based on climatic design principles, reduce the need to mechanical cooling and heating to minimum degree, instead they benefit natural energy existing around buildings.

Consideration of climatic conditions in architectural and building design is the subject matter of so many researches which clarifies its significance. Some of these researches are as follows:

In architecture and climate book, Kasmaei, (2003) studied climatic conditions, climatic parameters and the use of these parameters in construction. Ghobadian and Feiz Mahdavi, (2008) presented different methods for analyzing thermal comfort and climate control methods. Saligheh, (2004) has modeled housing compatible with the environment in Chabahar city. He has presented climatic design models compatible with the region climate considering sustainable forces such as sun and wind and using them for the improvement of thermal conditions and raising comfort indexes.

Gharaei and Javdni Khalifeh, (2003) have studied the use of climatic elements in the construction of settlements in mountainous and cold regions with the purpose of fuel economy optimization. They have shown that considering the problems in fuel delivery to these regions, and also trying to save fuel consumption, the use of traditional architectural methods compatible with region climate could be very effective in reducing consumption of fossil fuels specially oil products and optimization of such fuel.

Tian and Love, (2007), have conducted a field research on occupant thermal comfort and thermal environments with radiant slab cooling. Sakoi et al., (2007) have studied thermal comfort, skin temperature distribution and sensible heat loss distribution in the sitting posture, Spagnolo and Dear, (2003) have performed a field study of thermal comfort in outdoor and semi-outdoor environments in subtropical Sydney, Australia.

The purpose of the present research is to study and apply some climatic conditions in the architecture of Esfahan city for optimal utilization of natural energy resources.
MATERIAL AND METHODS

To conduct the research, metrological data effective on thermal comfort such as temperature and relative humidity of the synoptic station of Esfahan city have been extracted from meteorological station of Esfahan in a 30-year period mean (1980-2010) and then have been used. In the line of research title, in order to study how bioclimatic conditions of housings Giovanni method has been applied (figure 1). While showing human comfort regions more accurately, considering two factors of temperature and humidity, this method has also contributed different structural elements in adjusting thermal conditions of building indoor air. In this method, using bioclimatic chart, and considering thermal conditions and relative humidity, the quality of building indoor bioclimatic conditions has been specified.

Fig. 1: Giovanni Structural Bioclimatic Chart.

Findings:

Structural Bioclimatic Conditions:

According to Giovanni method, in Esfahan city, the months of January, February, and December fall outside H region. In H, H' region, the minimum temperature is so that there is no need for using heating equipment to provide indoor comfort conditions. However, beyond this area, in order to provide indoor comfort conditions, heating mechanical equipment are required. Therefore, in the mentioned months in Esfahan city, in order to provide thermal comfort conditions, mechanical heating equipment is required.

In this city, in the months of March, April, October, and November, bioclimatic conditions fall in H, H' region. In H, H' region, the minimum temperature is so that there is no need for using heating equipment to provide indoor comfort conditions.

In these months and during nights, by preventing penetration of outside air inside the building could maintain desirable bioenvironmental condition for people.

In Esfahan city, the months of May, June, August and September fall in N, N’ region. In these conditions, people feel comfort when they are in active or sitting posture at home. This region indicates tolerable thermal conditions in which air temperature is between 20-28°C and relative humidity is between 18-85%. In these bioclimatic conditions, people’s comfort is maintained and there is no need for cooling or heating equipment.

In Giovanni chart (v) shows conditions where air current and natural ventilation could be used for providing indoor favorable conditions. This char belongs to ordinary buildings. In Esfahan city, the month of July falls in this region. Table (1) shows structural bioclimatic regions in Esfahan city.
### Table 1: Structural Bioclimatic Regions of Esfahan City in Giovanni Method.

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<td>Bioclimatic Regions</td>
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**Conclusion:**

Nowadays, human bioclimatic studies is a basis and foundation of so many regional development planning specially in the area of urban and settlement issues, and the results of such studies are utilized in human settlement in new regions and also development of the present settlements. The purpose of the present research is to study and apply climate in the architecture of Esfahan city. Indeed, climate-architecture studies seek to provide housing compatible with climate in order to provide desirable comfort conditions for people.

Based on Giovanni method, in Esfahan city, the bioclimatic conditions in the months of March, April, Oct., and Nov. falls in H, H' region. In H, H' region, the minimum temperature is so that there is no need for using heating equipment to provide indoor comfort conditions. The months of Jan., Feb. and Dec. are placed beyond H region, so that in the mentioned months in Esfahan city in order to provide indoor thermal comfort conditions, heating mechanical equipment are required. The months of May, June, August and September fall in N, N' region. In these conditions, people feel comfort when they are in active or sitting posture at home. The month of July falls in V region where air current and natural ventilation could be used to provide desirable indoor conditions.

**REFERENCES**


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