

Investigation of Climate and Architecture of Sar'ain Touristic City

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ABSTRACT

One of the basic principles in designing a building compatible with climate is considering meteorological parameters. Importance of climate impact in architecture is studied in two scientific and theoretical parts. The scientific part uses statistics and climatic information of a particular region and climatic division and in theoretical part, the construction and framework is considered. The present research tries to investigate Sar'ain touristic city and factors affecting its touristic attractions. This research has been conducted in 2010 and presents 3 hypotheses. The present research is an applied one (from objective point of view) and it is a descriptive-analytical research from methodology point of view. Statistical analyses verified every three hypotheses and based on the results, finally some recommendations have been provided.

KEYWORDS: tourism, climatic conditions, dwelling design, Sar'ain city

1. INTRODUCTION

Today, in traditional architecture we observe that human beings have confronted rationally with their environment and stepped forward along with environment so compatibly that an appropriate space was created and all natural factors played a positive role in creating a favorable space. Impact of weather and climatic parameters on building design has become important today, because of reduction of resources in the world. Building designers (=architects), utilize all potential climatic features in order to use energy sources optimally and in this way, they ask help from climatologists. Establishment of thermal balance between human body and surrounding environment is a basic necessity for providing health and comfort for human being climate is an important biological factor which affects human behavior and temperament and mutual effects of human and meteorological system is very complex and they must be evaluated simultaneously (Jafarpour, 2000). In today's world, dissimilar buildings have been built in our country with copying western architecture incompletely and in various climates and traditional architecture has been consigned to oblivion thoroughly. (Mohammadi et al, 2004). Therefore, this dissimilarity between climatic conditions and buildings design was a motivation for this research in which the researcher tries to present an appropriate pattern for matching architecture with Sar'ain's climatic conditions.

Statement of the problem

Importance of impact of climate type on building design has necessitated comprehensive studies in this field. Therefore, climatic, micro-climatic, and meteorological data must be considered in building design in order to use energy in an optimal way. Accuracy and exactness of design capacity, design efficiency and building energy calculations depend on the quality of climatic data and information. Application of all weather information in order to get more energy efficiency in buildings and avoiding energy waste is essential especially in developing countries like Iran (Hosseinpour, 2007). Climatology is a branch of geography and tries to study weather elements and factors and phenomena in every region. In view of the fact that geographical position is the main factor in determining climatic conditions and characteristics, therefore weather conditions and relationships between them cannot be studied without investigating climatic elements and factors. The touristic city Sar'ain is located in north-western Iran and on the eastern slope of Sabalan Mountain or Savalan Dagh (= Sabalan mountain) and has cold and dry weather. Therefore, it needs providing heat, houses and dwellings heating system in more than half of a year which involves many costs. On the other hand, because of the presence of touristic attractions in the region which involves ongoing migrations and development of the city, construction of buildings and dwellings and infrastructure is required and this makes it necessary to conduct meteorological studies concerning dwellings design and architecture.

Research goals

The general goal of this research is to investigate climatic parameters influence on providing comfortable conditions for Sar'ain city. The subsidiary goals of the research are as follows:

1. Identification of bio-climatic conditions of Sar'ain
2. Investigation of compatibility level of buildings and climatic conditions of Sar'ain

3. Encouragement of changes in constructing dwellings in relation to climatic conditions in order to reach steady development and present a better pattern matching the climatic conditions of the city and gaining comfortable conditions.

Research hypotheses

1. Dwelling design pattern is not completely compatible with regional climatic conditions in Sar'ain touristic city.
2. Climatic Comfortable conditions of dwellings are different in different seasons of a year.
3. Assigning extra costs to the design of dwellings in Sar'ain can be justifiable in order to decrease heating and cooling systems costs.

Research background

Importance of climate in designing dwellings is undeniable and this has been dealt with more in developed and industrialized countries than in developing countries. In this field, many studies have been conducted and some of them are presented here as research background:

Siller, Minardous (Nazarpour, 2010: 9) proposed moisture and heat conditions scientifically in relation to human needs and climatic design and provided a bio-climatic table and its concerning curves. The mentioned research investigates phenomenon roles which are effective on comfort and the researchers have indicated comfort qualities in curves using dry temperature impacts and relative moisture impacts. Carl Mahani, (1971) provided some tables for calculating match level of buildings with weather conditions of regions. He presented day and night comfort region in tables investigated thermal condition of each month and its impact on building. In his table, wet and dry conditions different indices have been investigated and in every condition, some ranges have been shown. In spite of the fact that Mahoney provides building tables and suggestions concerning creation of thermal comfort, his research has some limitations like indistinct air flow speed in comfort region (Nazarpour, 2010: 9). Havard Krishfield (2000), deals with selection of a building place and considers the usage of local micro-climatic conditions as useful in providing comfort. He explains radiation, wind and buildings position and direction in controlling internal space heat and presents some solutions to use sunlight energy in order to warm houses (Gharebaghi, 2006: 27).

Kesmaee (1993) has provided Iran's vital climates divisions for using in dwelling design and architecture using bio-climatic table of building and statistics of 43 weather stations throughout the country. He has provided the first Iranian climatic categorization in relation to dwelling environments using Mahoney's method in 1993. According to his classification, Iran has been divided into 23 climatic groups.

Kaviani (1993) used statistics of 48 synoptic stations to divide Iranian bio-climate in Dey month to 12 types and in Tir month to 19 types and prepared human climate biological map based on Tarjoun index.

Najafzadeh (2008), evaluated human bio-climate of Tabriz and construction thermal requirements. In his research, after evaluating human bio-climatic range in Tabriz using Baker method, this city's bio-climatic conditions was analyzed through effective temperature method and finally, building thermal needs in Tabriz has been analyzed based on effective temperature.

Pourkhadem (2003) in his master degree thesis titled "climate role in forming and changing dwellings in Ardebil city" investigated regional climate compatibility with architecture.

RESEARCH METHODOLOGY

Research methodology was library and field method. In other words, this research is an applied one from objective point of view and it is a descriptive-analytical research from methodological and nature point of view. References, books and papers were used to study research background and literature. In order to analyze geographical conditions of the region, regional maps (1:50000) were used. Meteorological statistics and data were obtained from Provincial meteorology Office. Furthermore, effective climatic elements for analyzing regional weather were illustrated using excel software and Wplot software was used to sketch.

RESEARCH RESULTS

Hypotheses test

First hypothesis: Dwelling design pattern is not completely compatible with regional climatic conditions in Sar'ain touristic city.

As it was mentioned before, the main characteristic of growth and development of Sar'ain was haste and lack of planning in city development and presence of spa and echo-touristic attractions and pleasant weather and also presence of Sabalan Mountain has caused rapid growth. In the recent years, wandering investments have been illogically assigned to property seizure and dealing and consequently property price have increased a lot and luxurious constructions have been spread all over the city. Dimensions of windows are not compatible with climatic conditions and such windows have been installed in large numbers and in different directions. Heating

and cooling systems in all houses are new mechanical equipment which is operated by using a lot of energy. Because many dwellings do not have enough concordance with regional climatic characteristics, therefore the first hypothesis is verified.

Second hypothesis: Climatic Comfortable conditions of dwellings are different in different seasons of a year.

In view of the fact that, in Baker index, the months Azar, Dey and Bahman are in cold conditions and the months Mehr, Aban, Ordibehesht, Farvardin and Esfand are in mild stimulation bio-climatic conditions and other months have mild and pleasant environmental conditions and need sunlight in effective temperature index of months, so that from second half of Aban up to the first half of Farvardin the region is under cold bio-climatic conditions and Khordad and Tir are in comfort and Mordad is the hot month of the region and other months need sunlight for comfort. Furthermore, comfort conditions are different in different months based on bio-climatic characteristics of Olgi, Giuni, Mahoney and Trejeng. Therefore, based on different indices of architecture climate and statistical investigations and local studies in different seasons of Sar'ain city, it can be concluded that climatic comfort conditions and architecture conditions are different in different seasons of a year from human life and dwelling point of view, therefore the second hypothesis is verified.

Third hypothesis: Assigning extra costs to the design of dwellings in Sar'ain can be justifiable in order to decrease heating and cooling systems costs.

Although climate role was not considered in buildings design in the past with scientific approach, but constructions were concordant with local climate empirically such that the buildings were compatible with internal temperature in warm and cold seasons. Therefore it can be said that thermal insulators and other provisions can be used in new constructions in order to keep appropriate conditions in different seasons and investments and cost can be justifiable in the long run. Therefore the third hypothesis is also verified.

Conclusion

1. According to Baker index, the months Azar, Dey and Bahman are in bio-climatic region \square and have moderate to severe stimulation bio-climatic conditions and cold and relatively high pressure environmental conditions. The month Mehr, Aban, Ordibehesht, Farvardin and Esfand are related to X region that have cool environmental conditions and mild stimulation bio-climatic conditions and other months are located in B region which shows Sar'ain's environmental conditions are mild and moderate in these months and the region is bio-climatically favorable and comfortable.

2. According to effective temperature index, in some months the region needs sunlight because somebody with light clothing in his house and in relaxation and with little activity will not feel comfortable, so that the region will have cold bio-climatic conditions from the second half of Aban up to the first half of Farvardin and therefore sunlight will be necessary. However, in Khordad and a part of Tir, comfort will be present and Mordad is the warm month of year and other months need sunlight for comfort.

3. According to bio-climatic characteristics of Olgi in Sar'ain, thermal conditions do not have the required efficiency in the months Dey, Bahman, Esfand and Azar even in the warmest hours of day and this involves mechanical heating because the weather is cold. In Farvardin, Shahrivar, Mehr and Aban in the warmest hours of day, sunlight and suitable clothing will provide favorable conditions. For people. Ordibehesht, Khordad, Tir and Mordad are in comfort range and if a person is in shade, he/she will feel comfortable with constant air flow.

4. According to Giuni's index, Sar'ain is in N range in the months Khordad, Tir, Mordad and Shahrivar and is in H range in Mehr. That is to say, sunlight warmth and suitable construction material will provide a favorable comfort condition and other months are in H' range and this means the internal weather is so cold that it necessitates heating systems in buildings especially in cold months. Nights of all months have been categorized in H' range, therefore over these nights, utilization of suitable material that is compatible with climate will be effective in heating buildings.

5. According to Trejeng's index, Sar'ain is in K1 group in all months except Khordad. In other words, very cool bio-climatic conditions are prevalent over nights and days in these months. Khordad is in C2 group which shows prevalent cool feeling. In other words, Khordad has cool days and very cool nights.

a. Dey, Bahman and Azar are in group -d2 which indicate very cool days and cold nights. Khordad, Tir and Shahrivar in -b2 group indicate pleasant conditions with cool nights. Esfand, Farvardin, Mehr, and Aban in -c2 group indicate cool days with very cool nights. Ordibehesht in -c1 group has cool day and night. Mordad month, which is in -a3 group, shows warm conditions with warm days and cool nights.

6. Sar'ain evaluation based on Mahoney's index reveal that air thermal condition is cold over day and night from Mehr up to Ordibehesht and it has favorable comfort condition in other months' days but at nights it is cold.

In Mahoney's method, all months are in dry index A3 except for Khordad to Shahrivar when daily temperature is lower than the lowest temperature of comfort region in Mahoney's index and therefore severe cold will cause dissatisfaction and discomfort.

Considering Mahoney's method, buildings position is recommended to be designed in northern-southern direction and the longest axis is recommended to be designed from east to west.

1. Investigation of dwelling characteristics of Sar'ain, it was concluded that old constructions have been based on climatic conditions of the region and their position and direction have been facing south in order to receive the most sunlight. Walls material is mostly adobe with high thermal capacity, but the lower part of the walls have been made of stone and brick and the walls have considerable thickness in order to keep internal heat.

2. In the old buildings, windows have suitable vertical oblong size in order to use best from sun energy. Natural, climatic, religious and cultural factors have been effective in determining these buildings position and direction and they have been built regularly and they are mostly one-storey. Therefore, the old part of the city is densely-built and the buildings are close to each other because of the climatic characteristics of the region.

Recommendations

1. In order to reduce thermal waste and receive the highest sunlight energy, it is recommended the buildings be built so that they face south.

2. Windows must be designed south and in small to average size with vertical oblong shape.

3. Large windows especially in northern side are not recommended.

4. In order to reduce winds effect, it is better to design buildings in eastern and south-eastern directions.

5. All doors and windows must be insulated to reduce heat waste.

6. Suitable material with dark colors and with high thermal capacity must be used in order to control thermal flow of buildings.

7. The number of entrance doors must be located in higher positions with respect to building base.

8. It is necessary to install vertical sun-shade for windows in warm months of year in order to receive the least sunlight energy.

9. Windows must have thermal insulations and their number must be minimized in northern, eastern and western directions. In view of the fact that sun moves from south-east to south-west in cold months, it is better to design building's main rooms and windows in southern direction.

10. Greenhouse system is recommended to be used connected with internal spaces in southern part of the building.

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