

A Study of Traditional Urban Planning and Architecture in Dry and Warm Regions of Iran: Presenting Applied Techniques to improve Contemporary Urban Planning and Architecture

Mohammad Bahramzadeh^{1*}, Bahador Sadeghi², Sasan Khanboluki³, Abdollah Nasrollahi⁴

¹ Faculty Member of Archeological Department and Assistant Professor in Department of Restoration and Revival of Historical Monuments, Islamic Azad University, Abhar Branch

² Assistant Professor and Faculty Member of Humanities Department, Islamic Azad University, Takestan Branch

³ M.A. Graduate of Restoration and Revival of Historical Monuments and Lecturer in Payam-e-Noor University of Tehran

⁴ M.A. Graduate of Restoration and Revival of Historical Monuments

Received: June 10 2013

Accepted: July 10 2013

ABSTRACT

Dry and warm regions which are also called plateau plains form a major part of our country. They are significantly in eastern and central regions and generally involve one seventh of total area of Iran. Therefore it will be evident that study of urban planning and architecture of these regions is necessary. Such studies create various complicated factors related to architecture and urban planning. Partial knowledge of these forming factors and their effects is essential to understand appropriately physical construction and identification of real spatial values. Weather and climatic conditions of desert regions, even in normal conditions, make the life difficult for their residents. Iranian architects precisely identify this climate and take some innovations to provide comfort for residents of these regions as much as possible. This paper aims to study climatic characteristics of this region and to discuss indicative elements, urban planning and architecture, and to investigate indicate elements which are effective and useful for Iran's consistent architecture in order to contemporary urban planning and architecture.

KEYWORDS: indigenous urban planning and architecture, climate, contemporary urban planning, consistent architecture.

1. INTRODUCTION

Most parts of Iranian plateau are dry and warm. Although there are four mountains in Iran-Alborz in north, Zagros in west, central mountains and mountains in east- which are effective n adjustment of thermal status of their surrounding cities, they are located in relation to internal deep-set area is so that they can separate a wide area from the seas.

In Iran, rain is directly related to the status of these mountains and it is gradually decreased from western north to eastern south, therefore, environmental conditions become worse and the population will be reduced.

Low-lying basin locating in different Iranian mountain lines influence significantly living environment of the adjacent urban and rural areas, thus they present an appropriate area of research. One of the basin whose specific territorial and climatic properties and its size have greatly influenced architectural composition of adjacent cities is Lut Saline Desert and low-lying lands of Kerman and Yazd as a triangle-shaped area (Tavasoli, 1982).

2. Climatic Features in Dry and Warm Regions

In central parts of Central Plateau, the daily temperature is as highly as 70 centigrade degrees which in night reaches to -10 centigrade degrees. In the afternoons, the earth becomes hot and the scattering winds disperse the running sand and dust. Hills of running sands with total surface area of about 5 millions m³ destruct anything in their way and bury under the bulks of sand.

Raining, in such regions is a rare phenomenon, thus living in them is too difficult, if not impossible, for this reason, they are called dry desert climate. Definitely, the Loot Desert in the hottest zoon in this climate of Iran which is located in the center of this wide plateau and its area is about 5 millions m³. There may be possibility for living in some parts of mentioned lands in the margins of the desert. Obviously, more further from the central core of the desert and nearer to it margins, colder climate we have due to cold winds from above-mentioned mountains; therefore weather would be colder and the temperature would be milder (Zomarshidi, 2001, 17).

The following diagram summarizes the general weather features of dry and warm climate

*Corresponding Author: Mohammad Bahramzadeh, Faculty Member of Archeological Department and Assistant Professor in Department of Restoration and Revival of Historical Monuments, Islamic Azad University, Abhar Branch. mohammadbahramzade@gmail.com

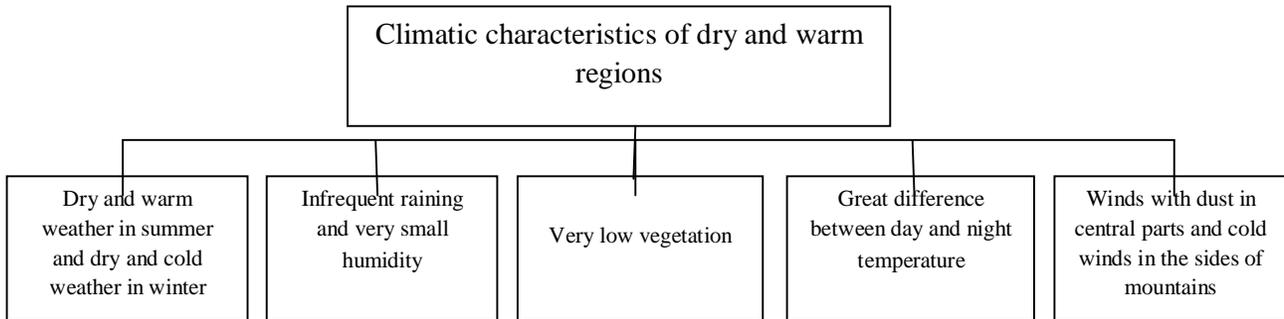


Diagram1. General weather features of dry and warm regions.

3. Indigenous Architecture of Dry & Warm Climate

There are some special techniques to provide suitable living conditions in such climates which will be discussed in below:

1. The buildings are constructed as compact and dense plans with thick walls made of mud-bricks (figure 1).



Figure1. Urban context of Semnan in which we could see the compactness and density of the building,

Reference: Dr. Izadi's Archive.

2. Due to the great populations of white ant, the coverage of building is vault and dome which are selected to have low and same heights.
3. Mostly deep-set lands are applied for housing so that the temperature of the land in summer and winter can influence the temperature of residential places.
4. Façade of these building is made of a mixture of mud and straw and thatch or wire mud with a light color.
5. There are a few windows and most of the doors and windows are made of wood. A network brick shield is usually made in front of the windows to prevent dry winds in summer and winter.
6. Sunshades and consoles in the façade and roof decrease the warmness during day and coldness during night.
7. Roof design of these building could reduce the relationship with internal spaces. This relationship is carried out through some channels because direct current in the internal spaces is very small. Yet, high and widespread windcatchers with connector channels create cold wind from wind blowing and transfer it to the middle parts of the building to provide comfort for the residents.
8. Garden holes, large yards with water pool and large gardens throughout the pool, plants, flowers and fruit trees particularly pomegranate, all make the air humid and decrease the temperature in external spaces of the building which in turn can reduce the temperature of internal spaces (figure 2).

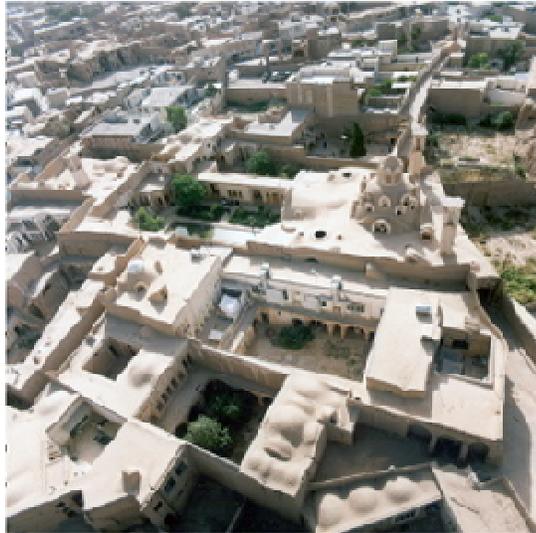


Figure 2. Old context of Kashan; the picture shows houses with central yard and garden hole. Reference: the authors' archive.

9. In indigenous architecture, there is a corridor (entrance hall) between alley and yard. The level of corridor is either the same or a few stairs upper than the level of yard. Corridor is related to the level of alley or street through a few stairs so that yard is located lower than alley and/or street. Surely this corridor can prevent direct movement of the wind from alley to the yard and it also prevents from intensive current blowing and whirlwinds. This difference between the level of yard, building, and alley or street serves as a shield against intensive current and warm winds and prevents them from entering the building. It should be noticed that corridor can be constructed both as an external space and within the yard (Zomarshidi, 2001, 18).
10. The establishment direction of building in these regions is toward south or eastern south. This direction, in terms of control and decreasing warmth of sunlight radiation in afternoons and prevent it from entering the house, is the most appropriate direction (Ghobadian, 2003, 20).

The following schematic diagram 2 presents indicative features of urban planning and architecture:
Indicative features of urban planning and architecture

1. Form of the building
 - i. All buildings are constructed as introspective and enclosed,
 - ii. All buildings have central yard and most often they also have underground, porch and windcatcher,
 - iii. The floor of the buildings, specially yard, is lower than the level of the alley,
 - iv. Rooms have long height and thick walls,
 - v. Ceilings are often vaulted and domed,
 - vi. The alleys are narrow with sunshade,
 - vii. Density of urban and rural context is high.
 2. Properties of urban context
 - i. Least ratio of external surface to volume,
 - ii. Most open surface toward protected scope (central yard),
 - iii. Connected buildings in which the directions of sunlight and wind are adjusted.
- Diagram 2. Indicative features of traditional architecture in dry and warm regions (the authors).

4. Study of indicative elements in shaping indigenous urban planning and architecture in dry and warm regions

Indicative elements which play a major role in forming urban planning and architecture are: 1. Alley, 2. Vaulted and domed ceiling, 3. Yard and porch, 4. Windcatcher.

In addition to above mentioned elements, plant coverage and application of appropriate material have an important role in adjustment of energy and providing comfortable living conditions for the people of this climate.

1.1. Alley

Narrow alleys are an indicative element in urban planning of desert regions. Some of the alleys are covered with a roof and are surrounded by high walls in two sides, thus they could enjoy a great deal of shadow and protect passersby from radiation of sunlight. Moreover, architecture of these alleys relatively prevents currents with dust (figures 3, 4).



Figures 3, 4. An example of alley in dry and warm regions (reference: Dr. Izadi's archive).

1.2. Vaulted and Domed Roof

Domed roofs due to their prominence are always exposed by blowing breeze. It is effective on decreasing the hot temperature of the roof due to extensive radiation of sunlight. At night when the roof releases some heat, it will return faster. At domed roofs, intensity of sunlight radiation is not same in all points of the roof surface, hence it is useful for lowering temperature under the dome, especially if dome have also a stem (figure 5). From the geometrical perspective, area of a semicircle dome is approximately three folds of its base surface. Thus, intensity of sunlight radiation on the rounded body will be decreased and the temperature of the lower parts of domed vault will also be reduced. On the other hand, radiation heat has less influence on the domed body due to its prominence exposure to the breeze than it does one flat roof. Rounded shape also is suitable for emitting thermal radiation at night and preparing cooling operation during night. It means that it could emit the heat released by the building in a better manner (Tavasoli, 1982, 67).



Figure 5. Sirjan market, Kerman (reference: Dr. Izadi's archive).

1.3. Yard

Yard is an important component in organizing various spaces in different seasons. Connecting-moving function is among other features of the yard. Its shape is usually four-sided quadrilateral but in some houses it is constructed as eight-sided.

Yard and its internal components are constructed in two following methods:

- In their longitude axis, flat yards usually have a pool and there are two or four gardens in the parallel of pool. Pools and gardens are also designed beautifully and variously (Memarian, 2006, 113).
- Yards consist of garden holes; examples of such yards could be found in Naen, Kashan and other cities of desert regions. Garden holes and their surrounding space have functional role of a part of underground spaces. In this case, spaces of ground floor are established around terrace, therefore garden hole due to its depth and green trees can create a cold place (Nayebi, 2002).



Figure 6. Old context of Birjand, South Khorasan. Buildings have central yard (reference: Dr. Izadi's archive).

1.4. Windcatcher

Windcatcher has been a component in Iranian architecture for a long time. Windcatchers were constructed in central and southern cities in Iran which were different in terms of shape, height and desired direction of wind.

Windcatcher captures the desired wind and directs it through main rooms of the building, water reservoir and/or basement (Farokhyar, 1990).

Windcatcher are usually one-sided, four-sided or eight-sided. While in Yazd, all windcatchers are tall, four-sided or eight-sided, in Meibod located in 50 kilometers from the west of Yazd, windcatchers are constructed short and one-sided, because in Meibod, desert winds with dust blow from desert and people have to make the windcatchers back to these winds and toward the desired wind. There is less desert winds in Yazd, for it is located between two mountain lines. Therefore windcatchers of Yazd could be constructed with long height and multi-sided (Pirnia, 1992).

In some cities like Gonabad, Khorasan, even the desired wind blows with dust; thus windcatchers are constructed with an embankment space under them. Channel base of windcatcher in this part is made slightly wider than its upper base so that wind speed will be decreased and dust will be trapped in it. After entering windcatcher entrance and crossing from embankment space, the wind will be filtered and entered rooms.



Figure 7. Four-sided windcatcher (Reference: authors' archive)



Figure 8. An example of windcatcher, Sirjan, Kerman (Reference: IranDeser.com)

2. Tree, Plant Coverage, Water

Combining water and plant coverage in this climate plays an important role in providing comfort for people. Plant coverage in the yard and in garden hole prevents from entering winds with dust. Water

besides plant coverage slightly humidifies dry and warm weather and makes the weather desirable for the residents.



Figure 9. Taheri's house, Semnan. (Reference: Cultural Heritage Archive of Semnan)



Figure 10. Abbasian's house, Kashan. (Reference: Cultural Heritage Archive of Kashan).

3. Construction Materials

For centuries, mud-bricks and mixture of mud and straw have been used as construction materials in cities with dry and warm climate and generally in villages of Iran.

Materials made of mud have been used in desert regions for climatic, applied and technical reasons. Due to boiling summer heat and intensive sunlight in desert regions, only a few materials such as unfired mud-bricks can resist. It also makes the rooms warm with a little heat in dry cold season. Ease of application and use of these materials is also among the reason for their frequent application. In technical terms, unfired mud-bricks combined with a mud mortar are stronger than bricks combined with mud mortar. Bricks are not suitable insulators for intensive sunlight radiation and they could not be used with mortars of plaster and dirt, because such mortars are easily disintegrated by heat and radiation of sunlight (Zomarshidi, 1998, 63)

The main mortar for unfired mud-brick was mud to which-if necessary- small amounts of lime were added. Mud-bricks were plastered with other mud materials of which mixture of straw and mud, finishing mud were the most frequently used and thatch and wire mud was the most beautiful one.

The light color of mud-and –straw mixture reflects radiant heat. In spite of their viscosity in thin walls, mud-and-straw body and cover are not so much resistant against vibration and easily destructed (Ghaffarisadeh, 1995). It is evident from destruction of cities made of mud-bricks such as Kakhak, Ferdows and Bam and many more villages throughout Iran by earthquakes that mud-bricks and mud-and –straw mixture were not appropriate materials. If the reapplication of mud-bricks and mud-and –straw mixture is the only option, their resistance and strength as well as building composition against vibration have to be considered as a scientific-practical issue.

4. Conclusion

This paper tried to study the properties of urban planning and architecture of dry and warm regions as well as indicative elements of this climate. Each of indicative elements of traditional architecture of this climate is also potentially effective on contemporary urban planning and architecture. Unfortunately, traditional architecture isn't considered so widely in designing of present urban contexts, and if there is any consideration, it is entirely superficial and symbolic. This paper sought to present effective techniques to efficiently decrease energy and to provide more comfort for people of desert regions. To this end, it studied indicative elements of traditional urban planning and architecture and features of dry and warm climate.

Following are some suggestions:

- design and execute alleys with respect to climatic conditions (such as width of alleys, height of walls, kind of materials)
- housing with special attention to climatic factors such as solar radiation, direction of desired winds, etc.
- application of construction materials with high thermal capacity
- application of plant coverage compatible with climate in the yard

- construction of pool in the yard
- application of double glazed windows
- use of small opening applications

REFERENCES

1. Tavasoli, Mahmoud (1982). *Urban Planning and Architecture in Dry and Warm Climate of Iran*. Tehran, Peyvand Publications.
2. Pirnia, Mohammad Karim (1992). *Techniques of Iranian Architecture*. Tehran, Islamic Art publications.
3. Zomarshidi, Hossein (2001). *Iranian Architecture (Execution of Building by Traditional Materials)*. Tehran: Zomorod Publications.
4. Zomarshidi, Hossein (1998). *Iranian Architecture: Study of Traditional Materials*. Tehran: Zomorod Publications.
5. Ghafarisadeh, Ali (1995). *Ecology of Ancient Cities in Central Iran*. *Saffeh*, No.19 and 20 (Fall and Winter of 1995, pp.4-19).
6. Farokhyar, Hossein (1990). *A Study of Historical Monuments of Kashan*. Tehran: Moalef Publication and Cultural Heritage Organization of Kashan.
7. Ghobadian, Vahid(2003). *Climatic Study of Iranian Traditional Buildings*. Tehran: Publications of University of Tehran.
8. Memarian, Gholamhossein (2006). *An Introduction to Residential Architecture of Iran*. Tehran: University of Technology and Science.
9. Nayebe, Fereshteh (2002). *Living in Yards of Iranian Traditional Houses*. Tehran, Nazhat Publication.
10. www.irandesert.com