



ORIGINAL ARTICLE

Green and Sustainable Iranian Traditional Architecture and Structure

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ABSTRACT

To make adjustment with nature in architecture, Iranian native architects in different climates of Iran have created lots of innovations. Air traps, undergrounds water reservoir and ice chests are some samples of these sustainable innovations. In a vast country such as Iran, with different climatic area, traditional builders have presented a series of logical and scientific solutions for human comfort. Sustainability in architecture means preventing constructions for the future, in terms of physical persistence planet protect conserving on energy resources. In this case, it seems that sustainability would be based on the introduction productive models in which available materials and also resources are used more efficiently. This paper concentrates on the results of sustainability provided by climatic elements in Iranian traditional architecture which the focus on hot and arid region.

Keywords: Sustainable architecture, Iranian architecture, arid regions, Environmental

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INTRODUCTION

First of all we need to concentrate on architecture in all over the world, soon we will figure out that there is a gap between scientific fields and professional executives in architecture. In Iran for many years architects have performed traditional works in traditional way, they believe traditional architecture is suitable for all aspect of country members like their behavior, culture and also their beliefs. Nowadays there is a real contestation among architects, Lots of them try to design and create a way to produce a model which society wants but with the focus on modernity.

Sustainable architecture can provides different advantages, but the main goal of sustainable architecture is reducing energy. Therefore, problems and precautions in design and construction have never changed totally, although a lot of development and progress has been seen in materials and technology. When "sustainable design and construction strategies for Iran" are under scrutiny, then it is possible to observe how traditional buildings and settlements in this region design and construction could be integrated in today's design practices. [1]

By paying attention on Iranian traditional architecture we could confirm that its fact suit buildings in best way in sustainability and in correspondence to the local cultural, behavior, topographical and climatic conditions which have the least conflict effect on environment as well as design compatible with nature by obeying its rules. Therefore, being in a harmonic architecture with the regions, "the old habitable states and cities have been serving both as a residential complex and as an answer for material, spiritual and cultural needs of indigenous people." [2]

In this paper we introduce some of Iranian traditional and sustainable features in old buildings in and try to suggest some unique ways to have these elements in our modern buildings again.

Some sustainable features of traditional architecture in arid regions of Iran:

Central courtyard

In hot area, almost all building is semi- introvert and rooms look upon the surrounding central yard. In this climate, Windows are made high and long with broad Ivan looking on the lanes spaces or with squares in second floors and particularly in third floors. They all account for mutual ventilation in heat if

one leaves the windows looking on the courtyard, he will make it possible for the natural two-sided air current to flow freely. This will slump down the intensely high temperature in interior spaces of building. "Shaping minor divisions of urban context has obeyed from organic order, while the empty cores within these components have been formed from regular forms in relation with the quadruplet directions. [3] Another difference is that in humid regions, the central courtyard is designed as more compact, and smaller. One reason for it is facilitated way of trees irrigation and permanent predominance of shadow in hot season. The traditional Iranian courtyard is an example of the void in architecture. As a matter of fact "negative space" of the courtyard, surrounded by rooms as "positive". [4]



Fig.1 Iranian courtyard

Sabat

In the design of traditional houses in the hot and arid area in Iran, there are several precautions taking against the hot climate. Houses are isolated from the street and surrounded by high walls. During the day, external walls of houses provide generally shady areas in narrow streets and especially in courtyards. By means of heavy and thick walls, warm environment in winter and cool environment in summer could be provided easily. One noticeable and conspicuous of urban planning in old location in cities with hot-dried climates is the roofed lane and porches passage. It is called sabat (fig2). A sabat is designed in order keep safe human living in desert from direct radiation of sunlight in shade for some moments. In fact, Iranian architects, in the same instances, built houses up to somewhere lying on the lane and began to build one or more protruded rooms with same eaves above the passage all commuting was made under these rooms called sabats. A sabat can modulate a transient temperature. It is such a way that any pedestrian on his way to his destination is positioned in shade in a suitable succession. In many sabats, there are several integrated entrances of houses that are of highest importance in view of improved sense of neighbored and local correlation. [5]

Debate is more usually laid up from blind alleys. A string gate is also more usually fixed at its entrance. Such space is commonly called "darband" that is in sum, wholly suitable to provide added security for the occupants across the lane.



Fig.2 Sabat

Structure

There had been numerous creative climatic planning in order to use energy efficiently. Studying of these and combining them with new climatic systems can be a proper way to make the building more sustainable. Regarding the four climate regions Iran, there are different adopted architectural approaches on the basis of the best ways of efficiency and sustainability by using the best combination of vernacular materials. The important point in using such materials is their environment friendliness. [6]

In arid and hot climate some other precautions against the solar radiation are:

- 1- Minimization of the number and the area of windows;
- 2- Construction of a window at a high level to obstruct the floor radiation;
- 3- Reduction of the absorbance of the facades by light colors;
- 4- Providing natural ventilation particularly at night;

- 5- Constructing a part of the building into ground which is to be always cooler than the outer ambient temperature in summer.

MATERIALS

In hot and humid regions some materials have been used (are used) that each has a lower thermal mass and has the capability to store and keep as reserved the volume of heat neither. For this reason, wood, as an example, is considered to serve as a good material. However, since in these regions, there is little grass covering, wood was merely used for roof framing and windows or doors woodworking. And in making other parts of building uses are made of native and local materials existing in any region there such as adobe, baked brick, brick and alluvial rocks, marine coral stone and reed. As these kinds of stones (rocks) are porous and they can be used as good thermal and acoustic insulators. [7]

Wind catcher

One of the traditional elements which is an architectural masterpiece among Iranian sustainable features in buildings and used in ancient times is wind catcher. Wind-Catchers are built in the direction of the most strong and pleasurable winds. Traditional wind-catchers have various types they are in 1, 2, 4, 6, 8 sides or sometimes they are circles which direct the wind through its way (fig2). It is used to dislocate, move and cool spontaneously the internal air of buildings by employing wind blow and varied air temperature. [8]

A wind catcher is a vertical canal that is drawn up in plans in the forms of square, oblong, octagon or circle. It is made up of two parts: Internal section of canal that takes its start from the ceiling and leads down to basement and external part that consists of entry pores or holes for the wind to blow in and it is laid up on roof. The way a wind-catcher works is mainly based on taking the fresh air into the building and sending the hot and polluted air out, or the suction functions. In the system of a wind-catcher we could see its intelligence in agreement with climate and of course it's a very good example of clean energy. In ancient times and in traditional buildings in arid and dry regions the air trap functioned like the present modern air conditioning system. [9]

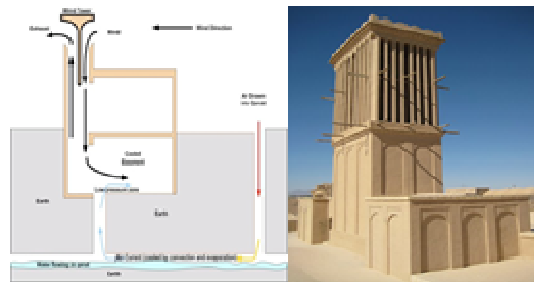


Fig.3 Wind catcher in Yazd

Spaces

In cities and towns with hot and humid climates, spaces are organized around central courtyards and within the limits of at least two stories of building. No basement has been designed for houses in this region for their proximity to the sea, higher levels of ground water and immense humidity of air. Ground floors, were used as facility spaces such as kitchen, foodstuff room and probably rooms to store provisions. First and second floors feature living spaces such as living room, bedroom, drawing room and etc. [10]

Developing living spaces in upper stories was to both create much better air current to cool the internal spaces and augment privacy by installing top window in upper stories. Rooms rise to 4 meters and sometimes more. The reason for it is that convection ascends writhing internal spaces to decrease eventually the air temperature at lower height. Furthermore, air in the room is ventilated by windows on both sides of room. [11]

Ivan is one important space in houses in a hot and humid region. Broad and high verandas (Ivan) around central court yard are used as living spaced during half period of year. The reason is that it has both air current with good ventilation and good shadow.

RESULTS

The effects of Iranian traditional sustainable elements on weather degree in city of Yazd in Iran

There are three elements (Central court yard, Sabat , Wind catcher) that play such an important role for controlling the weather degree in Arid region of Iran especially in central part of Iran like Yazd. I started processing the weather degree in city of Yazd in first of August in 2014 and focused on those elements.

Table 1

Effects of Iranian traditional sustainable elements on weather degree

Name of elements	Degree in 12 am	Degree in 6 pm	Degree in 12 pm
Nothing	42	39	33
Central court yard	41	37	30
Sabat	41	38	31
Wind catcher	40	36	29

CONCLUSION

Iranian vernacular version of architecture and urban planning in hot and humid climate is a representation of logical planning version for providing all living comforts there. [12] Sustainable architecture has a main role in the world of architecture nowadays. In any parts of the world architects try to suggest methods to use energy efficiently. Human is worried about energy for next generation, in the other hand culture and civilization of every society are of valuable things that every nation have. Nations like to keep and improve positive points of their culture in any part. Iranian traditional architecture has valuable features which could reflect Iranian culture in best way.

Iranian traditional building, architectural or structural aspects, have all taken shape based on natural sources of energies. These building have been designed in such a fashion to take in maximum sunlight in winter and maximum shade in summer, for better natural ventilation and good comfort.

The researches have shown that these elements of Iranian architecture could meet with needs and demands of their own age and adopt themselves with the identity, culture and climate of their regions by suggesting new ways to transfer sustainable elements our modern buildings.

The experiences at the 20th century showed us that we couldn't forget all our historic solutions, it means that instead of inventing new methods revising ancient and historic discussions can be more useful.

This manuscript let us say that the Iranian traditional architecture in a hot and humid climate is considered a sustainable version of it and can be, thus, used as a good model for designing in Contemporary architecture.

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