

Wind Catchers in Desert Regions for Making Green Buildings

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Abstract— Air conditioning system of a building is one of the major elements to be considered in houses and work places. If it is not designed properly and principally, it will cause the waste of energy and the increase of maintenance cost of buildings. Nowadays in the construction of green buildings it is attempted to provide natural ventilation as much as possible.

In designing houses Iranian architects have paid a great attention to the factor of making use of more shaded area in hot season and insulation of wall and ceiling against influence of hot weather and also air circulation inside the building. In order to circulate the air inside closed spaces and decrease the temperature, they have considered different winds which blow in Iran and its effective power, and in order to make use of it they invented wind catcher. Direction of wind blow and its height from the earth as well as the time and duration of wind blow and other factors have been effective in making different types of wind catchers. Using wind catchers has been and is prevalent mainly in central and south regions of Iran, coastal areas of Persian Gulf, and horasan, especially in cities like Yazd, Kashan, Bam, Abarghoo, Jahrom, and Tabas.

Keyword—Air conditioning system, Desert Regions, Green Buildings, Wind Catchers.

I. INTRODUCTION:

Especially climatic condition of Iran, the weather of a great part of which is dry and in some other parts sultry, has been the major factor in developing and making use of different methods of decreasing temperature inside residential places. Using cooling systems and gas coolers as well as CFCs in refrigerator, freezer, and refrigerants will cause the increase of greenhouse gases and greenhouse effects which will consequently damage the environment and cause warming of the earth which is in contrast with the principles of green buildings (1-3).

One of the principles for societies' development is the requirement to consider past experiences. Man should always take advantage of the predecessor's experiences and analyze their works and methods. The predecessors have had a more friendly relationship with nature and their lives less damaged the nature, and it is one of the elements of green building. One of the things the ancients have observed in regard to green building in their houses, stores, sacred places, etc... was using wind-catchers as an air conditioning and cooling system which can be considered as the first foundations of green building.

Yazd is the first city of mud brick and the second historical city of the world (after Venice). It has been located at the center of Iran in the middle of vast plains. The weather in Yazd is hot and dry in summers, and cold and dry in winters. Temperature difference in nights and days sometimes reaches to 28C°. The people of Yazd have reached some solutions to control climatic conditions to decrease annoying climatic effects. From among these solutions we can mention: constructing houses next to each other, making tall walls, using

mud brick, thatch, constructing domical arches, cellar, wind catcher, etc... which are the devices to control the adversity of hot weather in summer and cold weather in winter. Among the mentioned items, wind catcher has more efficiency in modifying climatic conditions of the region to the extent that it can be said that the cities and villages of desert regions breathe with wind catcher. In this type of architecture, wind catcher has been used to attract wind flow and make the inside environment cool.

In this article, the role of wind catchers in air conditioning and cooling houses and places without energy consumption as one of the major principles of green buildings has been studied.

II. CONSTRUCTION AND FUNCTION OF WIND CATCHERS:

The method of using wind factor in wind catchers is that they construct quadrilateral or maybe octagonal tall and narrow tower-like constructions on the roof of buildings and leave its top part open on four sides. Above the four or maybe the eight openings is closed towards the sky but open and unblocked towards inside the building, cellar or cistern.

Meanwhile, they divide the inside space of the tower-like building into four parts by oblique brick septum and fans in a way that in the upper space of the mentioned building wind enters the opening of the direction to which it blows and since the oblique septum and fans inside the wind catcher are continued downwards, the wind is also dragged downwards and reaches inside the building and the air goes out from the other side and it leads to wind blow and air circulation inside the building.

Here it is to explain that some wind catchers make buildings cool only through circulating the weather and some other wind catchers do the same both through air circulation and evaporation. Cooling system of the wind catcher of Dowlatabad garden works based on the second method. Air flow after entering the building passes over a stone pool and fountain and then it is directed to other rooms (figure1).



Fig 1. Cooling system of the wind catcher of Dowlatabad garden

The room under the wind catcher in which there is the pool and fountain is octagonal and has several doors. Whenever it is needed to cool a especial room, they open the door between that room and the octagonal room under the wind catcher.

III. USAGES OF WIND CATCHERS

Wind catchers differ from each other in regard to the form of cross section area, cross section area, height, side area, number of bases and fountains, type of decoration, plaster works, and etc... . Wind catchers are made not only for residential houses but for gardens, mosques and also cooling the water in cisterns. Between one to six wind-catchers are observed in cisterns of Yazd. Wind catchers have also the role of preventing water in cisterns to be stagnant. For this purpose, the wind catcher should be constructed on the pool of cistern in a way that it predominates over the water; otherwise, the water would become bad tasty and smelly. However, designing wind catchers in comparison with pool of cistern calls for architectural skill and experience.

Wind catchers are also constructed at the top of mines for ventilation. From among other specifications of wind catchers we can mention its chimney effect. At the times when there is no wind, the hot weather inside the building ascends and is transferred to outside the building through wind catcher and in this way an airflow is established inside the building though its intensity is less than the times when wind is blowing outside the building [4].

IV. RESULT:

Wind catcher and air duct on roofs or vaults are indispensable parts of cisterns in central regions of Iran. Humid environment of cisterns makes the water cool using airflow. Number of pools of each wind catcher has a direct relation with the size of wind catcher, and on the other hand, number of pools of each side of the wind atcher is in a close relationship with the intensity of wind in the same side and in general with weather of any region.

One of the problems in regard to wind catchers, is that despite all schemes, still some dust enters the building. Besides, birds, vermin, and insects enter the building through the wind catcher. Furthermore, it is not possible to completely control the airflow, level of humidity and coldness. Therefore, wind catchers have been gradually replaced with water coolers in central parts and gas coolers in south regions of Iran.

V. CONCLUSION:

A solution should be found for the problems of using wind catchers in hot and desert regions in order to encourage people to use them, though using wind catchers can not become as prevalent as before, and it is not possible to provide ventilation and cooling system for building only by wind catchers, but it is still possible to use wind catchers as a supplement for ventilation and cooling system of buildings. Wind catcher can provide a desirable environment inside buildings in some seasons of the year through natural ventilation, and only at the times when wind blow can not meet the inhabitants' needs anymore mechanical installations should be used.

If only the symbolic aspect of wind catchers is considered and they have no function, this valuable relic would gradually become eliminated from the visage of new and old textures of cities.

Culture and principles of green building should not be executed only in large towers and public departments, but also it should be observed and its culture should be established all over the society. Each house can direct the society towards becoming a green society with green buildings through making use of wind catcher as a supplementary device for air conditioning & cooling system, and even by replacing standard incandescent bulb with a energy saving one.

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