



Wind catcher technology (Past and Present)



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Abstract

Wind importance in construction and plan has been considered from old ages. Aristotle and Vitruvius, the Russian architect, talk about utilizing wind in architecture and city plan during 4th century BC and 1st century BC respectively and in our country all monuments were constructed regarding the environmental and weather condition from very old ages. Iran's people, especially those living in desert and hot weather cities of south were the inventors of the styles to protect against the troublous hot weather. Apart from technical and aesthetical aspects, this architecture is known as "Art of living". One of the typical indicates of these cities is the existence of windcatchers and sunshades which differentiate visage of south cities from others. In fact, windcatcher is considered as the respiratory system of spaces. Most of the windcatchers belong to old residential buildings, but they can be seen on top of some mosques, water reservoirs and old palaces.

Key words: windcatchers, IRAN, Technology,

Introduction

Since windcatchers are placed in the highest part of a construction, the place most prone to destruction, it is difficult to trace its origin. Its antique and different names including WATFER, BAAD HANJ, BATKHAN, KHISHUD, KHISH KHAN, KHISHUR, etc. shows that it is a very old construction. At the same time the historical and literally documents prove its use in Iran before the Arabic countries beside Persian gulf and the natural ventilation and use of non-mechanical cold making system by utilizing windcatchers as an indicator and main element of Iranian architecture is undeniably well-known all over the world. Windcatchers make the air to circulate inside a dwelling and by contacting moisture-making elements such as pool, garden, trees; land surface, stream and aqueduct compensate lack of humidity and provide a pleasant environment to live in the hot and troublous weather.

1. Importance of windcatchers

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2. Architecture of windcatchers

Construction material of a windcatcher is mostly composed of mud brick, brick, mud, plaster and wood; it is a vertical channel which is square, rectangle, octahedral and circle shape. Windcatchers are made of four main parts including: body (shaft), shelf, partition and roof. Windcatcher's body is constructed in cubic rectangle and charter shape and the partitions are made of mud brick and brick which divide windcatcher channel into smaller channels. The partitions are raised from 1.5 to 2 meters from windcatcher floor to its roof.

Decoration of windcatcher structure includes tore on top of it and brick decorations in the higher and lower channels as a brick rows and the tore decorations of windcatcher's shelf which are not functional are seen in different shapes and diverse arches. Apart from its function, windcatcher showed the social degree of its owner which was known through its height and kind of decorations.

Most of the windcatchers in Iran can catch wind from 4 sides, but there are also one, two or three-sided windcatchers. There is also another unique sample in a house in Sirjan located in Kerman province which is called pipe windcatcher standing on an octahedral base and its structure is matchless regarding its shelf, channels and catcher of wind.

The last stage of windcatchers' evolution is the two-storey windcatcher, where the lower windcatcher is a base for the upper one and the second floor windcatcher is smaller and is constructed independently with one or two meters height. These windcatchers are capable of catching the cooler wind in higher heights. There are a few samples of two-storey windcatchers in Iran.

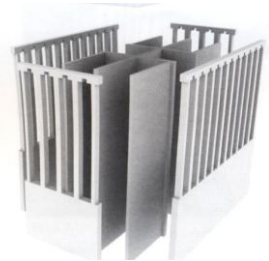


Fig 1: shelf & partition of windcatcher

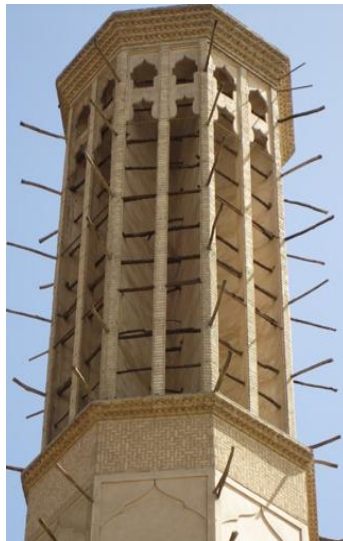


Fig 2: Examples of windcatchers



Fig 3: pipe windcatcher in Sirjan

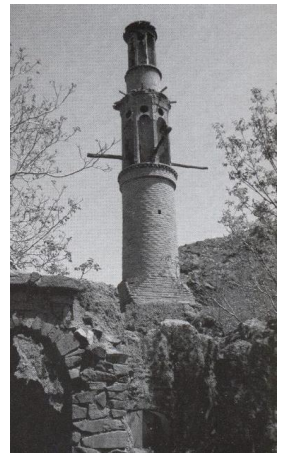
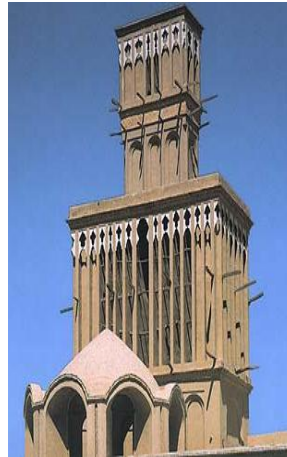


Fig 4: Examples of two-storey windcatchers

3. Windcatchers' function

Windcatchers functioned like present water air conditioners. In a way that the prevailing wind was caught and led down on water pool and the water was evaporated after coming into contact with wind this action cooled the hot wind coming from windcatcher's cap and the cool wind flew through the summer rooms and decreasing the structure's overall temperature. Windcatchers were constructed mostly in southern part of the yard, summer residence part of house; they were usually connected to saloon, pool house and basement. In hot and dry central regions of Iran, water is evaporated fast due to the dry air and in addition to cooling the air, increases air moisture to some extent. Therefore, it decreases both the heat and dryness of the air and provides a pleasant place for the residents; this method cannot be used in south windcatchers where the weather is hot and humid. First of all, since weather is highly moisturized and air is relatively saturated with steam, water evaporation is not so simply achieved and at the second level addition of a moisturized air to an environment with unbearable level of humidity exacerbate the living condition. Therefore, the southern windcatchers help decrease the temperature of the space through displacing the air inside the building. Another characteristic of windcatcher is its shaft effect. When the weather is windless, the hot air of the house interior travels upward and escapes out the windcatcher;

thus an air flow is created inside the house even though its rate is less than the time it flows outside.

Since the traditional architecture and the roles of old architecture are the main planning pattern of these windcatchers, their appliance in the present time buildings come with some difficulty. In spite of considering all provisions some dust and particles, birds and insidious and harmful insect and animals enter house space through windcatchers. In addition, rate of humidity and coolness cannot be completely controlled. In appliances, where sound pollution mattered (schools, lecture saloons,...) the entrance and exit of sound was troublesome. Diverse and vast openings in the roof present the immunity matter. Therefore, windcatchers are little by little replaced with water cooler and gas cooler in central and southern areas respectively, and in some houses in Meybod, windcatcher's opening is used for transferring air conditioner canal. Definitely, windcatchers cannot be utilized as they were in the past and providing the cool and ventilation of a house is not possible by sole use of windcatchers.

4. Modern windcatchers

Since the industrial revolution invited human to hurriedly exploit and use non-recyclable energies, there has always been dependence to these energies to balance and create a suitable environment. In spite of their widespread role in human advancement, their heavy destructive effects on the environment have become a considerable issue to return to the traditional methods of having the environment under control. That is why, since the second half of the last century, especially 1970s climate and the environment have become very important subjects in the researches. As it was mentioned earlier, the monuments were built with regard to their own environment and climate in our country for so long, however, when the modern architecture was introduced in Iran, whatever changed our surrounding with its wind, sun and rain into an optimum space was forgotten and by the passing of time we were more dependant to the mechanical ventilation systems. As the life style and architectural materials in humans' habitats changed, it is clear that the traditional strategies would also change dramatically in accord to these changes.

In the industrialized construction world some products like windcatcher was introduced as a reliable and effective tool concerning the usage of wind energy, also, in designing these pieces of equipment there was a great attempt to utilize experience and the structure of traditional windcatchers by removing their faults as traditional form as well as implementing the main idea to use them in the modern and current developments in the field. For instance, Hassan Fathi, the Egyptian architect, who had done a great deal to combine the traditional architecture and the modern technology of his time, used a water pump inside the canal of a windcatcher in his buildings, through which he reduced the amount of heat and dust by developing a water fountain on the days where it was really hot and full of dust. In addition to the examples mentioned above other designs have been devised in other countries based on the natural ventilation, among which the shopping center Blue Water in England Armory tower in china and Queens building in Montfort University can be noted.



Fig 5: Examples modern windcatchers

5. How modern windcatchers work

Without any mobile part and by using vertical holes and relying on natural effects of wing and cold and hot air movement, modern windcatchers direct the fresh air into the room and send out indoors. This system functions based on simple roles in traditional windcatchers through upward movement of hot and light air which decreases pressure in the room and causes suction and as a result assist movement of cold and hot air.

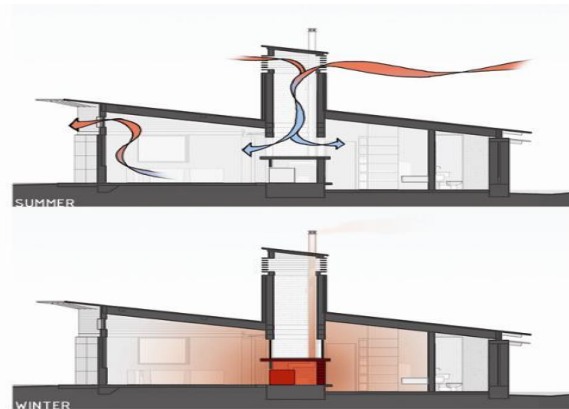


Fig 6: Common channel between the fireplace and the windcatchers

Threatening immunity of commercial offices, etc. is an important issue due to the existence of openings. This problem is solved by applying rustproof metal holes. Modern windcatchers are designed to help air ventilation in different floor in high buildings; this is done by directing and internal compass-shaped partitions, therefore, the air flow in different floor with different distances. Noise transfer is another problem in using traditional windcatchers which is balanced by addition of a 15 millimeter cover to the device's body and noise transfer of a modern windcatcher is around 26 units less than an open window. To plan its utilization in different seasons of the year, it is equipped with a low energy consumption system which controls entering wind. Fire detector of the monument block the windcatcher to prevent from both reaching air to fire and the windcatcher to act as a fire tunnel and transmit the fire to other floors. Another capability of these windcatchers is the use of natural light for the existence of holes on the windcatchers' roof at the time of need which is called light conducting modern system. This works utilizing sun pipes which reflects



natural and recyclable light of sun and even reinforce weak light of the day and transfers it inside through special silver-coated pipes.



Fig 7: Examples windcatcher with light conducting modern system

5. Conclusions

One of the capabilities of windcatchers is the conformity of their architectural planning with environment and they are outstanding samples of using clean energy. Even though Iranian architecture is a pioneer in the field of architectural planning based on sustainability principles and energy conservation, no attention is paid to these great examples of the past and they are simply ignored. These abundant inspiration sources can lead us to new inventions. Our architectural history should be our guide to modern architecture.

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