

AIR CONDITIONING IN IRAN DESERT

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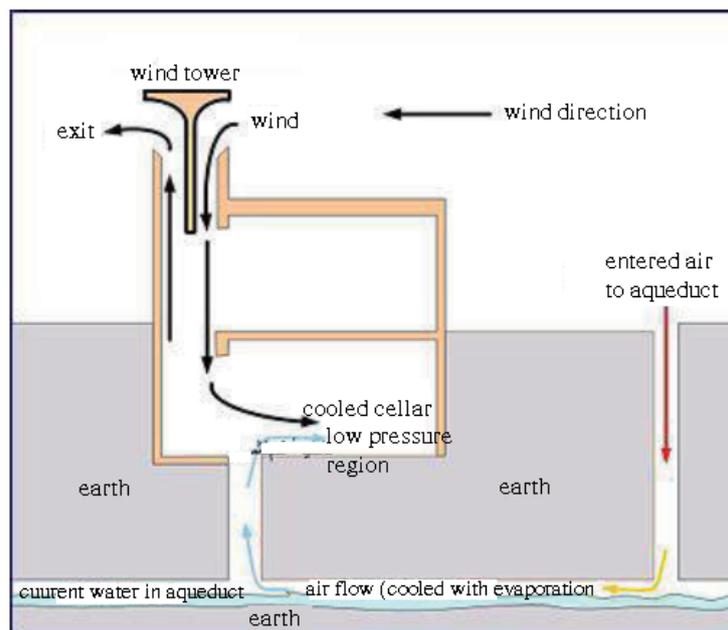
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Abstract

Deflectors have been considered as the main elements of traditional architecture of Iran. They can be seen in settlements with warm climate, warm and moist, and warm and dry climates and they are shown off as vertical evident elements in the sky line of ancient cities of Iran.

Deflector is a symbol of Iranian civilization. It isn't clear that the first deflector has been constructed in which city of Iran, but travel account writers in the Medieval have pointed out to deflectors in desert and hot and dry cities such as Yazd. Without doubt, canal, deflector, and dome-shaped houses are considered as symbols of Iranian civilization. Deflector is composed of a turret on roof of house pretty much higher than elsewhere. Deflectors have been commonly built on a part of desert houses under name *aquarium*¹. The aquarium has been a small patio in end of summer rooms of each building. Summer rooms are composed large rooms with many doors- sometimes 5 doors- for air flowing, which they are located in end of the aquarium. The aquarium is like as an interface space between yard and summer rooms. There was a small pool in this space, which it is reason for naming this space. Deflectors are exactly located on top of the pool, but they direct air flow on water of the pool through their orifices. Deflectors have been made from mud brick and clay, and there have been used from wooden beams for their strong against wind.



¹ Part of the house containing a pool or stream

In history of the world, the first deflectors have been made in Yazd region. Function system of these deflectors is like the manner that they pull the current air outside of house and then cool and light the air by the prepared water tubs inside them, and finally conduct the air to the house.

Deflector is an Iranian innovative method for creating a cool atmosphere inside warm desert houses. The air conditioning system has been intolerable life space Iranian people for long time. Deflectors are usually small turrets as regular quadrilateral or polygonal which there isn't observed their triangular structure any way. Deflector is composed of a vertical canal with holes in head section which they conduct appropriate wind to inside space. Deflector has been possible accessing to concept of natural conditioning from previous times. This feature shows fitness capabilities of architecture based on the best form using environment for accessing appropriate air conditioning at that time. In traditional fitted plans with environment, deflector is an element which it works based on stability principles, energy conservation, and accessing to the best air conditioning.

Introduction:

Architectural design based on the best and the most effective form of accessing to appropriate air conditioning has been considered as a solution from previous times, in order to create a shelter for security against current climate conditions in Iran desert. In warm regions, Iranian people have invented different methods, in order to confront against tiresome warm. Tiresome warm, especially in the Central Iranian Plateau, has been one of the factors it is sometimes intolerable as which it can thread many life. There has been pointed out some methods for accessing appropriate temperature in Iran's historical documents, which they show Iranian efforts for safety against warm. Manazer Ahsan writes: "Abbasid covered their homes with two folder roofs by imitating Persian kings and smeared roof of their summer roofs with mud. Wet mud absorbed heat and cooled their inside air homes.

Natural conditioning and using un-mechanical cooling has had special place in the Central Iranian Plateau, and deflector, as indicator of Iranian architecture for this issue, has very important fame. Deflectors are elements of Iranian architecture in warm and wet and warm and dry climates, which they are observable in habitation space of old cities as a vertical element. These elements conduct appropriate wind inside space of buildings by holes in their heads, and they use from the environmental permanent energies by linking architecture with its environment and entering active air flow.

Deflector is a vertical canal which it is seen as square, rectangular, octagonal, or circular forms in plan. Deflector is composed from two sections:

- Inside section of the canal which it starts from ceiling and continue to basement
- Outside section which it includes wind entrance holes and it is located on the roof

Most of deflectors can get the wind from four directions, in order to increase their efficiency. But there can be seen one sided, two sided, and three sided deflectors.

Introduction with Working Method of Deflector

Deflector is the most natural method of conditioning. Deflectors are designed according to speed and direction of the wind. Air movement due to difference of air pressure is called the wind. The wind is a major factor changing temperature, humid, and transmitting suspended particles. This is very important for increasing mental and physical efficiency of people and decreasing affection to diseases. It can also be considered as a factor for decreasing use of fossil fuels. Importance of the wind has been considered for designing and building residential environment from previous times. Aristotle- 400 BC- and Vitrovires- Russian architecture, 100 BC- have talked about using the wind in architecture and urbanism.

Deflector, Past Heritage

In our country, all buildings have been built by considering environmental climate and conditions. The sun, wind, humid, cool, heat, and in general, weather and geographical conditions have had direct effect in traditional architecture of Iran in different regions.

Deflector is the most obvious method of natural conditioning in buildings. There have been different deflectors in many major cities in center and south of Iran, according to speed and direction of the wind. It is clear that deflector is very old phenomena by considering to its ancient and different names

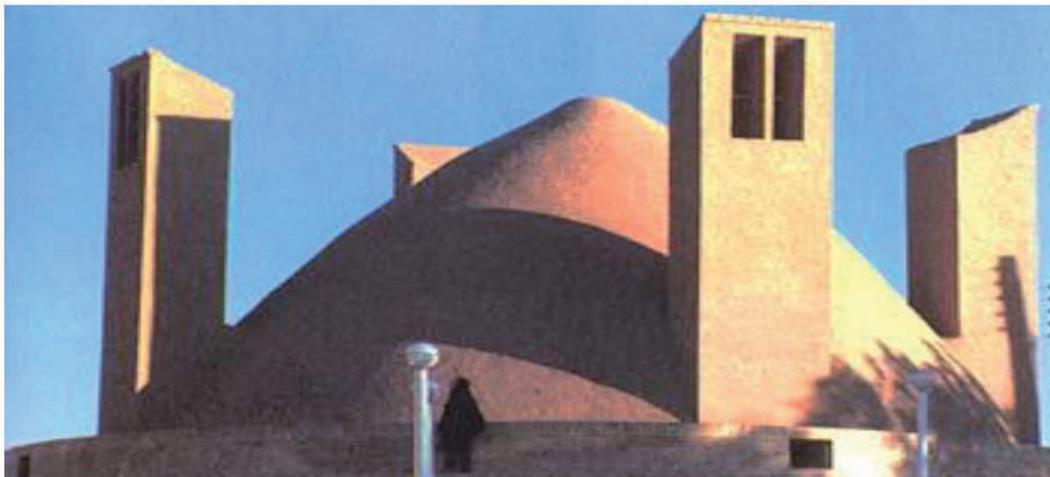
such as Waffer, Badhanj, Batkhan, Khishood, Khishkhan, Masooreh, and Havakep. After conjunction the wind with upper levels, it is guided to corridors which contacts with water in aquarium (such as deflector of Dowlatabad Garden) and then cools inside space of the room. In humid regions, the wind only passes from dry canals and ventilates room space (such as deflectors in southern port of the country).

Deflector types:

- 1. Ardakani Deflectors
- 2. Kermani Deflectors
- 3. Yazdi Deflectors

Ardakani Deflectors

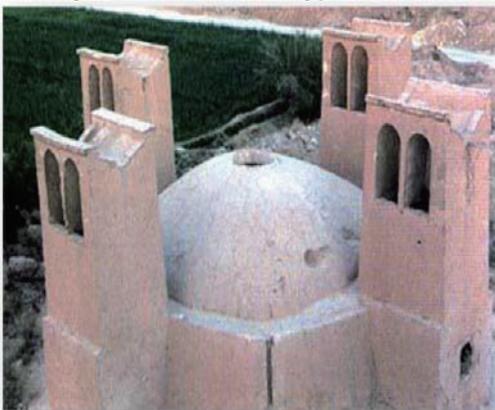
This type of deflector is most seen in Ardakan region. In these deflectors, direction of springs is coordinated with Isfahani wind and it doesn't have any hole in its west, east, and south sides.



one sided deflectors- old structure of Ardakan

Kermani Deflectors (twins)

Kermani deflector, with its simple and small shape, is for middle and low middle families. Each bricklayer can build this type of deflector and its major constructions are mud brick and mud.



Dowlatabad reservoir with four Kermani deflector in Dowlatabad Garden, Yazd



a reservoir with two storage and seven Yazdi deflector in Hossein Abad, near Yazd

Yazdi Deflectors

Yazdi Deflectors are larger than other deflectors and they are often built as four sided deflectors; for this reason they are called four sided deflectors or four directions deflectors in some regions.

Affecting Factors on Categorizing Deflector types:

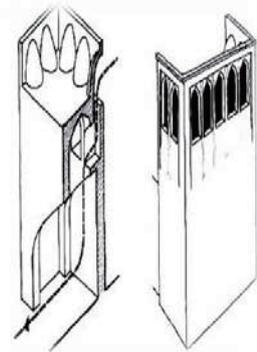
1. Column section form (square, rectangular, octagonal, or circular forms)
2. Numbers and types of deflector openings (one opening and four openings)
3. Numbers of deflector's floors
4. Construction of inside column

One Sided Deflectors

One sided deflectors are the simplest types. In this method, deflectors are made in direction with cool winds and light breezes, in order to avoid from heavy windstorms and floods and close their other openings. In some cases, one sided deflectors are made on opposite of violent winds. One sided deflectors are mostly found in Ardakan and Maybod regions. Of course, there is seen many one sided deflectors in other regions such as Mohanneh.



one sided deflectors- old structure of Ardakan



an abstract plan of a three sided deflector in Emamzadeh Hassan, Tabas

Two Sided Deflectors

These types of deflectors are made with two dimensions on opposite each other and with long and narrow windows without any fence; they can be seen one or two holes in shelf inside the building. This type is seen in Sirjan and hardly rare, in Kerman.

Three Sided Deflectors

These types of deflectors include two categories: connected three sided and separate three sided (torn abdomen). There can be used from one, two, or three sides separately in this type of deflector. Of course it is used rarely.

Four Sided Deflectors

Fourth type includes four sided deflectors which it is built more complete and comprehensive than other types. Usually inside canals of these deflectors are divided to some sections by brick, wood, or chalk partitions. In some cases, there has been built a beautiful and large pool under the deflector canal which dry and dusty air after conjunction with water, has changed rooms' space with a cool air in the summer season. In regions without possibility of building aquarium in ground floor of the building, water of aqueduct has been flown underground. These spaces (cellars) have been a place for collecting



four sided deflector with square section, Kashan

members of family in warm afternoons in the summer season. This type is seen in Yazd, Kerman, Booshehr...

Multi-Dimensional Deflectors

Using multi-dimensional deflector (usually octahedral and sometimes circular) which includes fifth type deflector is common in Yazd and some central parts of Iran. Reason of building these deflectors is appropriate winds which they are flow from every side and canal partitions can get the wind from every direction and then guide it to inside the considered path.

Pipe Deflectors

Pipe deflectors are sixth type of deflectors, which bricklayer has used from some bent pipes (denticulate knee-shaped) in outside section of the deflector, instead using cubic space. But inside canals and sections are like to the multi-dimensional deflectors. This deflector has been only seen in Sirjan.



eight sided deflector, Dowlatabad Garden, Yazd

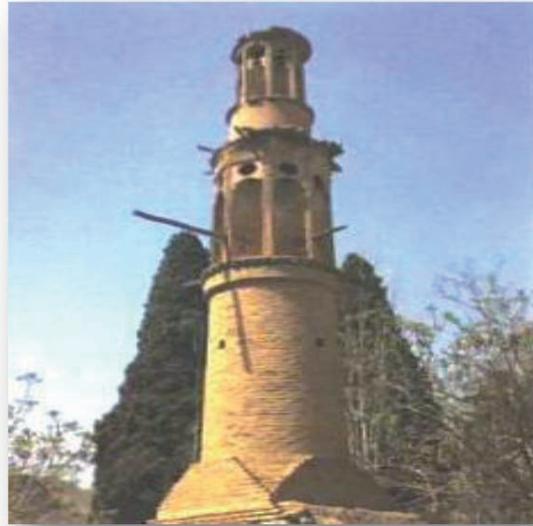


high and unit deflector, Rajabi House, Semnan



calument deflector, Sirjan

Deflectors have been constructed in multi floors which it has resulted increasing efficiency of deflector.



two floor deflector with circle section, Chehel Sotoon Palace, Sarhangabad village, Lorestan

Conclusion

Different typology of deflectors in Iran and their diversity in cities in warm regions of the country shows genius of Iranian experts in optimized using from natural elements, in order to be kept against tiresome warm. By inspiring the environment, they could build deflectors which they decreased air temperature to 15 degree which shows that Iranian people have been elite function technology, in addition to consider to build beautiful buildings. So it can be said that Iranian people have been innovators of this element (deflector) and they have provided deflector to the worldwide as an important result for appropriate conditioning. Although west countries have registered different types of natural conditioning under their name by studying Iranian deflectors but it can provided unique innovations to the world by considering innovation such elements including aqueduct, wind and water mills ... in order to coordinate with the nature and save energy consumption.

References

1. Dr. Mehdi Bahadorinejad, Alireza Dehqani. Deflector, Masterpiece of Iran Engineering;
2. Hossein Zomorahidi. Iran Architecture, Building a Construction with Traditional Materials;
3. Dr. Mohammad Karim Pirnia. Iranian Architecture;
4. Mahnaz Mahmoodi. Deflector Technology in Iran;
5. Behdornejadi Mehdi. Cooling Efficiency of Deflectors, Appropriate Conditioning Monthly,