

Investigation the wind catchers of residential houses in Yazd Province, Iran

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Abstract: In this paper, wind catchers in Yazd Province have been investigated. In this study, the relationship between the area of hall, length and width of wind catcher, the high of wind catcher and other factors have been investigated and analyzed. The relationship between the parameters that is associated with each other being determined.

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1. Introduction:

Iran means Aryaee land is known as Islamic Republic of Iran which located in Southwest of Asia and the Middle East and its area is 1648195 square kilometers. [1] More than half of Iran's vast territory, the climate is hot and dry, hot and humid architectural design features that reduce reliance on wind, temperature, and so it is in a residential area. [2] These areas include the northern part of Persian Gulf and Oman Sea and the East Central part of Iran. [3]

One of the 30 provinces of Iran is Yazd in central of Iran. The city located between the mountains Shirkooh and Kharanagh and in the wide Valleys. [1] Yazd is first historic adobe city in the world and the second largest city after Venice, Italy. Yazd Province of Iran is a land of ancient history [4] Yazd, the global climate is hot and dry desert and fluctuating temperatures in summer and winter, and day and night and even varies, and this is one of the features of climate. From this perspective, we can say: Yazd has two chapters. Long hot season from March to October and the winter season from November to late February shorter. [5]

Operation of the climatic conditions, the wind catcher created as the flagship and most common structural elements, air conditioning, with a record of history. [6] Wind catcher, as its name suggests would minor buildings and areas of the body warm and dry or hot and humid Iran is the flow direction of the wind and enjoying nature at moderate temperatures and deliver clean energy at room temperature, the residence has been effective in humans as well. [7]

The wind catchers in the face of this old city area are known as vertical channels are glaring and the minarets are seen as the culmination of the city sky line. Windward channel is placed over the summer to stay at the house, which is behind the sun

used in summer and with its opening facing the side of the head winds are favorable, wind currents are driven into this part of the house. [8] Wind catcher diversity of forms and proportions to their plan and cross section, all of this suggests that the architect of the climate and micro-climate of each region's climate and its empirical science has different forms in different places. [3]

B. History

Find detailed background wind is very difficult because these structures were the tallest buildings and the first signs of damage to the building's roof, especially indicate your windsock. [9] The simplest example is found on the windward among the Indians of Peru Mouchicay. They were using the wind to ventilate their homes. [10] In the Egyptian drawings on papyrus from 1500 BC have been drawn, a sample is drawn deflector. [11] Roof also noted that the two recipients of the wind deflector behind the royal halls of Babylon (600 BC. M) exists. [12]

The basic concept is similar to a simple louver vents on the tent can be considered a primitive in Sri Lanka, there is a small opening at the top of the tent, which can lead to tent at the center of the air stream [13]. Ventilation air to the traditional structure which is defined as the entire Middle East, from Pakistan to North Africa, with different names and forms have been seen. [14] Except in Iran, Egypt, Pakistan, Afghanistan, Iraq and the United Arab Emirates deflector is found. Windward few buildings over the Mediterranean such as Syria, Lebanon, Palestine or Israel or Turkey, the island have been Mezopotamia. [13] In 1815 AD, the English tourist Patgir say that all houses in the palaces of Hyderabad state to Windward Cottages are all sober. [3] The background paper deflector to 4000 years before Christ brings. The first historical document about Iranian wind catcher s to the fourth millennium BC is on. A simple

example of archeology in Japan by one of the staff Khmaq in a house on the hill, eight miles north of the southern slopes of the Alborz mountains anymore and is found in northeastern Iran. [10]

Naser Khosrow in his travel notes, he writes that water storage Naein (The buildings have been built to store rain water and its domes and wind catchers find and clear away). [15] Venetian explorer Marco Polo in the thirteenth century AD has traveled to Iran's use of simple and original wind catcher s in the Hormuz. [16] Travel Explorers of the 17th century in which Iran is a description of the wind catcher s, can be Tounat, Chardin, Tavernier and John Fariran noted. [3] Though used like the element of North African, Central American, Egyptian pharaohs and Babylonian times, there are, nevertheless, its historical roots in Aryan civilization, coherence is clearer. [17]

C. Introduction of wind catchers

C.1: Types of wind catchers

Since wind is an architectural element that is a function of climate and, it is also a technical point of view, it is also important to note that wind categories what they consider to be an angle. Due to the different perspectives, it can be stated that critics and scholars have offered a variety of categories. Memarian the functional aspects funnel them into two general categories: 1. Wind catcher s purely functional 2. Wind catcher s function - symbolic of the divide. [18] Shariyatzadeh classified and named based on the local name of the ancient architecture has been done. [19] Windward has been done by Mrs. Roof top categories. Based on their windward sides of the division is the recipient of the wind deflector. Mrs. Roof categories include: one-sided wind catcher s, two wind catcher s. Wind catcher s with diameter blades, four sided wind catcher s, six or eight-sided wind catcher s are included. [13] Compared with about 700 wind of Yazd province is shown in Figure 1, Figures 1 to 4 and the wind profile in the city and you can see how the wind.

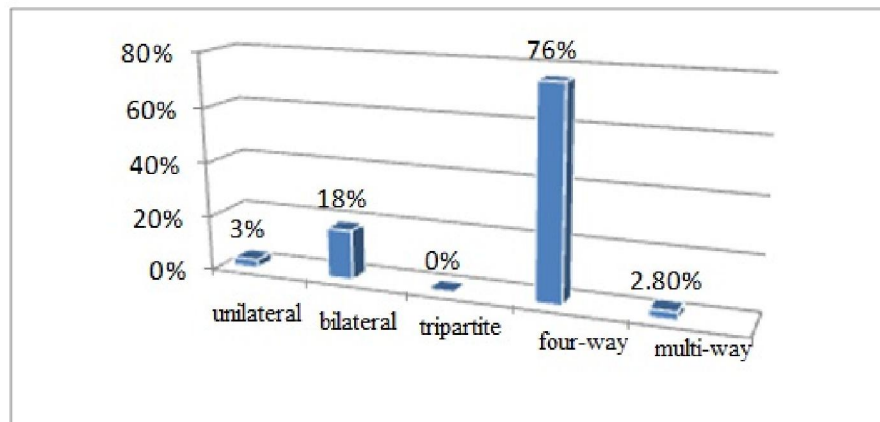


Chart 1: Ratio of wind catcher



Figure 1: View of wind catcher in Yazd Province



Figure 2: View of wind catcher in Yazd Province



Figure 3: View of wind catcher in Yazd Province



Figure 4: View of wind catcher in Yazd Province

C.2: the physical components of wind catchers

Windward is made up of several components, some of which have the beauty of nature and some are extremely functional.

C.2.1: Roof

Deflector can be in the form of three wind catcher s in the roof with a flat roof, curved and inclined split. Approximately, 90% of the roof is flat. In figures, 5 to 8 Windward roof of the doubts you're viewing.



Figure 5: Type of roof



Figure 7: Type of roof



Figure 6: Type of roof



Figure 8: Type of roof

C.2.2: Shelf

Shelf is the top of the wind catchers including blades and air flow ducts. There is also great variety in the shelf. Windward master builder by climbing up ladder with double Tulips and apply your ear to feel the wind on top of where the original test how well they do it. [20] If any place regardless of how wind speed, wind chest is made of the desired result is not achieved, but the dirt and dust into the air pocket collapses, without any ventilation or cooling the air.

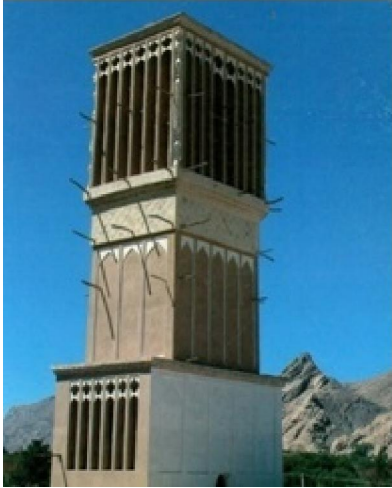


Figure 9: Shelf and stem in wind catcher

C.2.4: Blade

Blades made of adobe and brick elements are the deflector channels into several smaller channels are split. The blade is 1.5-2 feet in height from floor to ceiling and the floor started Wuthering continue. The blades can be divided into two categories, sub-blade main blades. The main blades to the center channel and wind towers continue to divide the smaller channels. When the wind blows, the channel is the recipient of the wind break wind and so-called, when the wind blows from different channels and they do not have a role Badkhan and in accordance with the chimney effect (displacement of air convection), warm air down into the top of the pass. The main blades with diagonal form, I, H, + have been observed. Blades are sometimes called sub-base, they are considered a carminative, and there are many benefits in terms of architecture.

- Special effects give the windward facade.
 - The strength of the wind is building.
 - Wind in the south and overlooks the streets are. If no natural base, especially in the last part of the region was unsafe, unauthorized intrusion into your home through the vent deflector were found. [19]
- Channel is divided into smaller funnel to channel using the key blade and sub-blade sometimes

Master builder windward, by long, double-sided climbing ladders to put your ear tulips, to feel the wind on top of where they want and how to test it, it did. [20]

C.2.3: Shoot

That part of roof racks and is located between the deflector, the stem is called a deflector are longer, the longer it will shoot. In some cities due to low-altitude wind currents are favorable, this stems from the physical structure of the stem of the funnel is removed. This deflector, roof rack sits directly on.

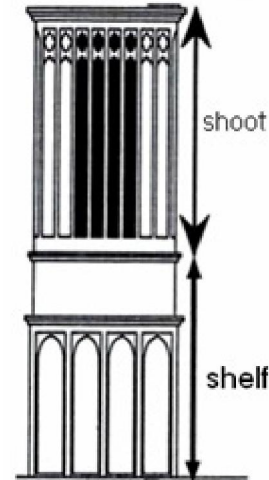


Figure 10: Shelf and stem in wind catcher

done, make up air speed when crossing the channel, according to the Bernoulli Effect of the increase in fluid mechanics. According to the Bernoulli Effect, the air flows from a narrow cross-section increases rapidly, the blades of the old architecture and therefore reveals phenomenon. [21] Besides the aesthetic aspect id blades sub, function, and such weather vanes or blades, radiator air valves work. At night, the heat stored in the brick blades then has so in the morning when you are ready to absorb heat and with the hot wind vane adobe; heat is transferred from the wind blades, mailed to more favorable temperature and wind down. [22] Accordance measuring the burning roof, difference between shades of environmental temperature and outgoing air temperature, the bottom of the flue deflector at the bottom, 1 to 2 ° C [12].

C.2.5: Channel

Windward hull is the vertical channel or duct, sometimes, usually in the form of a cube prisms are made in the direction perpendicular to the air flow from top to bottom or vice versa transfer of clay and mud brick and mortar channel and the outer casing is made of straw flowers. However, in many cases, the interior lining is cast. Wooden beams inside the walls of the channel have to be the berries are of wood

against termite resistant, the wooden beams, channel structures. [19]

C.2.6 Building

Yazd wind catcher s in the structure of clay or mud bricks with straw have been used. Clay transit time heat is desired, the volumetric soil element can be uncompressed and mildly the flower comes from a combination of soil and water. After evaporation of water from mortar. Empty wind catcher s where there is due to the lack of heat and cold to get into the dirt and mud are molecules. Usually the windward are including of adobe, brick, clay, plaster and wood. [19]

C.3: Construction and Manufacturing

Wind deflector for your height and body height than the height of the building is wind suction wind catcher s and also reduces its resistance against lateral forces. [23] For making wind catcher s in Yazd, wooden coils are placed horizontally in the mud which appears to be seen as bracing, its resistance to lateral forces make possible. [24] The ropes are tied together to make the structure scaffolding and wooden beams left and continue up the ladder to get to the top of the funnel and subsequent restoration to be applied. Major and minor drywall wind catcher s in Yazd is the factors that will be more stable. [25]

Local architects, to build a wind from the roof of the house where there is a small room overlooking the Windward account, or adobe brick with a rectangular stokewind catcher the wind picked up to reach a certain height. The top four walls stokewind catcher two wood cross X mark through the walls of the East and the West and South wind will take two to two and a half feet high. Then with a half brick or brick on the north half, the stokewind catcher are picked up to a certain height. Usually the blade height is forty centimeters taller than the other walls. [19]



Figure 11: Structure and wind catcher



Figure 12: Structure and wind catcher

C.4: space on Windward at the Iranian

Wind tower spaces that are associated with them include: Hall, spring house, pergola, wind, basement or cellar.

C.5: function

Wuthering for summer cooling and ventilating rooms on the ground floor or basement dweller is used. [14] The traditional structure of the wind can be a dynamic and spontaneous indoor cooling defined. [26]

Windward natural cooling is effective in two ways:

1. Displacement
2. Evaporative cooling [3]

D: Materials and Methods

Including those that define the identity of the city of Yazd has a charm of landscape architecture, there is an element of vertical rise over the rooftops of the city are the respiratory tract. [27] Currently, about 180 Windward in terms of Yazd are glaring. [3] Yazd overheating, builders built buildings the measures of forced cooling and comfort. Wind catcher as a function of cooling architecture that has seen the four functional buildings in Yazd, which include water storage, caravanserai, mosques and homes. In this study, the wind has been studied in Yazd residential homes. Among the existing wind catchers, 50 were selected as wind and its characteristics have been studied.

D.1: direction of wind

Position and angle of the wind relative to the north - south angle of the courtyard is the heart of the home and also depends on the location planned for the summer. Most of the south wind, south - south-east and south - southwest is made.

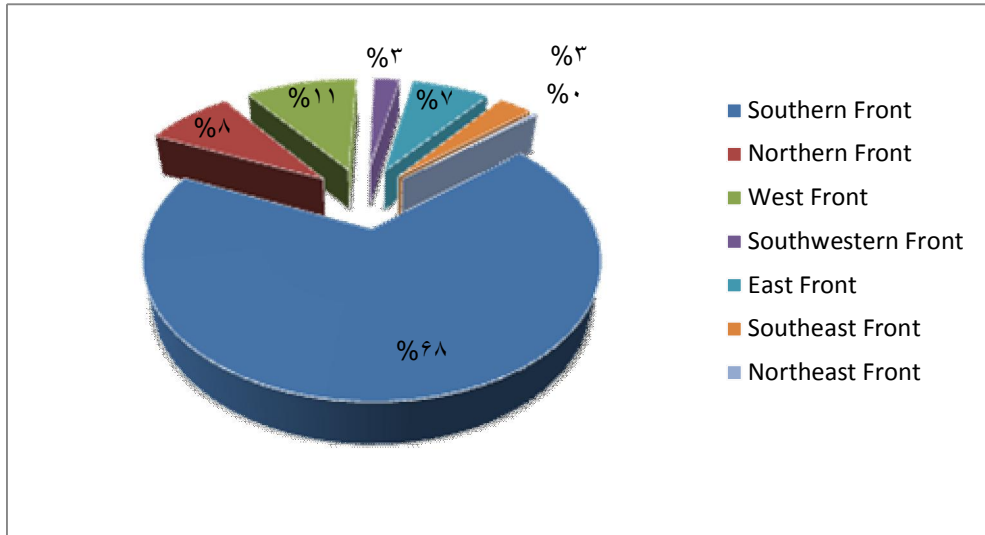


Chart 2: The position of wind catcher against the front of building

Like other wind catchers in Iran, Yazd's wind catchers are favorable to the prevailing wind. According to the most favorable wind deflector to the North West and larger pores in the direction that the wind.

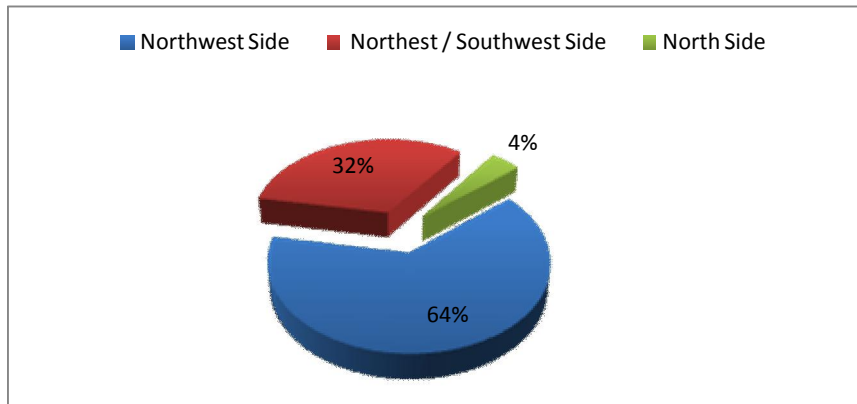


Chart 3: The position of wind catcher against the wind direction

D.2: blades and louver vents open and closed

The main blades wind between 9 and 15 cm thick. The main blades are the tower center and there are a variety of forms, including H-shaped, X-shaped form I and + form. The main blades of the ceiling to the floor of the channel can not be used, but to a certain height of the room and resume the wind not been lowered. The main blade height from the floor varies in different wind catcher s. These range from 2 to 4.8 m. The average height of the blades of the main roof rack wind deflector and some medium-height ceiling, or rather to stem funnel come down. Pores open and close louvre widths in most sizes.

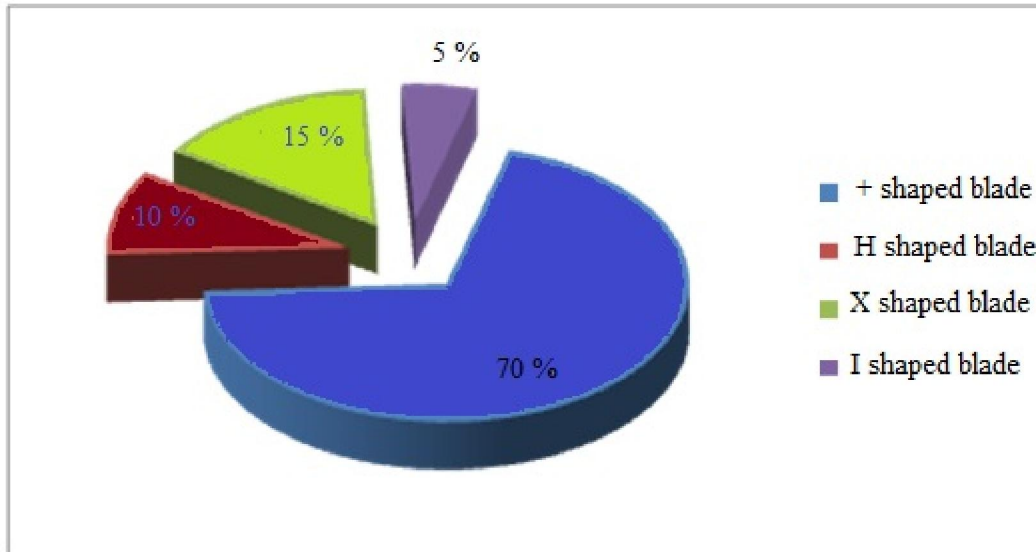


Chart 4: Type of blades in wind catchers

D.3: Wind catchers Height

Compared to other cities in Iran, Yazd wind catcher s hot wind in their vernacular architecture is built taller. [26] Roof enjoying travel (Poutinger 1816, Khanikouf, 1861; Goldsmith, 1867 and 1876, McGregor 1879, Stewart 1881, Floyer 1882, Stock 1882, Vegan 1890 Korouzon 1892, Napier 1905) and historical research doctor Afshar in 1969 CE and geographer renowned Bounin has proven the building boom since the late nineteenth century and the construction of the tallest wind deflector by the manufacturers. Because of his previous two decades of the nineteenth century travelers did not mention the wind catcher s in Yazd short, they have described. [13]

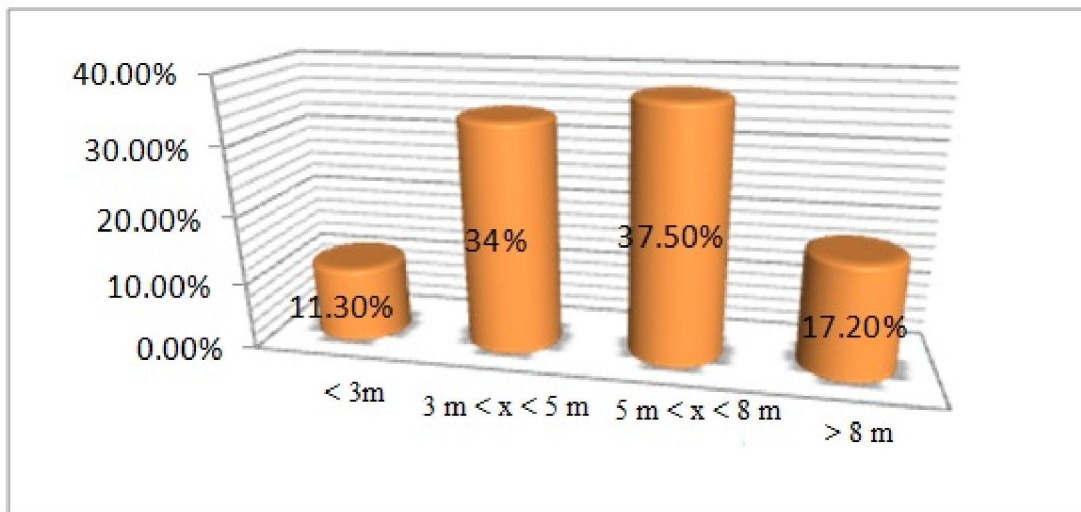


Chart 5: Height from roof of Yazd wind catcher

D.4: Relation between Hall's area and Wind catcher's area

The relation between Hall's area and Wind catcher's area is shown in Figure 6.

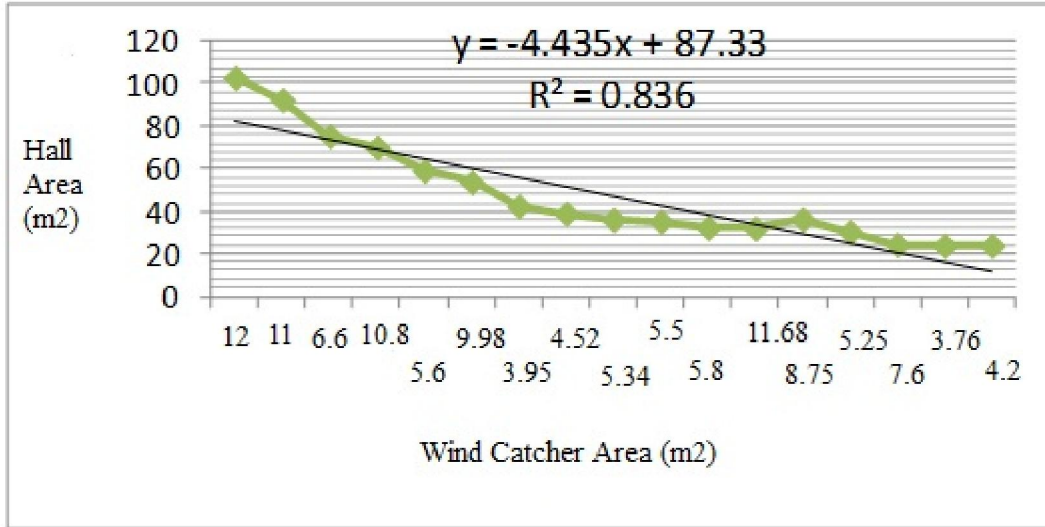


Chart 6: Relationship between hall area and wind catcher area (m)

D.5: Length and width of wind catcher

Relationship between length and width of the wind catcher is shown in Figure 7.

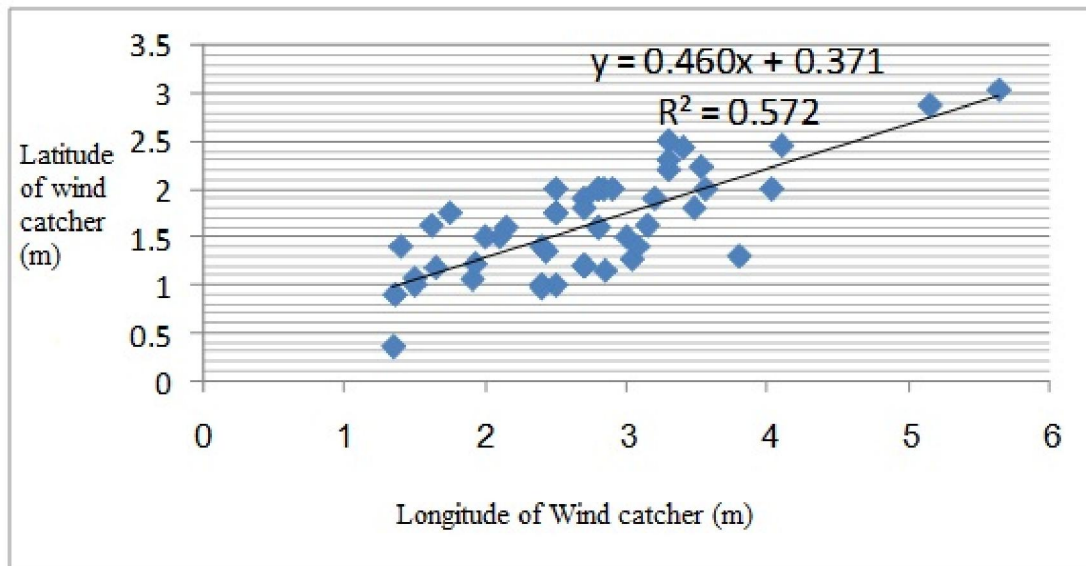


Chart 7: Relationship between latitude and longitude of wind catcher

D.6: Height of wind catcher

In Figures 8 and 9, the relationship between the height, length and height of the roof you can see wind catcher s in the wind.

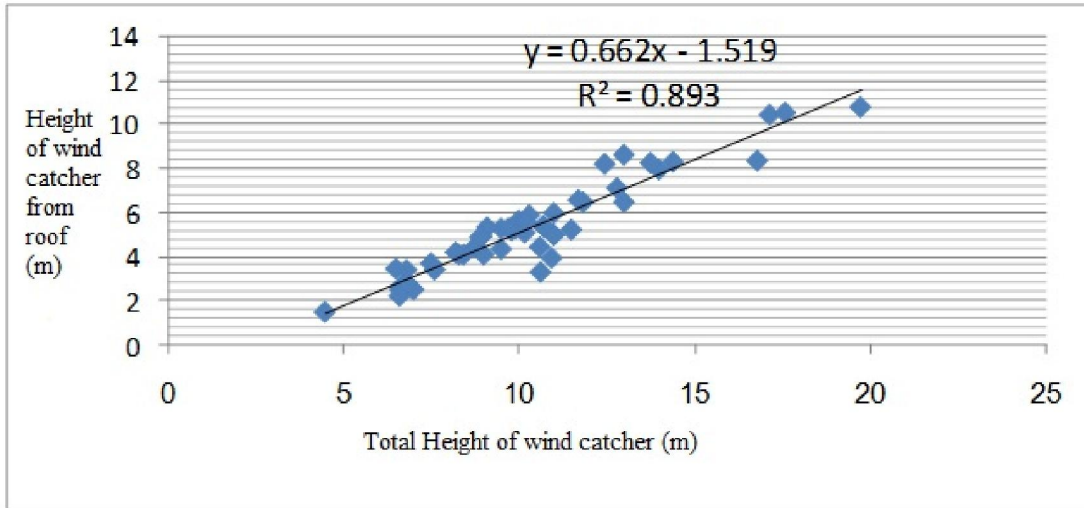


Chart 8: Relationship between height of wind catcher and total height from roof

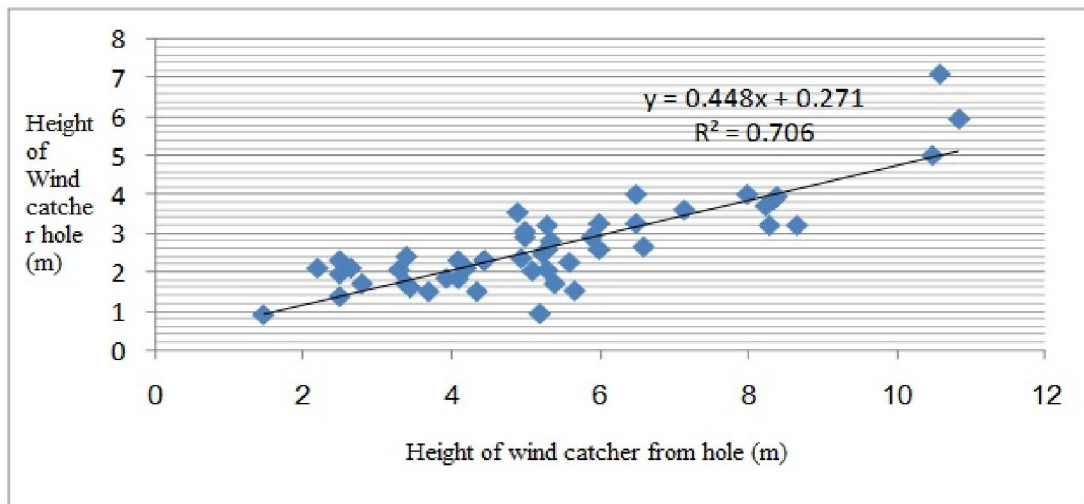


Chart 9: Relationship between height of wind catcher from roof and from hole of wind catcher

E: Conclusions

A total of 50 patients were considered for the project, the wind deflector and calculated structure factors. Then, to determine what factors are associated with the correlation coefficient was used and the results showed a significant linear relationship between total height and length and width of the deflector is used. Thus, the total length and width and height as independent variables and the dependent variable in the regression, we performed the following results were obtained: Table of ANOVA can be concluded that the amount of (000/0) sig of the 05/0 are smaller, so the null

hypothesis based on the lack of correlation between total height and three independent factors (length, width and height of the roof) will be rejected words Evidence is sufficient evidence on the relationship these factors. The correlation coefficient (867/0), the result is stronger. From the table it can be concluded that the regression sig length (0.049) and the width of the sig (0.035) and the sig height of the roof (0.000) of 0.05 is smaller. As a result of these factors affect the regression equation. According to information obtained from the regression line equation can be shown as follows:

$$A = 1.635 + (0.833 \times B) + (1.355 \times C) + (0.867 \times D)$$

A: total height (m)

B: Length of wind catcher (m)

C: Width of wind catcher (m)

D: high of wind catcher from the roof (m)

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