

STRUCTURE OF HISTORICAL HOUSES WITH TABRIZ MASONRY STUFF

Fereshteh Pashaei kamali¹, Farahnaz Pashaei Kamali², Kambiz Farbod³

¹ Department of Architecture, Maragheh Branch, Islamic Azad University, Maragheh, Iran

f_pashaei@iau-maragheh.ac.ir & fer_pa73@yahoo.com

² PhD Student in Extended Life Cycle Assessment, Business Economics, Wageningen University, Hollandseweg

farahnaz.pashaeikamali@wur.nl

³ PHD Student at Radboud University Nijmegen Medical Centre (UMC St Radboud)

kambizf@kth.se

Keywords: Windmill, Nashtifan, Nashtifan, wind

Abstract. Windmills or windmills are mills that revolve with the power of wind. Windmills are the biggest collection of adobe, mud and timber structures that have come down to us from Iranian civilization. They stand sturdily there despite all the natural forces that have attempted to wash them away, destruct them or cause any harm. The windmills of this land are concentrated mainly in Sangan and Nashtifan area, dating back to the Safavid Dynasty (1501–1736).

Two parallel walls ten meters high and four meters away from each other from the main structure of these windmills. To the north of this structure, there are huge fan wings that orbit with the blow of wind. This rotation makes the lever and lower mill stone revolve and consequently the process of milling and grinding materials begins. The Chahar-Farsakh village, unlike all other desert lands enjoys the presence of a huge aqueduct that helps agriculture flourish. Close to this aqueduct there are huge windmills that supplied the flour of the village and other communities in the vicinity till twenty years ago. In this area of the desert, where is influenced by the Sisatan 120-day seasonal winds, there is wind blowing for most part of the year. For this very reason the windmills have changed into the local industry and could be prosperous.

1 INTRODUCTION

It Human being's various requirements concerning energy resources have always been one of the most fundamental issues in his life; therefore, his effort to have an access to an never-ending energy resource has been one of mankind's ancient desires. As human being's civilization progressed, wood along with coal, petrol, and gasoline entered into energy marketing. However, because of a growing need for energy and as well as limitations concerning fossil resources on the one hand, and an increase in environmental pollution resulting from burning these resources on the other hand, have made the consumption of renewable energies much more than ever. Wind energy is one of the major renewable energies that have been attracted to mankind's open mind in such a way that he has always been thinking about making this energy applicable in industry.

2 HISTORICAL NASHTIFAN ANA SANGAN KHAAF

Khaaf is located on the west side of Khorasan Razavi just at the side of the bordering line of Iran and Afghanistan. Nashtifan is also located 8 km from north east of Sangan and 20 km from Khaaf, on lowland margins leading to desert lands on a smooth river slope flowing to one of Kalshur alluvia.

The term Khaaf which is spelled **Khavaf** in Persian but pronounced differently is the other name of Beh Afard – a son of Farvardin¹ – who was originally from Siravand rose up and added some innovations to Zoroastrian. The appellation *Nashtifan* is because of the intensity of monsoon winds in this village, and it has been at least for 6 centuries that this title has been given to it, and because it has been exposed to very severe storms it was first called Nish Toufan (storm's sting) and then it was known as Nashtifan.



Figure 1: Site Plan of Nashtifans Windmills

Khaaf and Nashtifan have hot and dry climate because it lies at the side of a desert margins and has little rainfall. Summer is very long and scorching alongside 120-day monsoon winds in these places plus cold and dry winters. Due to the direction according to which this village is developed (northwest - southeast), it lies exactly perpendicular to the directions that 120-day winds blow. Since the old part of the village lies in a lower position compared to other ground surfaces, northeast winds blow faster on the margins of the village and this, in turn, has a great effect on the energy gained by Asbaads. The most important winds the people think are known include 120-day winds (northeast). These known winds are called Baad Kouh or Siah Baad by the villagers. They have had great importance since old times because of rotation of Asbaads. 120-day winds of Sistan blow from highlands of northeast parts to-

ward southeast parts of Iran for 120 days during the hot period of the year- i.e. from June 4, to October 7, leaving major effects once gone. Basic features of these winds, that is their high durability and speed has made the exploitation of wind possible. Its high speed which sometime reaches 120 km/hour generates lots of force, when controlled a huge amount of energy is made available to people. Asbaads have been established for this very reason; therefore, they can show capabilities of human being and reduce human's difficulties, providing comfort and relaxation for him. Generally speaking, the main and the most important air current in this region concerns the blowing of these 120-day winds which have overshadowed all aspects of the region's residents' lives.

3 WINDMILLS(ASBAADS)

According to many references, Sistan has been considered the primary location of windmills. One can discover the history of windmills if he/she pays much attention and think deeply about the term "Aas". "Aas" means tiny granule of stone. In Moen dictionary "Aas" means to circular and flat pieces of stone in which one is over the other and the lower piece of stone has a hole in the middle through which a metal bar passes and comes out of the upper one, and finally it grinds grains and cereals changing them into flour by means of water, electricity, steam or human's arm power. Primary Asbaads consisted of vertical planes, the inventors of which were Iranians. The number of the planes of these windmills was from 6 to 12. Their planes were covered with pieces of cloth or palm leaves and they were used to grind food grains. Unlike western windmills, these windmills got their force alongside horizontal axis and then they transferred it to the vertical axis of the windmill so that more force could be gained from wind. John Barmen, an English researcher, found out that the first windmills were exported from Iran to Europe in 1150, stating that Europeans did not have any experience in making windmills earlier than this year.



Figure 2, 3: view of Nashtifans Windmills

Windmills are considered to be one of the most important and eye catching cultural constructions in Khaaf and Nashtifan. There is no accurate information with regard to the emergence of the windmills. Most of the historians that had traveled to Iran in different intervals in past had stated that their origin dates back before conquering Iran by Muslims. And some of them even go too far and link the development of windmills to AD 1700. Old windmill collections of Nashtifan-Khaaf are considered to be a series of largest clay or wood collections remaining from Safavid Dynasty and sometimes these windmills are supposed to be the largest and oldest windmill collections in the world, their number reaching to 40. These windmills stand between 15 to 20 meters from the ground level. This collection has been registered in Iran's National Historical lists in 2nd February 2003 with the registered number of 7490. Historical background of Nashtifan Asbaads is akin to Safavid Dynasty. The emergence Asbaads in Nashtifan is as a result of 120-day winds of Sistan. Feeling that something needs to be done about the power and intensity of the wind mentioned, the villagers had started making them since many centuries ago. Rich culture and knowledge has allowed humans to tackle one of the natural environment restrictions and turn it into a useful force so that it not only expels people but also absorbs and stabilizes the population. Studies carried out in Nashtifan indicated the fact that the existence of the windmills has had a fundamental and valuable role in the lives of people living in the past in this region. In ancient times when there were no special forces to meet man kinds' need, controlling wind and using it for grinding wheat into flour in this region has increased the efficiency of the village in a way that the economy in this village was in a suitable situation. Also people's role in providing better service to the residents of Nashtifan (transportation) has had a significant effect on people's income level as well as functions of other sectors (industry and agriculture). Disorder in wind's blowing does make windmill's malfunction and everything goes on smoothly. A miller could leave his work place for hours, seeing no need to have a steady control on windmill. If the wind blows and stone starts moving, the wheat will be poured into the stone and the windmill will work, unless the wind stops blowing, the work will be stopped. To solve this problem, in the seasons when there were weak winds, the villagers used the water from south rivers of Nashtifan, which was enough at that time of the year and it was then people started implementing water mills. The remains of water mills could be seen in Nashtifan. On the whole, development of technology and technical science alongside weak points that windmills and water mills had, and better functions of fire (motor engines) mills and electrical mills had allowed the success of these kinds of windmills over the previous ones easily.



Figure 4, 5: view of Nashtifans Windmills



Figure 6, 7: views of Nashtifans Windmills



Figure 8: view of Windmills

4 WINDMILLS' FUNCTIONING

According to the scientific research and the issues mentioned in the book *Historical Geography of Terrain Zaveh*, the wheel and the planes of the giant mill having 48 doorjambes, 32 planes and 8 gates are placed on top of the roof and the direction of wind blowing. The body of the wheel and also the plane are made of a heavy and solid base. Wind passes through the gates of a wind catcher reaching the angles of eight-fold gates and rotating both the wheel and plane. Some force is transferred to the beam of the mill as a result of the wheel and plane movements and since the other end of the beam is attached to the upper stone of the mill, stone must necessarily start rotating harmoniously in synch with the rotation of beam and it does. Once the upper stone moves in the way mentioned, it cause movement of a small piece of wood called "Lak laki". "Lak laki" movement causes oscillation of a wooden waterspout

and this gradually directs the wheat from wheat storage to the mid-hole of the stone. It is natural that the faster the wind blows, the faster the stone rotates around, and if this stone rotates fast, more wheat would go to the middle of the stones. Wheat turns into flour and ready to be collected as a result of stone's movement. There are an old and a primary machine beneath the hole of stones which can function as a lever instead of breaks to stop the stones from movement whenever necessary.

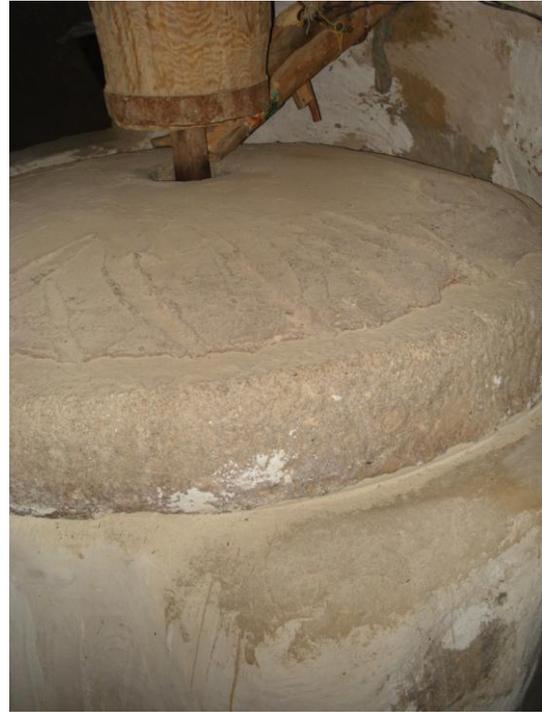


Figure 9, 10, 11: Structure of Windmills

5 PRESENT SITUATION OF WINDMILLS(ASBAADS)

Nowadays many of these Asbaads have been destroyed and some of them are being destroyed. At present time, of many windmills in Nashtifan only two windmills are possessed by Cultural Heritage Organization to be a reminder of prosperity and flourishing of old days, and a commemoration of cultural achievements of our ancestors to be presented to future generation, which are being developed without requiring any foreign aid only by relying on local forces and resources. Cultural Heritage Organization has recently made an attempt to renew and revive some of Asbaads. However, in Sangan no efforts have been taken until now and it seems that the Asbaads in this city are being forgotten forever. Maintenance of these valuable works can be one of the attractions for the tourists coming from foreign countries or inside Iran or any people who is interested in the field. This cultural and historical heritage can be a sign and a picture of the art and cultural development of the history of that terrain for future generations. By so doing, requirements for encouraging the inspirations concerning innovations and productivity and its adaptive engagement with nature can be provided for the people of this country. The invaluable potential of the wind in Sistan in such a region and the methods of using it properly which is done on the part of the people and this country reminds the people's minds of the fact that why this heavenly free gift isn't used in this country. Installation of wind turbines in this region can have a significant contribution in generating electricity and energy. Exploitation this climatic condition is one of the most economical steps that can be taken in line with the sustainable development and in forms of new technologies.



Figure 12, 13: one of Windmills before and after restoration

REFERENCES

- [1] A. poup, G.Sadri Afshar, *Architecture of Iran, Akhtaran*, 2001.
- [2] M. Mahmudi, *The world's oldest windmills in Iran*, Architecture & Construction, vol. 16
2008
- [3] E. Zanganeh Ghasemabadi, *Date of dignitaries east*, Khatereh, 2010.
- [4] Cultural Heritage Organization Archives