

# A Historical Heritage in the Architecture of the South West of Iran, Case Study: Dezfoul City

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**Abstract**—Iranian architects had creative ways for constructing the buildings in each climate. Some of these architectural elements were made under the ground. Shovadan is one of these underground spaces in hot-humid regions in Dezfoul and Shoushtar city that had special functions and characteristics. In this paper some subjects such as the history of Shovadan, its elements and effective factors in the formation of Shovadan in Dezfoul city are discussed.

**Keywords**—Architecture, Dezfoul city, Shovadan, southwest of Iran.

## I. HISTORY OF SHOVDAN

ACCORDING to the references that are used in this paper and by considering the formation time of Dezfoul city and some of its historical buildings that belong to the Sasanian era, such as its historical bridge, the age of Shovadan is probably more than 1500 years. In addition its most famous mosque that belongs to the seventh Hijri century has a Shovadan. A lot of Dezfoul Shovadans had been used until Ghajar and Pahlavi era.

After the invention of electrical coolers, the use of Shovadan reduced and it became unnecessary. Shovadan had been a derelict space before the war in 1980. But during the war time Shovadan became the best shelter for citizens. After finishing the war during two decades a lot of houses in Iranian cities were built. At this time a lot of Shovadans, for renewing old houses, were destructed and were filled with building wastes. Now some Shovadans are used as warehouses and some of them are derelict and useless [1].

## II. INTRODUCTION OF SHOVDAN

In Dezfoul and Shooshtar city only during short time of the year people can live comfortably but during other months of the year accessing to the air current and shade for reaching the comfortable conditions is a must. Furthermore setting up on stone texture and higher elevation of the city from the Dez River are some effective factors in the formation of Shovadan [2].

Shovadan is a cool underground space in the traditional buildings of Dezfoul and Shooshtar cities that is constructed just by excavation because of the characteristics of the soil in these two cities. It does not have any constructional materials, just plastering is sometimes used for covering some parts of

the walls and there are not often any ornaments [1], [3]. Its depth is 5 to 12 meters under the ground surface. That is accessible by stairs [1], [2].

When the temperature of the outdoor spaces is more than 50 degree centigrade the Shovadans temperature is 22 to 25°C. This moderate temperature is provided by the moderate temperature inside the ground [3]. Therefore, Shovadan provides the best shelter for people during the hot days in Dezfoul and Shooshtar cities [2], [3].

Shovadan's temperature depends on its size and depth. The more depth and size it has, the more reduction and stability in the temperature occurs. The depth and size of Shovadan depends on the following factors:

- 1) Size of the house,
- 2) Type of the soil and limitation of the resistant layers,
- 3) Financial capability of the landowner,
- 4) The relationship among the neighbors [4].

Excavating Shovadan because of the suitable soil and low level of the underground water is a gift that is provided for people in these two cities and had conducted the creative architects to construct this space. Therefore life is possible during some hours of the day by the dense urban texture, narrow shady alleys and Sabats and during very hot hours of the day life is continued in Shovadan. Furthermore during some seasons the roofs of the buildings are used for sleeping. So life exists from the roof to Shovadan [1], [3].

A lot of Shovadans are connected to each other in such a way that a great part of the city has been connected as a group and causes an underground life to be formed beside the ordinary life on the ground. These connected Shovadans reach Dez River through the Shovadans of the houses next to the river [2].

The most important factors in the formation of Shovadans are the low level of the underground water and suitable soil for excavation [1], [4].

## III. CLIMATIC AND GEOGRAPHICAL SITUATIONS OF DEZFOUL CITY

Dezfoul is located in the south west of Iran. It is in the eastern side of the Dez River and in the southwestern part of the Zagros Mountains. This city is between the Zagros Mountains and Khuzestan plain that reaches Persian Gulf [1]. Therefore, it has climatic conditions between the conditions of the desert cities (hot-arid climate) and cities along the Persian Gulf [1], [5].

Sometimes in summer the air temperature gets higher than 50 degree centigrade and because it is about 250 kilometers away from the Persian Gulf, it has hot-semi humid climate.

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The most important and effective factor in the formation of architectural spaces in Dezful and Shooshtar cities are the hot climate [2]. Heat mixed with humidity provides a very adverse condition. Dense urban texture and a lot of shade in the alleys are responses to the climatic conditions. Alleys are narrow and have Sabats. The elevation of the city is higher than the Dez River level and it has always benefited from the cool and freshwater of Bakhtiar Mountains [3], [4].

#### IV. EFFECTIVE FACTORS IN THE FORMATION OF SHOVDAN IN DEZFOUL CITY

Hot and semi-humid climate in Dezful city, its proximity to Dez River and having high elevation from the river are effective factors in the formation of Shovadan in Dezful city.

The depth of the underground water in Dezful city is low. In the other cities of the province such as Ahvaz and Khoramshahr, having Shovadan is not possible because there is water from one or two meters under the ground surface. But the elevation of Dezful from the sea level is more than 140 meters and from Dez River level is 20 to 30 meters [5].

#### V. SHOVDAN ELEMENTS

Constructional elements of Shovadan are often as the follow:

- 1) Entrance: Shovadan has a rather wide entrance. Its width is about 1.2 to 1.8 meters and is often without any door. It is located in the yard or in a small veranda next to the yard [2]. Fig. 1 shows the entrance of Shovadan that is located in the yard.

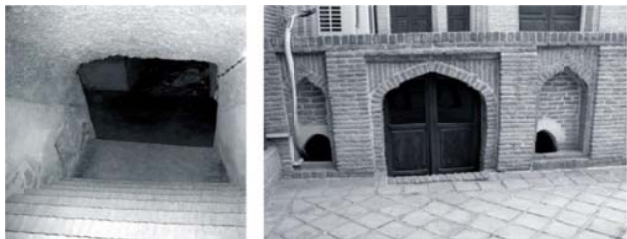


Fig. 1 Entrance of Shovadan

- 2) Stairs: Stairs are the connecting elements between the building and Shovadan. The number of the stairs is sometimes 40. The height of each stair is more than the height of today's stairs. After each 12 stairs there is a wide stair as a landing stair that is called wide stair or Pellaie. In large Shovadans there were two or three wide stairs. The use of these wide stairs is more than a landing stair and by increasing the number of residents in a house it was often used as a space for rest and sometimes it was as an entrance to Shabestan. Shabestan is an underground space that isn't very deep and sometimes its ceiling is even one meter higher than the surface of the yard. The temperature of Shabestan is higher than the temperature of Shovadan because its depth is less than the depth of Shovadan, so when the weather was not very hot Shabestan was used [1], [2], [6]. Fig. 2 shows the stairs

that are connected to Shovadan on the left and to Shabestan on the right of the picture.



Fig. 2 Stairs to Shovadan and Shabestan (an underground space)

- 3) Sahn (Hall): Sahn is the main space of Shovadan. Its plan is often square form however sometimes it is in the form of polygon. Sahn is the central space of activity and life in Shovadan and is the main organizational element in the Shovadan and other peripheral spaces are connected to it.

Sometimes in large Shovadans there is a difference in the depth of Sahn with other spaces and caused Sahn to be recognized easily from other spaces [1], [2], [4]. Fig. 3 shows a Sahn in a Shovadan. White line shows the districts of Sahn.



Fig. 3 Shovadan Hall

Fig. 4 shows the plan of Shovadan. As it can be seen, Sahn is the largest space in Shovadan and is located in the center of Shovadan.

- 4) Kat: The rooms that are connected to the Sahn are called Kat. Kats are more private spaces than Sahn which sometimes are separated from the Sahn through a difference in their depth. The number of Kats depends on the size of Shovadan [1], [2], [4].
- 5) Tal: Tals are narrow tunnels that make connections between neighboring Shovadans and make a route under the ground of the city.

Furthermore cool riverside air entered Shovadan through these tunnels [1], [2]. Fig. 5 shows that Tals make different Shovadans connect and are connected to Dez River. Sometimes for providing privacy for each Shovadan, grid walls by using bricks, were made throughout the width of the Tals. So in addition to providing privacy for each Shovadan, the air would flow easily through the grid walls [2], [7].

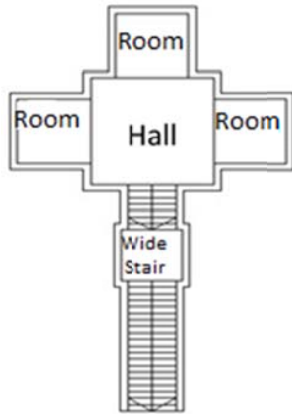


Fig. 4 The plan of Shovadan

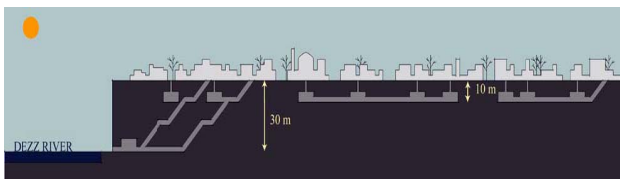


Fig. 5 Tal (route under the ground)

- 6) Dariche or Darize (Vertical duct). It is a cylindrical vertical duct that its diameter is about one meter. It provides light and ventilates the spaces of Shovadan. This duct connects the house spaces to Shovadan and causes the cool air of Shovadan to enter the spaces of the house. Sometimes Darizes are connected to the yard so in addition to providing light for Shovadan, it is used for carrying soil at the time of construction. In some cases Darizes are connected to the alleys or even roofs, so air would always flow. In Shooshtar city Darizes are called Sisara and in Dezful city are called Dozbare. The right part of Fig. 6 shows the real picture of Darize and the left part shows the way that Darize connects Shovadan to the housed [8].



Fig. 6 Darize (a cylindrical vertical duct)

In Shovadan, the temperature of Kats and wide stairs, that have less depth than Sahn, is more than the temperature of Sahn [2]. The underground connection between neighboring Shovadans and having access to the riverside through the underground way for avoiding the intense solar radiation during summer days and for defense against enemies caused the formation of an underground life in Dezful city. During the hot days of summer social connections were made in Shovadans.

To sum up there is a daily life under the ground similar to it

on the ground. Shovadans can be considered as the houses and Tals as the alleys [7], [8].

## VI. CLIMATIC ANALYSIS OF SHOVDAN

As it was told Dezful and Shooshtar cities have hot – semi humid climate and except short period of the year, during other months the intense solar radiation is intolerable and is the most important and effective climatic limiting factor. Based on what was said two ways are suggested:

- 1) Preventing the heat absorption through the reduction in the absorption of solar thermal energy and reduction in the penetration of the warm air.

The first solution is about preventing the heat and warm air entering to the building. Choosing materials with high heat capacity is really important. Among all of the materials that are used for constructing architectural spaces, the soil is without any doubt considered the best insulator.

The temperature of the upper layers of the earth's crust, where almost all of the buildings are setting up, changes rapidly by changing the seasons. However, in the lower layers, From 1 to 20 meters under the ground, the temperature isn't affected very much by the changes of the outdoor temperature. Therefore excavating the soil for making Shovadan is because of the characteristics of the soil that is a good thermal insulator and has high heat capacity. So changes in the outdoor temperature don't have a great influence on the Shovadan's temperature. It may affect Shovadan temperature just about 1 to 2 degree after several months of weather changes.

- 2) The second solution is using air current and ventilation. The night cool air is conducted to the Shovadan through its big entrance in the yard and the air in the Shovadan that has become warm and light during the day is sucked out of the Shovadan through Darize. Because the natural current of warm air is upward, during the day there is no air current although Darize is open [9].

## VII. SHOVDAN RESTORING

Shovadan is an example of a sustainable architecture that is being destructed. There are some suggestions about restoring Shovadan:

- 1) By combining traditional architecture and modern technology cool air from underground spaces like Shovadan that its temperature is 22 to 25 degree centigrade is sucked upwards, towards the building. So the temperature of the internal spaces of a building is reduced and the necessity to use electrical coolers reduced.
- 2) Another suggestion is transferring some spaces to the underground.
- 3) Finally the last suggestion is converting Shovadans to public spaces like restaurants and coffee shops [1], [10].

## VIII. CONCLUSION

The situation of Shovadan under the ground and the creative technology that is used in it has made the Shovadan an outstanding element in hot-humid element.

The way that Shovadanis constructed and used in hot–semi humid climate of Dezfoul and Shooshtar cities, the air current to and out of Shovadan and using the thermal insulator characteristics of soil are the signs of a sustainable architecture. Unfortunately nowadays by creating electrical coolers this is being forgotten. In near future the earth will not have enough energy to provide for human and future architects will face a lot of problems in providing energy for their buildings. Some architects that work in a field called eco tech architecture try to save the natural potentials of the earth and use them correctly.

#### REFERENCES

- [1] Gh. Yeganeh, "Showadan, a sustainable architectural element in Shoushtar city", 8<sup>th</sup> symposium on advances in science and technology 8<sup>th</sup>SASTech, Iran, 2014.
- [2] L. ZamaniAghaie, and N. Bareshadat, "Showadan, A historical heritage in the architecture of the south of Iran", National conference of the cultural industry and its role in the sustainable development, Iran, Islamic Azad University of Kermanshah, 2011.
- [3] F. Soflaee, and M. Shokouhian, "Natural cooling systems in sustainable traditional architecture of Iran", International Conference Passive and Low Energy Cooling for the Built Environment, Greece, 2005, pp.715-719.
- [4] M. Bina, "The climatological analysis of Shovadan in Dezfool houses", *Beautiful Arts J. (Honarhai e ziba J.)*, Iran vol.33, 2007, pp.37-46, 33.
- [5] A. Kaboli, "Shovadan and Shabestan, "Manifestations of life in hot-semi humid climate of Iran, Dezfoul and Shoushtar cities", *Sun J (Shams J) Iran*, vol. 93, 2012.
- [6] S. M. Abdellahzadeh, "Adaptation to nature in Iranian traditional architecture", *Abadi J.*, Iran, vol. 70, 2010.
- [7] M. Raboubi, and F. "Rahimieh, Shovadan and Shabestan", *Asar J.*, Iran, vol. 2,3,4, 1980, pp. 192-208.
- [8] W. Donald, *Climatological Design Theoretical Bases of the Use of Energy in the Building*, Ghobadian, Iran, Tehran University, 2005, pp. 37.
- [9] M. Kasmaei, *Climate and Architecture*, Iran, Tehran, 1988.
- [10] V. Ghobadian, *Climatological Survey of the Iranian Traditional Buildings*, Iran, Tehran, Tehran University Press, 2009.



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