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## **TYOLOGY OF SUSTAINABLE SPACES IN THE ARCHITECTURE OF HOUSES PLACED IN SOUTH WESTERN IRAN CASE STUDY: DEZFOUL**

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### **ABSTRACT**

In hot and semi-humid climate regions of Khouzestan, Iran, one of the distinctive features of the architecture of houses is their constituents making the identity of cities like Dezfoul and Shushtar. This kind of architecture is rooted in culture, customs and local rituals and totally consistent with climate. One can see highly functional spaces in these cities and feel concepts such as sustainability, climate-fashioned architecture and sustainable development (to save energy and to protect environment) are manifested in them. The constructive interaction between architecture and climate is the most salient feature which has been truly addressed in houses of the regions- an aspect which is nowadays not considered as it should have been. The present study aimed to introduce sustainable spaces of traditional architecture of Dezfoul, to show the involved principles and performance and to examine the climate-based considerations to meet today's architectural needs. The methodology has been functional, inductive and historical with a case-study approach.

**Keywords:** *Climatic Spaces, Dezfoul, Sustainable Architecture*

### **INTRODUCTION**

The idea of climate is a key issue in sustainable development. Because, the rationale of sustainable development, that is saving energy consumption, would be satisfied by designing spaces in which climatic considerations have been respected. Examination of vernacular architecture reveals the fact that nearly all of the houses have been designed and built based on climate-oriented principles taking utmost advantage of natural energy sources to protect against harsh climate of the region. At the same time, such an approach is clearly consistent with the cultural values of the region so that a literally vernacular architecture has emerged (Ghobadian, 2000).

Of the major steps towards sustainable architecture is to design based on architectural rules of each region; each region has its own architectural obligations and necessities. Basically, the key concern of sustainability is addressing environmental issues as well as finding ways to wisely exploit natural resources. Sustainability takes into account economic, social, cultural and aesthetic aspects as well. To put it simply, a sustainability-based attitude strives to provide solutions based on ecological, social and cultural considerations of the region. Therefore, buildings must be designed in such a way that ideals, needs and wants of the local residents can be suitably met. Therefore, based on considerations such as nature-architecture interaction, simplicity and privacy, the architecture of the region can be conserved effectively (Beiranvand, 2010).

Fighting with harsh climate of Khouzestan has been the major challenge for the architects of the region; a mission which they have successfully managed to handle with. Introducing architectural elements such as shavadoun, Khovoun, Sabat, Kanise, etc. have been considerable achievements in this respect satisfying the comfort of the local residents.

Two key elements have played the major role in creating the identity of Dezfoul city: water and soil. The Dez River constitutes the corner stone of the architecture of this city. Concerning the architectural features of the city it is worth mentioning that nearly all travelers and architects who visited the south-western part of Iran have been fascinated by the architectural attractions of the city. Notwithstanding,

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except the special cases which have been reported and studied extensively, many of other architectural aspects of the city have been scantily addressed. Studies deserving special mention in this respect include the valuable book *Dezfoul, the Brick City*, an extensive research on architecture of the city, by Gh. Naeemian as well as *The Hot and Semi-Humid Climate of Dezfoul and Shushtar*, a successful investigation on identifying the city and the vernacular residence in Iran, 1974, by Farangis Rahimiye and Mostafa Rabboubi. Despite such outstanding works, however, still many more remain to be done.



Figure 1: Souzangar's House, Dezfoul. Source: writer

## MATERIALS AND METHODS

### Methodology

In this research the methodology has been functional, inductive and historical with a case-study approach with an aim to reach a better understanding of sustainable architecture based on examining the cases.

### Climatic Characteristics of Dezfoul

The chains of Zagros mounts and the mounts of the hot southern plateau of Iran separate the country from the Persian Gulf. If such topography had not existed locally, the climate of the region would have certainly changed resulting in considerably increased temperature. During the summer the temperature usually ranges 35-45 °C or even exceeds. Because of existence of the southern coasts of the country, which are in close proximity to the ocean, the relative humidity of the region is very high reaching as much as 70% which has created a hot and humid climate for the city. Notwithstanding, marine breeze along with hot wind create a soft climate alongside the coastline which vanishes out approaching the depth of the land. Regional precipitation may appear in the form of heavy, light or sporadic rain. In regions with little rain there exist sizzling wind known as *fire wind* (literally atash bad) which may cause eye and skin damages (Kasmaie, 2006).

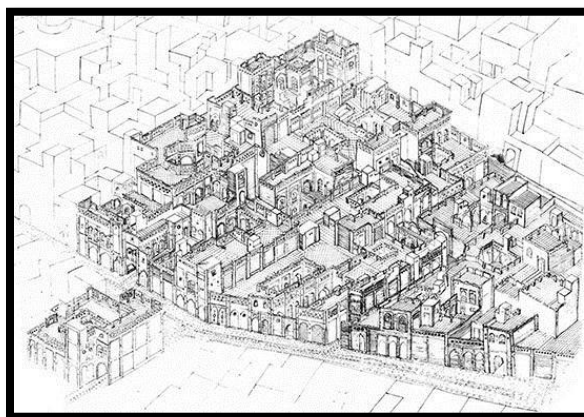


Figure 2: Arrangement and connections of the urban fabric, Dezfoul

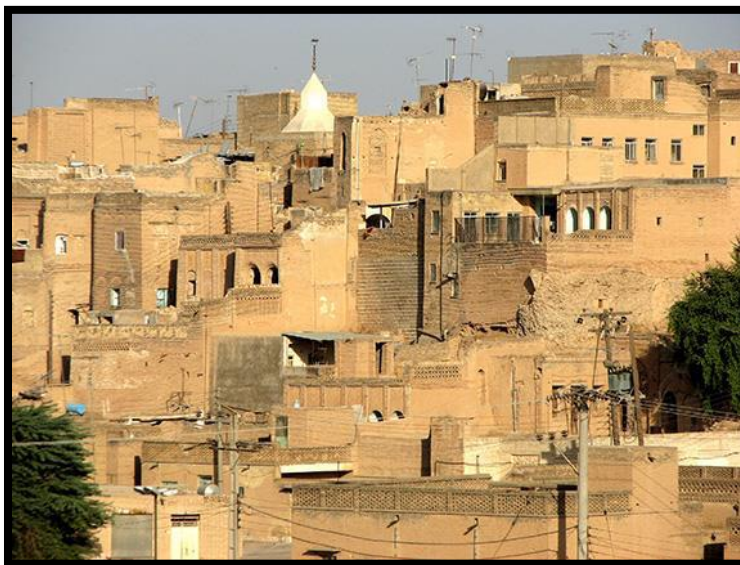
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### *Climatic Spaces*

The city of Dezfoul, placed in southwestern Iran, has a hot and semi-humid climate. Traditional spaces of the city enjoy certain characteristics making them distinct from those of other cities. In fact, these spaces make up the identity of the city which itself, in turn, relies on cultural values, rituals and local customs. Climatic spaces of the traditional houses are those spaces which are meant to meet conceptual and functional purposes; the existence of such spaces may create spatially pure experiences.

### *Void and Solid Spaces*

Since the traditional architecture of Iran is introvert in character, the view of the city is very simple rather in a minimalist manner. For this reason, it is very unlikely to see built spaces alongside or in front of the passage- ways. The reflection of meeting this social purpose has been represented in the form of architecturally even surfaces with, except when necessary, no portico, arch or passage. Archways and entrances within the traditional fabrics are cases of interaction of void and solid spaces. There is no trace of a market cross, commonly found in traditional architecture of desert regions, in Dezfoul city. The elements such as trees, water pools and open spaces are visible only sporadically in residential neighborhoods. The reason is the climate-based compactness of the city's fabric. Narrow lanes are suitable passages in terms of climatic considerations: They both make shade during the most hours of the day and function as air ducts, due to their narrowness, making pleasant breeze for the passersby. If the lanes are covered, the inner space becomes still cooler. The importance of all this doubles when we remember that the whole city is placed in a hot climate and the existence of water is absolutely vital. The water available, from one hand, and the topography of the region, from the other hand, has been factors forming the narrow lanes (Naemian, 1997).

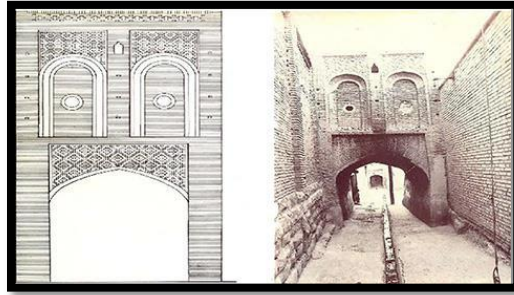


**Figure 3: Arrangement and connections of the urban fabric. Dezfoul. Source: Dezfoul Cultural Heritage Office**

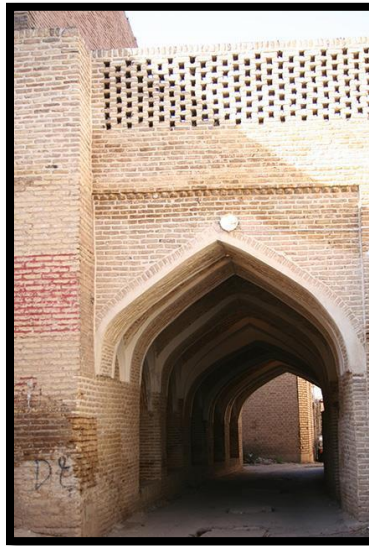
### *Sabat*

Archways, locally called as Sabat, serve several functions the most important of which is extending the space of house using the passageways. In addition to making shade, the space of an archway, may be used as a room. Even in some cases, a archway may connect a house at two ends of a lane. Irrespective of the reasons to build an archway, the obligation dictated by climate must not be forgotten. Additionally, Archways create an interwoven network of ways connecting the residential fabrics. Unlike the other cities located in desert climate, houses are built in two or three stories. Because of the introvert character of traditional architecture of Iran, the view of the city is at utmost simplicity.

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**Figure 4: The outer view of an archway and the room over it. Source: Naeemian**



**Figure 5: The outer view of Karvan archway. Dezfoul.**

*Khowun*

Brick, as a construction material, is used in many different ways in different cities of the country with different climates. One of these ways is locally called as khowun originally emerged in Dezfoul. Khowun is a kind of decorative brick bonding flourished especially in Safavid era and then continued until Qajaar and Pahlavi I eras (Naeemian, 1997). In this kind of brick bonding, bricks are used from thickness to create trellis patterns on the fascia of the view. The word Khowun, a term used in Persian architecture, refers to mosaic-like patterns built on the fascia of the view and has stopped to be used in the Persian language in recent centuries; there is not a trace of the word in none of the Persian dictionaries.



**Figure 6: The transom of Zargar's house. Dezfoul**



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*Kanise*

Bricks were used to build step (stair). Kanise is a kind of step-like form connecting the basement to the roof. At the same time, the space created under the staircase could be used as a place to keep different things and gadgets. In addition, Kanise creates shade and pleasant breeze.



**Figure 7: A view of staircase of Souzangar's House. Dezfoul.**

*Riyah*

Riyah refers to the brick wall- in trellis form- of the parapet (of the roof). It is usually as high as a man. This structure turns the roof into a private walled yard. The latticed form of the riyah makes the air movement possible. In Dezfoul, roofs may be used as a space for sleeping, living or as an additional space in certain months of the year. The parapet of the roof is usually built by full size/half size bricks. Top of the parapet is finished by a course of full size bricks (Naeemian, 1997). Three major benefits of riah include (a) creating a cool space during hot months due to its latticed form; (b) creating a private walled space on the roof and (c) meeting an aesthetic purpose.



**Figure 8: Souzangar's House. Dezfoul**

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**Figure 9: The residential fabric of Ghal-e Neighborhood. Dezfoul. Source: Naemian**

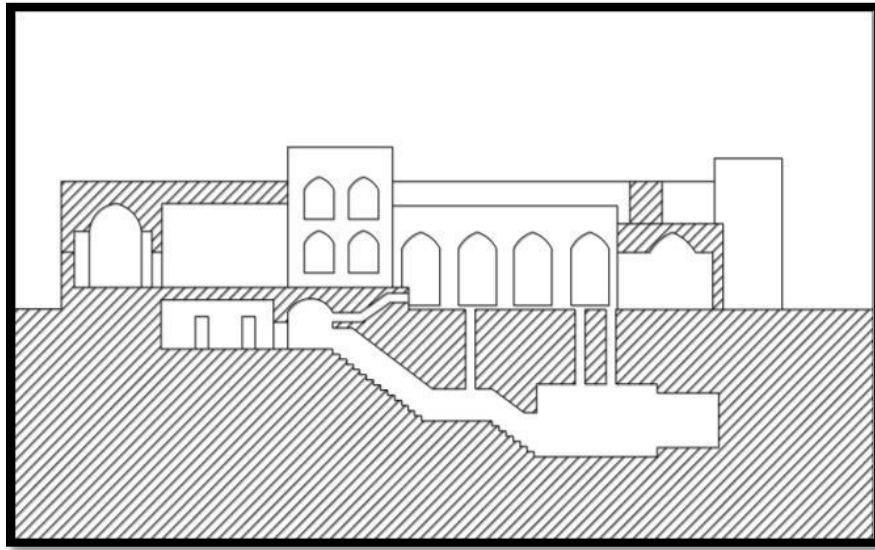
*Shavadun*

Studying the sustainable architecture of Iran reveals cases of architectural genius. Shavadun, only seen in Dezfoul and Shushtar, has a special purpose. The rationale of Shavaduns can be summarized in several factors including the hot and semi-humid climate of Dezfoul; proximity to two rivers- namely, Dez and Karoun; taking advantage of cool water of Karoun; and being on a higher topographic level than that of the river. Taking advantage of the cool water of Karoun and of moderate temperature of underground environment, the intelligent architects of the region have managed to create livable conditions in a local temperature exceeding 50°C much earlier than the advent of cooling devices and systems. The climatic tables and statistics also indicate clearly that livable conditions are only present in a very short time span of the year. Additionally, the old fabric of the city resting on a hard and vast area of conglomerate bed (Imam, 2003) provides suitable conditions to dig underground water-guiding channels and Shavaduns in the depth of the ground (Pour, 1995).

The origin of the word Shavadun is not still clear but given that certain monuments of Dezfoul, including bridges and dams, date back to Sassanid era, it seems acceptable to suppose that Shavaduns must be at least more than 1500 years old (Safaie, 2009). There is not a consensus regarding its etymology. The word Shavadun as used in the book *Iran's Cities in Parthian and Sassanid Eras*, by Enayat-o-La, is derived from Pahlavi word *shutapuata* meaning to help somebody in taking off his coat especially when a person enters underground spaces. Also, some believe the word Shavadun is a combination of *shab* (night) and *abadan* (peaceful/ prosperous). The former root, however, seems to be more reliable (Bina, 2008). In addition, the word *shoune* in Shushtari dialect means the water cooled by the breeze blown from the north. Therefore, there may be a connection between the two words (*shoune* and *Shavadun*) in terms of semantic similarity and function.

Not only does *Shavadun* provide comfort, as a cool basement, for the residents during hot months of the year, but also it was used as reliable barrier against the invaders. The underground connections through neighboring Shavaduns, the accessibility to the river by underground routes in order to fight unbearable heat of summer and meeting a defensive function, all created a kind of underground life-style.

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**Figure 10: A cross section of one of the Ghal-e Neighborhood's Shavaduns. Dezfoul.**



**Figure 11: The Shavadun of Zargar's house. Dezfoul.**

**RESULTS AND DISCUSSION**

**Results**

This study tried to introduce the climatic spaces of Dezfoul city. It was made clear that the architects of the region adopted various architectural approaches to develop and enhance comfort for the residents. Although being consistent with harsh environment seems to be a hard challenge, it has been responded to intelligently taking advantage of local possibilities and potentials. Dezfoul, in terms of climatic conditions, is placed between desert cities and the Persian Gulf's cities. In this city the temperature sometimes exceeds 50 °C and due to the considerable distances from the coastal line, the intensity of humidity decreases forming a hot and semi-humid climate; the geographical conditions dictates that a compact city is created so that human-made shade and breeze are formed. Narrow lanes and numerous archways provide the acceptable comfort while approaching the houses. One can be readily fascinated by the art of the architects who have not had a one-sided outlook. Looking at the uniquely beautiful trellis works (khowun) on the door frames or on the walls, one may tell him/herself how beautifully they have been built. Looking at them, this time more closely, one may find that aesthetic aspects were not the only intention; recessed and projected bricks have made shades in a manner radiating more comfort- making pleasant breeze in the heart of sizzling summer. In Dezfoul, from the roof to shavadoun, houses pulsate

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with life. The way such climatic spaces have become consistent with hot and semi-humid climate and the way of exploiting soil energy and wind are all true manifestations of a sustainable architecture.

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