

# Conservation of *Badgirs* and *Qanats* in Yazd, Central Iran

Dr Reza Abouei<sup>1, 2</sup>

<sup>1</sup> School of Architecture, University of Sheffield, Sheffield, UK

<sup>2</sup> School of Architecture, Art University of Isfahan, Isfahan, IRAN

**ABSTRACT:** Of all historic Iranian cities, Yazd, with thousands of historic residential buildings and a large number of traditional structures such as *badgirs* (wind-towers) and *qanats* (underground tunnels) contains the largest uninterrupted historic urban fabric in Iran. The city is also an important example of Iranian urban history, whose urban fabric, well adapted to regions dry and hot climate, is relatively a living and dynamic area. The special climate of Yazd has made it necessary to adapt a particular architectural style and urban development/redevelopment schemes. Furthermore, most historic areas of the city contain various traditional structures such as the *badgirs*, *ab-anbars* (water storages) and *qanats*. The existence of these mud-brick ventilation structures, which dominate the city's roofscapes, creates a distinctive architectural feature of Yazd in which an efficient clean energy system has been used for centuries. As an ancient Iranian system of irrigation, the *qanats* are also among the outstanding infrastructural features of Yazd in which an organised network of deep water wells linked a labyrinth of subterranean tunnels to form an artificial spring. Currently, many of these traditional structures remain in use, but the historic urban fabric of the city is under the risk of gradual depopulation. Accelerated modern technology and the change of social and economic aims of the community, in Yazd like many other historic cities, alongside the infeasibility of changes in traditional infrastructure have caused the gradual abandonment of these areas. This is, in effect, the first step of demolition. Faced with this dramatic situation, which leads to irreversible cultural heritage losses, this paper aims to advocate the potential and capabilities of *badgirs* and *qanats*, and addresses a developed concept of the conservation of these traditional structures in Yazd.

Keywords: *badgir*, *qanat*, conservation, Yazd

## 1. INTRODUCTION

Most parts of Iran have a very hot and dry climate. Most important is the existence of the two deserts of Kavir-e-Loot and Kavir-e-Namak (Dasht-e-Kavir), as well as scanty rainfall which resulted in the central part of the country having a semi-dry and dry arid climate with hot summers and cold winters. In many historic city centres of this region, the urban and architectural features indicate the particular life style in which the adaptation with the specific climate situation of the relevant areas has been an initial principle of architectural and urban planning. In fact, this situation made the country necessary to adopt a particular architectural style in which the old parts of many central cities such as Yazd were mostly built of *kheshts* (sun-baked bricks), with the walls being plastered with clay and straw. It is worthy of mention that since clay and straw have always been present in abundance in the central region of Iran, the *kheshts* have been the dominant building material in this part of the country. To these must be added a complicated system of *qanats* and specific architectural/structural styles which have been used in the design of many residential, religious and commercial buildings, particularly in the historic quarters of Yazd.

## 2. YAZD: AN OUTLINE OF THE GEOGRAPHY AND HISTORY

The province and the city of Yazd are located on the central part of the Iranian plateau. The city of Yazd, 420 miles (670 kilometres) from Tehran, is the capital of Yazd Province which borders Southern Khorasan, Isfahan, Fars and Kerman provinces. Being located beside the central mountains and far from the Caspian Sea and the Persian Gulf, Yazd has a climate which mostly resembles dry and semi-dry desert climate. It is also due to proximity to the two major deserts of the Iranian Plateau and in the shadow rainy region. Hot weather, low dampness with lowly rainfall and highly evaporation are the main factors that make Yazd Province one of the driest provinces of Iran [1]. The maximum temperature in the hottest months of the year, particularly in May and June, in north and north eastern areas of the province is about 50 degrees in Celsius which is greatly intolerable. In the coldest month of the year, the temperature in western area, particularly on the foot of the Barfkhaneh and Shirkooh peaks mountains falls down to about -20 degrees in Celsius [2].

Historically, Yazd, with a large number of monuments and sites possesses a rich heritage of ancient culture and civilisation during various historical periods of Iran. Fortunately, due to its distance from important capitals and its harsh natural

surrounding, the city remained immune to major troops movements and destruction from wars and mainly held its urban forms and architectural style as well as its traditions for centuries. Currently, a bird's eye view of historic urban areas of Yazd still gives a specific impression of its particular urban fabric (Fig. 1).



**Figure 1:** A bird's eye view of the Fahadan Quarter, Yazd (Author)

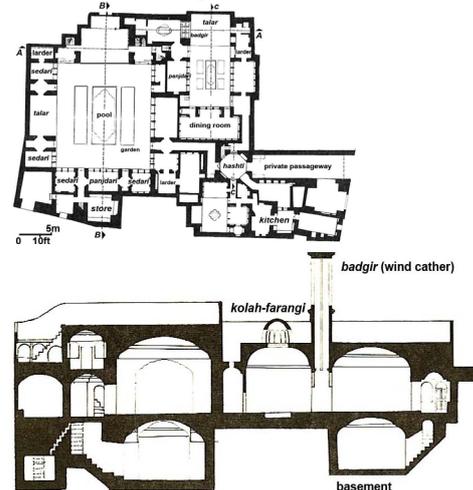
The individuality of Yazd was largely enriched by the city's sustainability, as the product of a developed urban planning and architecture. Most historic areas of Yazd contain various traditional structures such as historic residential, commercial and public buildings, religious monuments, historic narrow covered alleys, *ab-anbars* (underground water-houses or water storages), *hussainiehs* [3], caravanserais, and the *khanaqahs* (monasteries). Among the important architectural and urban features of Yazd there have also been a large number of the *badgirs* (traditional wind catchers or wind towers) and the *qanats* (underground water tunnels) which are among the most significant elements of its built environments for centuries.

### 3. THE BADGIRS, QANATS AND AB-ANBARS OF YAZD

By using the *badgirs*, the *ab-anbars* and much more importantly the *qanats* the people of Yazd remarkably battled against the dryness of the neighbouring deserts for centuries. The *badgir*, literally the 'wind-catcher' is a high structure built above the roof of residential buildings that catch the passing fresh air and channel it down to the ground floors and basements. The weathering shaft, ventilation shaft and wind tower are other names which are also used for the *badgir*. In the *badgir*, the hot air is captured at the top of the structure and passed through a simple canal, delivering the cooler air at the bottom of the canal, where there is a small water pool in the basement. Basements were used extensively in the old houses in which the temperature is about twenty degrees less than the courtyard, particularly in summer. In the hot and dry summers of Yazd the inhabitants of these houses still use the basements and its small pool and fountain to escape from the hot weather of Yazd during summer. In the past, the basement of houses was also used as a natural refrigerator in which foods such as fruit and meat were stored and preserved for several days. Figures 2 and 3 show a ground floor plan and a

schematic view section of a historic residential building in which there is a typical *badgir*.

As a natural cooling system, the mud-brick *badgirs* are good examples of the efficient clean energy system and make not only the traditional environments of the city cool especially during hot summers, but they also provide ventilation to refresh the air surrounding the residential buildings.



**Figure 2, 3:** A ground floor plan and a view section of a historic residential building in Yazd (Author and Iranian Ministry of Housing and Urban Development-MHUD)

Some mosques and old residential quarters of Yazd and the neighbouring cities such as Meybod and Ardakan have their own specific *badgirs* in which the form and architectural and structural styles are different from other *badgirs*. At present, the most famous and the highest *badgir* of the world is located in a historic sight-seeing area called the Dowlat Abad Garden in Yazd. This garden has been located in the south-eastern part of the old city centre, in the historic quarter of Dowlat Abad. The lower part of the 250 year-old *badgir* of this garden, which is 108 feet (33 metres) high, has been surrounded by the lattice wooden doors and windows with small pieces of the stained glass and a small pool, irrigated by the Dowlat-Abad *qanat*. Through the elevated *badgir* of the Dowlat-Abad Garden, air is conducted into the interior and cooled through a small pool (irrigated by a *qanat*) which is located on the ground floor of *kooshk* or mansion.

The *badgir* has been also used for public buildings such as mosques and the city's traditional water reservoirs or *ab-anbars* to cool water by breathing air through it.

The *ab-anbars* are among other traditional structures of Yazd which were widely used in historic quarters of the city during past eras. The *ab-anbar* in Persian literally means the public water-storage: *ab* as 'water' and *anbar* as 'storehouse or storeroom'. Located at the centre of city neighbourhoods, these structures made urban settlements possible in many desert regions of central Iran. The *ab-anbars* were also located very close to the ancient trade routes leading to populated villages, towns, and cities.

Structurally, the *badgirs* have usually been beside *sabaats*. The *sabaats* are the linked arches between two walls of an alley which make the hot temperature of the city more tolerable. One of the main intentions behind the construction of *sabaats* has also been the creation of a bracing system for the linked structures. These structures have also enriched the sense of neighbourhood among the citizens. In fact, these linked arches have been multi-functional structures. Particularly over the long days of the hot summer of Yazd, these structures together with narrow alleys and tall walls of residential buildings widely create shade and prevent sunlight falling directly on inhabitants who walk through the alleys and also protect them from the cold wind in the winter. In some cases they also function as single rooms over the narrow alleys. Currently, there are many *sabaats* and narrow alleys in old quarters of the city, in particular near the Jame Mosque Quarter.

The *Badgirs* harmoniously point to the city's warm and dry climate and remain the good examples of efficient desert architectural design and innovation. The existence of these special ventilation structures, which dominate the city's roofscapes, is a distinctive architectural feature of Yazd. Some new and old *badgirs* in different areas of Yazd are shown in Figures 4, 5 and 6.

Apart from *badgirs*, the underground water tunnels or *qanats* are also among the city's outstanding infrastructural features. As an ancient Iranian system of irrigation, the *qanat* or *kariz* is an organised network of deep water wells linked a maze of underground tunnels and canals to form an artificial spring. In this ingenious system, a fresh subterranean water source, from distant resources, is tapped and channelled down through a series of tunnels to the ground level. The *qanats* are usually used to irrigate farmlands and small fruit orchards of residential buildings throughout the populated areas. In winter, when there is less need for water, it is stored in reservoirs to be used later in summer [4].



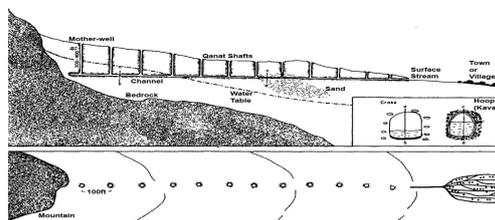
**Figure 4:** (above left) A modern *badgir*, Safaeiyeh, Yazd (Author)

**Figure 5:** (middle) The old quarters of Yazd are dominated by many tall *badgirs*. (Author)

**Figure 6:** (above right) Two pairs of *badgirs* and *sabaats* (Author)

Due to the shortage of water in the central provinces of Iran, there are thousands of water wells connected together by *qanats*. At the present time, although the *qanats* have been replaced by the modern deep wells, the agricultural lands of many Iranian cities in the central part of Iran such as Yazd, Kerman, Naein, Kashan, Shiraz, and Isfahan are still

benefited from the *qanats*. In Yazd, some parts of the city are located on several *qanats* and their branches which have provided the lower agricultural farms with an adequate water supply system. The traces of some of these *qanats*, dating back to the fifth and sixth centuries, can also be found in ancient quarters of the city and neighbouring towns and villages such as Zarch [5]. It should be noted that these urban facilities are the main water resource for irrigation of the agricultural lands of the city and neighbouring areas. Many residential buildings, schools, bazaars, and mosques have also been connected to the network of *qanats* by gutters, grooves, rivulets, and ponds. In some cases, people also used to take advantages of the water of *qanats* for their personal use such as drinking, cleaning and irrigating their small gardens. Figure 7 shows a cross section and aerial view of a typical *qanat*, and the direction of the four main *qanats* of Yazd is shown in Figure 8.



**Figure 7:** Cross section and aerial view of a typical *qanat* (English, 1996, p. 31)



**Figure 8:** Traces of four main *qanats* of Yazd. The city wall of Yazd and the oldest quarters of the city are highlighted in brown. (Author and Yazd Zonal Water Organisation)

#### 4. CONSERVATION OF THE ARCHITECTURAL RELICS OF YAZD: PROBLEMS AND OPPORTUNITIES

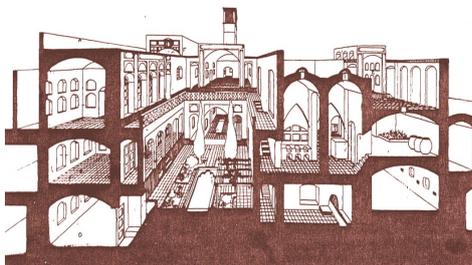
The existence of these structures in most parts of the historic quarters of Yazd is widely one of the main potentials for attracting tourists and can be effectively considered within urban conservation schemes. Nevertheless, these structures remain not only neglected but are gradually being demolished [6]. Although there are currently about 3,300 *qanats* in Yazd Province of which 3,000 *qanats* are still active and in use, these facilities are becoming increasingly polluted due to discharge of industrial effluents from local factories of the city [7]. Furthermore, less than 500 *badgirs* are located above the roof of historic buildings of Yazd, witnessing the modern mechanical and electrical ventilations on the roof of many structures, in particular residential buildings.

As a matter of fact, these traditional structures have been generally under threat from the impact of

inappropriate restoration and conservation and most importantly the rapid growth of technology and the rising standard of living in the modern period. A rapid growth in technology usually takes place alongside the growth of people's social, economic and cultural expectations concerning urban facilities. Because of the nature of the construction techniques and materials used in the historic buildings of the city as well as the organic growth of the old city which is mainly influenced by its natural environment, the historic neighbourhoods often cannot meet people's expectations [8].

It should be noted that there are differences between urban planning strategies during the pre-modern and modern times. Despite having been organic in the historic quarters, current urban development and redevelopment schemes are as a result of the modern definition of urban life. This is systematically influenced by the contemporary attitudes of people, their contemporary needs, as well as the developed concept of their lives.

The lack of similarity between the two aspects of urban form in old and modern buildings directly shows the lack of similarity between the old and contemporary needs of communities. For example, people in the past could tolerate hot temperatures in Yazd by using *badgirs*, small pools in the middle courtyard, and streaming *qanats* in the basement of their houses, but today, the majority of the population of the city more often use water coolers and air conditioners. However, the summer of Yazd is so hot that many people have to go to the foot of southern and western mountains outside the city. Ironically, it seems that even these modern facilities cannot satisfy new standards of living. Another example is the type of house. A huge number of Iranian families used to live in small residential complexes, usually three houses with several rooms (Fig. 9) [9]. People in this kind of small residential complex could tolerate each other well and enjoy their lives without any problem. Today, many people, especially in large cities, live in small flats and apartments. In comparison with previous eras, they live in lonely, even ugly, and inconvenient new environments, while a huge number of beautiful buildings gradually become unworkable in historic areas.



**Figure 9:** A schematic view section of a residential building in Yazd (Tavasoli, 1989)

In fact, the lifestyle of people living in historic quarters is rapidly modernising, giving rise to many new trends towards a high-standard style of life. These inhabitants need, for example cars for various purposes such as travelling, going to large scale shopping centres, taking their children to parks,

countryside and public places or even taking a patient urgently to hospital. They need, therefore, adequate parking areas and easy and rapid accessibility from and to their homes, which are mainly located in the heart of historic quarters.

To these problems must be added the instability of historic buildings against some natural disasters. Iran is located on several major fault lines on which many powerful earthquakes frequently happen. Unfortunately, many residential and public buildings in the country, particularly in historic villages, towns and cities, by implementation in Yazd, hardly withstand intensive earthquakes, such as those quakes with magnitude 7.0 or more, on the Richter scale. By reinforcing historic monuments, particularly the public buildings which are still in use, against the earthquake before it strikes, the amount of fatalities, casualties and demolished monuments will be largely reduced. This can be carried out by the stabilisation of historic structures and the reconstruction of main structural elements of monuments.

Although many historic buildings and areas impose these kinds of problems and the lack of modern facilities, a large number of inhabitants still enjoy some important qualities of these buildings including: the lack of sound pollution, a feeling of peace and tranquillity and the close vicinity to their relatives in historic quarters, as well as a feeling of independence in their large houses. These houses were built close to each other, protecting one another from solar radiation and sandstorms. Generally, built around a courtyard, they became the entity around which the social life of the city family revolved. They were characterised by the simplicity and the thickness of their walls, the use of curved roofs for roofing and the use of the mixed mortar of clay and straw, the size and location of windows and the restrained embellishment of the doors and windows [10].

Furthermore, because of the existence of an individual roovescape, full of the *badgirs*, brick and sun-baked brick domes and other structures in various architectural styles, designs, and forms, the historic monuments might be considered among the main potentials of these traditional areas of the city for either permanent inhabitants or temporary residents such as tourists.

In addition to tourism potential as well as its economic role in the city of Yazd, these monuments and their components can also present the residents and visitors with an individual opportunity to enjoy the particular scenic townscape, roovescape and landscape which are unique among the historic desert cities. It should be noted that the harmony of residential, commercial, public, educational and religious buildings under which the old city centre of Yazd has developed over the centuries has played an important role in its architectural and structural uniformity. This role is considerably relied on the specific character of the architectural relics of the city, such as *badgirs*, *ab-anbars*, and *qanats*. In fact, the physical setting of these structures in the old quarters of the city has contributed to the city an unrepeatable experience of urban planning. To this should be added the existence of tranquillity among the roofed alleys of the city neighbourhoods and the skyline of

the quarters which still remains intact and reveals a unique and very picturesque townscape to inhabitants and visitors.

## 5. ADPTATION TO NEW USES: A REVIEW OF AN EXAMPLE

The restoration and revitalisation of a historic residential building, the house of Malek-o-Tojjar (now a traditional hotel) in the traditional bazaar area of Yazd, has played an important role in the socio-cultural as well as economic norms on the periphery of the area and neighbouring quarters. The hotel was opened as the first traditional hotel in Iran which was previously a private house. By using a comprehensive programme of restoration, this historic monument was restored and revitalised within a very short period. Although there were limited facilities and resources for restoration and rehabilitation, this monument was renewed in only 64 days in the summer of 2000 [11]. The restoration project of Malek-o-Tojjar House included the reconstruction of demolished parts such as the *badgir*, the *qanat*, the *sabaat* and other structural elements. To this should be added the restoration of wooden doors and windows, internal re-planning by respecting original features and structural elements, re-opening old accesses to basement, restoration and coating whole exterior, and finally interior façades. This physical restoration actually has served as a catalyst for a process of awareness-raising as to the intrinsic value of the historic monuments and their traditional components such as *badgirs* and *qanats*.

The restoration and revitalisation of this historic residential building, its *badgir* and *qanat* and other components in the centre of traditional bazaars of Yazd has played an important role in the socio-cultural norms on the periphery of the neighbouring areas. This restoration project obviously shows the effect of an individual revitalisation plan on the urban conservation in the historic quarter of Bazaars. Following the restoration and rehabilitation of Malek-o-Tojjar house, the form of historic quarters and the social norms of the city in its traditional areas were considerably influenced by the changes in the traditional bazaar area of Yazd. It is worthy of mention that since the restoration and revitalisation of the Malek-o-Tojjar House, the value of the historic monuments of Yazd has increased to more than ten times the previous price over a few years ago.

Beside the restoration and revitalisation of the Malek-o-Tojjar House, the historic quarter of Sahlebne-Ali has been also witnessed the rehabilitation of many other historic buildings. At present, this quarter and neighbouring areas benefit from the existence of the schools of art, architectural and urban studies of the University of Yazd, the office of the Friday prayer Leader of Yazd (Imam Jome), the official office of the religious affairs (Sharia) of the city and the traditional restaurant of Hammam-Khan. Furthermore, the mausoleum of the Father of Iranian Architecture, late Dr Mohammad Karim Pirnia (1922-1997), is located in the basement of a historic residential building of the quarter which now serves the Faculty of Art. It should be note that the act of restoration and revitalisation of these buildings

indirectly guaranteed the preservation of their invaluable components such as their *badgirs* and *qanats*.

The revitalisation of these historic monuments has taken much times, effort, and money, but they have gradually provided new economic and cultural opportunities for the inhabitants of the quarter and much more importantly for the preservation of unrepeatable monuments, located in the area. Figures 10 to 12 show a number of examples of the adaptation of historic monuments of to new uses. In addition, Figures 13 and 14 depict a number of historic monuments of Yazd whose *badgirs* have been demolished through urban redevelopment schemes.



**Figure 10:** (top left) The *badgir* and mansion of the Naji Garden, the 19th century, Rahmat-Abad, Yazd (Author)

**Figure 11:** (top right) A new traditional hotel in the heart of the historic urban fabric of Yazd (ISNA)

**Figure 12:** (above) A historic residential building in the Fahadan Quarter, Yazd. The exterior view of this building was restored by the ICHTO and the Municipality of Historic Zones in the early 1990s.



**Figure 13:** (above left) The remains of a historic façade in a new boulevard, Yazd. This boulevard, built in the late 1980s in the heart of the historic quarters of Tal (Mahale Tal) and Atashkadeh, was the result of conflicts between the municipal and cultural departments of the city. Many *badgirs* were demolished through this construction scheme.

**Figure 14:** (above right) The remains of the Mohamedi historic house in the heart of the Takhte-Ostad Quarter, Yazd. As a result of an unsuccessful urban conservation plan in the Takhte-Ostad and Imamzadeh Jafar Quarter, this invaluable monument was demolished in the early 1980s, following the construction of a wide street.

## 5. CONCLUSION

Because of the rapid growth of modern technology it is in many cases impossible, and even in the most optimistic condition it is very difficult, to prevent the process of emigration from the historic quarters. Frequently, people, in particular the teenage population, are interested in using the new technology for various aspects of their lives such as travelling, shopping, entertainment, education and relaxation. In other words, the growth of technology which usually occurs alongside the growth of people's expectations need to be taken into consideration through conservation schemes. For example, the rapid change in attitude towards modern technology, especially over the last decade, is shown by the enormous increase in the use of the internet and various computer software packages as well as different electronic and digital devices. While old-fashioned residential buildings such as sun-baked brick structures can be replaced by high-resistant structures in which there are usually optimised spaces with sufficient lighting, ventilation and sanitation, it is difficult to encourage the residents, especially the young people, to stay in the habitats that were once the houses of their ancestors. Therefore, the lack of modern facilities, founded in new areas of the city, has a negative impact on the life of the historic quarters.

The presence of *badgirs*, *qanats*, *ab-anbars*, historic walls, roofed alleys, traditional materials from which the old buildings and areas were constructed, low noise levels, and much more importantly the spiritual values of this urban heritage make it more attractive than the modern areas of the city. Furthermore, by developing a new way of investing in an historic urban district, functioning for instance in the Malek-o-Tojjar house, a dynamic process in traditional urban districts can be established to combat historic urban black spots.

In summary, there is a real need to breathe new life into the inherent character of the monuments, old quarters and neighbourhoods. This can be achieved by providing some attractive infrastructure. Entertainment centres, cinemas, art galleries, public libraries, coffee bars and coffee nets are some examples of these facilities.

By breathing new life into historic urban quarters, and by applying the required changes in a way that is acceptable to the traditional character of buildings, the gradual process of depopulation of historic buildings and therefore their gradual demise can be prevented. Besides the establishment of new infrastructure, the demolition of some historic fabric is unavoidable. However, a part of this demolition process can only be acceptable if it prevents large-scale demolition in the future, and if it contributes a new life to the monuments and their components. Much more importantly, the conservation of historic buildings and quarters of Yazd can not effectively happen in ignorance of those components and structures by which old buildings and quarters can regain their identities.

## REFERENCES

- [1] The main moderating climatic factor is usually height and so, there is a pleasant climate dominant in the western heights of the province, particularly in the historic villages of Tezerjan (Tarzejan), Dehbala, and Sanij (Sonij). However, the existence of deserts and moving sandiness are the main geographical features of this province.
- [2] Mostofiol-Mamaleki, R (1997), The Geography of Yazd, in Yazd Provincial Government Office (Ed.) Yazd: Negine Kavir (Yazd: The Gem of the Desert), Yazd: The Society of Yazd Public Libraries, pp. 25-52.
- [3] The *Hussainieh* or *tekyeh* is a traditional place to mourn the martyrdom of the third Shia Holy Imam, Imam Hussein.
- [4] Owlia, M R (1997), The Traditional Art and Architecture of Yazd, in Yazd Provincial Government Office (Ed.) Yazd: Negine Kavir (Yazd: The Gem of the Desert), Yazd: The Society of Yazd Public Libraries, pp. 105-144.
- [5] From the author's interview with Reza Fayyaz, the most experienced *moqanis* of Iran (September 2002). It is worthy of mention that the *qanats* are usually dug with the aid of very experienced *moqanis*. The *moqani* is a person who sinks well and digs these subterranean tunnels. Yazdi's *moqani* is still very famous cross the country. Abouei, R (2000) Restoration and Reconstruction of the Malek-o-Tojjar Hotel, Yazd: Satavand. See also Mostofiol-Mamaleki (1997), pp. 46, 47.
- [6] Abouei, R (1998b), The Historic Badgirs of Yazd, Yazd: Satavand, passim. See also Owlia (1997), pp. 130-132.
- [7] Semsare-Yazdi, A A (2005), Payame Niroo (Iranian Ministry of Energy), Iran: Jame-Jam1 (IRIB2), 21 December 2005.
- [8] Farshad, M (1993), Interaction between the Traditional Architecture and the Historic City in Iran, Proceeding of the Conference on the 'Continuance of Life in Historic Urban Fabric of Iranian Cities', Moradi (Ed), Tehran: Iran University of Science and Technology, pp. 99-119. See also Tavasoli, M. (1993), 'An Introduction to the Historic Urban Fabric', Proceeding of the Conference on the 'Continuance of Life in Historic Urban Fabric of Iranian Cities', Moradi (Ed), Tehran: Iran University of Science and Technology, pp. 5-15.
- [9] In the interior or main house (Andarooni), some rooms were allocated for parents, some of them for children and one or two rooms for each newly-married couple. There were also two houses including the exterior house (a house for VIPs and special guests) and a small house very close to the main house for domestic servants.
- [10] See Owlia (1997), passim. Further detailed information about the historic monuments of Yazd is available in an informative book, Yadegarhaye Yazd (Yazd Monuments), written by Iraj Afshar (1995).
- [11] Abouei, R (2000), Restoration and Reconstruction of the Malek-o-Tojjar Hotel, Yazd: Satavand, p. 1.