

# Traditional architecture in central Iran an inspiration for engineers of modern era

By Leila Imani\*

The architecture of old Iranian houses has always inspired the new generation of the country's engineers. The houses that had an *andaruni* (inner quarter), a *biruni* (outer quarter), an entrance and sev-

eral corridors. *Ivans* (rectangular halls or spaces, usually vaulted and walled on three sides, with one end entirely open) and the large courtyards were also their inseparable parts.

The central part of Iran has a hot desert climate, thus houses should be built in a way to

help residents escape the heat. There have long been various methods to cool the environment. In the city of Yazd, a traditional structure called *badgir* (wind-catcher) has been used for passive air-conditioning of buildings.

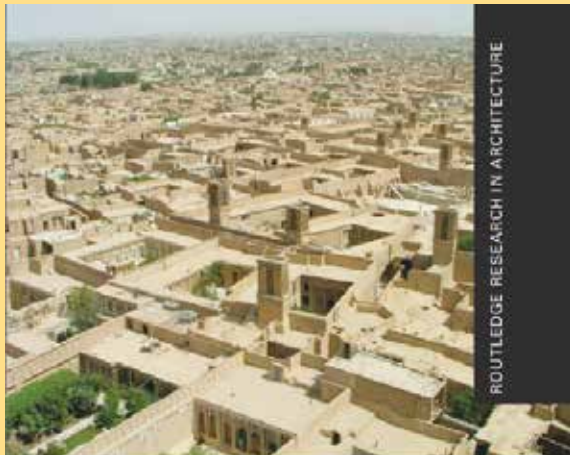
In a book entitled 'Thermal Comfort in Hot Dry Climate' published in 2017, Ahmadrza

Foruzanmehr, an academic and architect, writes about the main cooling systems and methods used in traditional houses in central Iran and examines how architectural elements such as central courtyards, distinct seasonal rooms, basements, and wind-catchers can contribute to the provision of thermal comfort

in vernacular houses.

Following is an edited version of the second chapter, 'Vernacular dwellings in hot and dry climates: The city of Yazd,' of his illustrated book.

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ROUTLEDGE RESEARCH IN ARCHITECTURE

## THERMAL COMFORT IN HOT DRY CLIMATES

Traditional Dwellings in Iran

AHMADREZA FORUZANMEHR



### Introduction

This chapter describes definitions and meanings of vernacular architecture and introduces the reader to vernacular dwellings, specifically those in the hot and dry climates of Iran. It illustrates how they were used in the past, and how they have changed and developed over time; it also shows the kinds of buildings with which they have been replaced.

### Discourse of vernacular architecture

In architecture, vernacular refers to architecture concerned with ordinary domestic and functional buildings as opposed to the monumental.

'Traditional' is broadly applicable to a variety of buildings, from monumental and architect-designed to anonymous constructions. Traditional architecture' is a term to describe all buildings from the past that survive to the present.

In Persian, the terms *sonnati* and *boomi* are the closest equivalents for vernacular and literally mean 'traditional' and 'local' respectively. In the studies which have been done in Iran, *sonnati* or traditional architecture refers to the pre-industrial architecture before the overall modernisation of Iranian society, which started to occur in the early twentieth century. In the context of this research, a vernacular or traditional building refers to a building built by local people using traditional technologies, from locally available materials, in accordance with environmental context, to accommodate domestic ways of life. For the purpose of this

study, which focused on the city of Yazd in central Iran, earth (sun-dried or fired mud-brick) central-courtyard buildings or neighbourhoods built before the 1920s embrace the above-mentioned characteristics and can interchangeably be called vernacular or traditional.



A view of a typical central-courtyard house

### Vernacular dwellings in hot and dry climates

A large part of the world is under the influence of hot and arid climates. Around 20% to 30% of the earth is classified as hot, arid land, and this has been predicted to increase by 15% because of climate change.

Investigation of the Iranian traditional urban dwelling gives a great insight into vernacular architecture of the Middle East region. This is because the design of vernacular dwellings in Iran has strongly influenced the dwellings in neighbouring regions in the Middle East. In addition, since dwellings are the most common form of vernacular architecture, any research on vernacular dwellings will broaden the knowledge of vernacular architecture in general.

For this purpose and in order to set the context, some information about

Iran and Yazd is provided in the following sections.

### Yazd

The city of Yazd is situated at the fringe of a desert in central Iran, almost 600km south of the capital city of Tehran, at an elevation of 1,230 metres above sea level.

Yazd has a hot, dry summer and a cold, dry winter. The summer and winter periods are much longer than the spring and autumn, making it a two-season city. The annual average temperature is 19.3°C, the maximum and minimum recorded temperatures being 45.6°C (July 1982) and -16°C (December 1963), respectively, showing that the city has experienced a fluctuation of 61.6°C. There is a considerable temperature difference between day and night. In summer, the average relative humidity is about 18%. The annual precipitation is low and the average annual rainfall in the city is 71mm.

The history of Yazd

The central courtyard has a pool of water and beds of mixed planting around it. The courtyard level is slightly lower than street level.

The shape of a courtyard is closely related to the size of the plot, the rectangle being the most common shape. The typical traditional dwelling always faces inwards, turning blank lofty walls to the streets and spaces outside, responding to the desire for privacy and climatic requirements.

term 'four-season houses' or 'year round houses'.

The front door has two separate door knockers, the larger one for men (a metal hammer) and the smaller one for women (a metal ring). This is to signal to the household whether they have male or female guests, so that the appropriate action can be taken by the occupants of the house.

The practice is now obsolescent, however, and most houses today have replaced the traditional fittings with modern bells.



A portal entrance in Yazd



Central-courtyard houses in Yazd

Rooms and spaces located in the north of the courtyard are exposed to solar radiation and form the winter quarters. Rooms and spaces on the south side of the courtyard form the summer quarters. This is the area that receives most of the shade, and therefore is cooler than the winter quarters. The main feature of the summer quarters is a semi-open space called the *talar* or *ivan*. It is open to the courtyard and sometimes has a wind-catcher (*badgir*) to aid in its cooling. Dwellers migrated through the house when the seasons dictated. The use of different areas of the house during different seasons has given rise to the

The front door opens on to a reception foyer, called *hashti*, which is usually either hexagonal or octagonal and has a domed roof. There is a long corridor (*dalan*), designed so that women can be given time to put on appropriate dress before the guest gets inside, from the *hashti* to the main courtyard. To add to the provision of privacy, the corridor is off axis and has a bend in it to cut the direct view of the inside of the house from the *hashti* or the street.

They were used in summer for a number of domestic tasks such as drying washing, drying vegetables and fruits. Flat rooftops were also used for sleeping

during the summer nights. There, the family could enjoy the breezes and cooler temperatures unavailable inside the house. The family's privacy on the roof was ensured by a parapet, higher than standing eye level, surrounding the edges of the roof. This parapet provides shade and allows a portion of the roof surface to stay relatively cool and assist cooling in the space beneath. It also protects the family from excessive dust and wind.

Curved roofs (domes and vaulted roofs) have also been used in vernacular buildings in hot and dry regions. They have been the subject of several research studies and are claimed to have different (and usually better) thermal performances compared to flat roofs. However, in vernacular houses in Yazd, when these curved roofs were constructed, their rooftops were usually made flat in order to make them usable for the previously mentioned purposes.

There is often a *zir zamin* (basement) under the sum-

wife, married and then unmarried sons, unmarried daughters and daughters-in-law, and finally grandsons and granddaughters. Junior members of the extended families were generally economically dependent upon the family head and lived together with him in the family courtyard house. Usually three generations lived together. Each was obedient to the previous one. Family members were also supportive to each other and had some responsibilities and roles in the family.

Family-life structure and relations defined the structure of spaces in the home. The central-courtyard house, which is particularly suited to hot climate regions, was a social response to the extended family organisation. The general arrangement of interconnected rooms, and the way they were used, were in line with the emphasised group life and constant interactions and patterns of living and sharing together, rather than the individuality signified



Rooftop of vernacular houses in Yazd

mer quarters. The basement was used for resting and sleeping, as well as for storage. Not only did dwellers migrate through the house during the year from north to south and back, but they also did so throughout the day. In summer they slept on the roof and spent daytime moving around from the courtyard to the summer quarters to the basement, depending on the outdoor temperature.

### Social life in traditional houses in central Iran

The basic traditional household unit was the extended patriarchal family in which moral attitude between children and parents and also between female and male members of the household was, in spiritual and cultural terms, clearly defined and followed in a hierarchic structure. The family was headed by the father, followed by his

and symbolised by owning a room. The many linkages of most rooms or spaces to one another depicted the tight integration and interdependencies of family members and their lives, activities and behaviour, symbolising the unity of the family as one people.

Change in traditional architectural and urban patterns

### Change in traditional architectural and urban patterns

There is a consensus that after the industrial revolution in Iran in the early twentieth century, particularly in the 1920s, traditional patterns of streets, domestic buildings, households and labour in the cities changed in tens of years, whereas in earlier centuries these changes had occurred over hundreds of years.

All of these changes have influenced the way that traditional houses and their elements are used at

the present time, and resulted in the creation of building types which are fundamentally different from traditional ones. The following sections explain some of these changes.

Changes in building form in Iran were largely associated with the change in the street system. The motor car was the most significant factor that transformed the Iranian residential environment in the twentieth century, during which pedestrian access was segregated from vehicular access, and the traditional relationship between the house and the street was completely transformed.

The orientation of the buildings was largely determined by the orientation of the street system. The new system of land subdivision, the rationalisation and standardisation of the size and shape of land parcels, which was consistent with the orthogonal blocks and streets, led to new building forms.

Newer housing areas were much more regular in their arrangement and layout, clearly resulting from more formal subdivision of large land tracts and a more technological approach to house design and construction.

### Changes in households

In the second half of the nineteenth century in Iran, the economic necessity of large, extended families declined. The patriarchal economic structure of the extended family was undermined by the weakening of the traditional sources of income on which it was based. Money in the community shifted into the hands of young workers, juniors in the old family hierarchy. These younger members often chose to live independently. They left the older generation behind in their neighbourhoods, villages and towns. The pattern of household structure and central family unit in Iran changed rapidly from that of large extended families to small nuclear families in the twentieth century. This dictated the smaller sizes of houses and therefore meant a demand for more dwellings for the same number of people. This demand was also triggered by increasing living standards and rising expectations, as well as population growth. High land prices also led to the development of smaller and smaller dwellings.