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THE SPECIFIC LOOK TO ENVIRONMENTAL DESIGN AND SUSTAINABILITY FACTORS IN VERNACULAR RESIDENTIAL ARCHITECTURE OF SHOUSHTAR, IRAN

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ABSTRACT

Environmental design is defined as the process of addressing surrounding environmental parameters when devising plans, buildings and it can refer to designing due to ecological and sustainability issues. According to this definition, it could be said that the first traceable concepts of environmental design is visible in some ancient architectures, which among them Persian architecture has always been well-known because of its solutions for climatic issues and moving toward a sustainable architecture.(Iran is one of the unique countries which have the widest variety of climates, hence architectural solutions differ from one region to another in this country). In this paper, vernacular residential architecture of Shoushtar city, which is one of the oldest in Iran, is studied according to its caring about climatic factors and the amount of success it has had in creating sustainable architecture (in harmony with surrounding environment).

KEYWORDS : Environmental Design, Residential Complexes, Sustainable Architecture, Shoushtar

The city of Shoushtar is located in southwest of Iran in Khuzestan province, whereas a couple of thousand years old civilization there exist. In this province , different ethnic groups from around Iran have mixed together in urban areas. The oldest main residential colonies in Khuzestan are in flats especially alongside the rivers (not mountains). Among these places, Shoushtar has had a content for dwelling a larger number of populations.

In this city there are the oldest Persian water constructions and mills (related to Achaemenian era), which have global reputation and have been recorded as world cultural heritage. These have been founded here for satisfying primary needs of the amount of population which have been dwelled here, and especially their requirements for agriculture. On the other side, the system of housing and especially traditional architecture in this city, has always been well-known because of the maximum effort of architects for making houses in harmony with surrounding environment .There has always been various methods for creating a sustainable architecture ,which could be adapted in contemporary architecture of the region (which has less concentration on the issues mentioned) .It is considerable that previous studies are generally descriptive and don't focus on environmental issues, but in this paper the methods of sustainability are studied and analysied due to their efficiency against corrupting environmental factors which could be a step forward in figure, 1.(Saedi, 2009).

MATERIALS AND METHODS

There is a hot and almost dry to semi humid climate in this region. The temperature in some months [often from 15th May to 15th September] exceeds over 40°c which is not easily tolerable. Hence architects are forced to design their buildings according to climatic factors in table 1 (Kasmai , 2006).

There has always been in here, a sort of harmony between nature and architecture which is apparently considerable in constructing different buildings. it means in a sort of way that buildings make little or no impact on the nature of the site and its resources. This could be recognised in residential architecture of this country by some factors. The research is basically a case study with concentration on traditional samples which could result to some answers about the question of sustainability in the architecture of the region .

Figure 1 : A view to Shoushtar and Karoon River

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Table1: The Annual Average Temperature and Moisture in Shoushtar (Kasmai , 2006)

The average moisture(%)			The average temperature(°C)			*Months*
Daily average	12½ PM	6½ AM	Daily average	Maximum average	Minimum average	
67.5	53	82.5	11.6	5.7	17.5	January
66	49.5	82.5	13.4	7.4	19.5	February
55	37	73	17.5	10.6	24.3	March
47	31.5	62.5	22.2	15.2	29.3	April
28.5	17	40	39.3	21.2	40.4	May
16.5	9	24	34.2	24.9	43.5	June
18.5	10.5	26.5	36.2	26.8	45.5	July
20.5	14	27	35.7	26.5	44.9	August
19.5	12	27	31.6	21.8	41.4	September
30	20	40	25.9	16.7	35.1	October
54	39	69	18.8	11.3	26.3	November
61.7	43.5	80	13	6.8	19.2	December

RESULTS AND DISCUSSION

The Type of Material

Brick is regarded as the most common material in Shoushtar architecture. It is used not only in the structure of buildings (as portal walls) but also in facades and details.(in fact, Shoushtar is called as the city of brick (Rahimieh and Roboobi, 1989).

Burnt-clay bricks are perhaps the earliest example of a manufactured building material . by moulding clay into standard-sized bricks and firing them at around 1150˚c sintering and partial verification take place , permanently changing the properties of the clay . the load bearing and weather resisting characteristics of good quality bricks enable local builders to produce long-life structures at less cost than was possible using stone (Figure 2).

Cave and cliff dwellings provide natural shelter from temperature extremes . Massive buildings are often designed in imitation, with blank walls, shuttered openings, courtyards and narrow streets to baffle dusty winds. Heavy construction materials using earth, brick or other masonry can mediate and delay the substantial thermal flux. Walls need to be a minimum of 25cm thick to provide an 8 hour thermal lag , but 50cm walls and thicker are more common.

Brick walls with light facades can either cause less absorption of heat, also reduce the waste of energy from inside the buildings. Besides, massive brick walls could act as obstacles against penetrating heat inside the building. In nights, the thermal storage in mass of the building would be removed by frequent winds in the region.

Form and Spatial Composition

The general form of the buildings in this region is based on a central courtyard. A courtyard is an outdoor space that has buildings, rooms or building elements around enough of its perimeter to give the space clear definition, the courtyard building consists of its outdoor space together with the built elements that surround it. Courtyard buildings often have an inward focus rather than a primary orientation to the external street or public space (Thomas , 2006) .The type of courtyard used in Shoushtar is significantly different from familiar samples located in oasis cities (like Yazd and Isfahan) (Rahimieh , 1989).

Traditional houses of Shoushtar basically have a U shaped plan. In this form, courtyard is located in the middle and three wings (as residential spaces) surround it; the plan is open from one side which is toward the (Karoon) river. (and this is done for using suitable airflows from the river especially in nights). The issues mentioned before are clearly visible in famous "Mostofi" house. The ground floor plan of "Mostofi" house illustrates the use of heavy brick walls for three dwellings around a courtyard. The outer walls are defensive, but the inner walls and splayed windows are as climatically responsive as the seasonal changes in use. The view from "Mostofi" house to the river and ancient bridge of Shoushtar from open side of the building and within the arches is so superb.

`The other point about this sort of plan is that it causes a noticeable increase in the amount of shadows on different facades and especially inside the court. on the other hand one of the considerable aspects in designing "Shoushtar" houses is that there is a trial to reduce the surface of outer walls which are exposed to open-air. This could be achieved by using a compact spatial composition

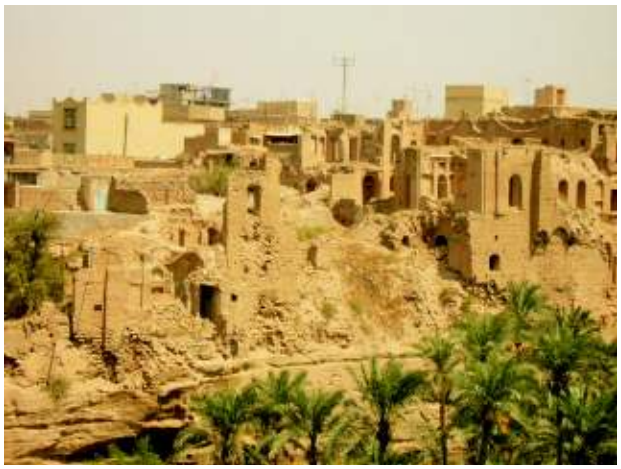

Figure 2 : Brick as The Most Common Material in The Architecture of Shoushtar

with two-story buildings which always shade on narrow streets.

Specific Spaces

There is some sort of colonnades in front of (usually traditional) buildings named Revagh which could act as a filter between the radiation of sun and the building. These (covered from top and open from side) pathways make shadows on building facades (or entrances) and decrease considerably the temperature of the interior space. These colonnades are visible across central courtyards too, especially in front of the rooms. There are also sort of spaces in traditional houses of Shoushtar which are unique in residential architecture. These spaces called "Shavadan" are kind of rooms digged in depth of ground. These spaces are used frequently in summer when the high temperature is too annoying. The depth is about 70-80 steps. (the soil is in a type that could be easily removed and does not require any sort of reinforcement) (Khaleghi, 2007) . The inside temperature of Shavadan is considerably lower than surrounding environment. When it reaches above 50°c outside, it is about only 20°C inside Shavadan. These deep spaces are adjacent to soil and this is the main reason of mentioned coolness. The only problem with "Shavadan" is that it does not have direct access to open air and therefore there is less circulation of the air inside it; which the architects trying to solve it by building special kind of valves.

In general, the height of rooms in Shoushtar houses is more than normal. (bedrooms are between 3-4m high and services about 3m). This issue besides numerous apertures in façades (grilled facades), could increase the circulation of the air inside the building. This sort of grilled surfaces could be seen in cancellate parapets on top of the facades too.

Developing Vernacular Architecture

A developing vernacular architecture is one that uses the characteristics of vernacular architecture to achieve better spaces and broader development objectives for current constructions. It uses and develops local cultural and material resources . it is small-scale, technologically and organizationally simple, and inexpensive. its planning and construction can be controlled by local communities and implemented by these and by local builders. It expresses the values and needs of the local, especially poorer communities and demonstrates continuity with change: remaining rooted in the past and the local, while incorporating the new and the external to meet contemporary needs. The items issued, could be seen less and more in contemporary housing in this region. One of the most famous contemporary residential complexes in Shoushtar is new-Shoushtar complex which has been designed by Iranian well-known post modern architect Kamran Diba.

What really makes this complex unique, is its attitude towards nature which is the soul of Shoushtar vernacular architecture. Brick walls, grilled facades and parapets, narrow pathways, kind of colonnades and are from considerable elements of Shoushtar vernacular architecture mentioned before.

Negative spaces (pathways, courtyards), have a vital importance in New-Shoushtar figure 3. As it was said before, central courtyards are used in traditional architecture of Shoushtar widely. In New-Shoushtar this issue has been utilized in almost similar way. As Diba said : "...the whole concept is an appropriate response to the hot-humid climate of low-lying Shoushtar, which has little water to divert from agriculture. Generally narrow pedestrian streets offer continuous shade. Greenery is limited to a few highly visible and manageable public areas along the spine and to private courtyards in virtually all units...these courtyards could be used as an open-to-sky room. Also roof terraces were moderately screened to provide privacy , as it is customary to sleep on the roofs, where one can enjoy the cool breeze of the night and (Salamati, 2001). Two story buildings with central courtyards in New-Shoushtar architecture are similar in form but differ in dimensions with traditional ones . These courtyards are too narrow (both in width and length),

besides the height of surrounding walls show them even tighter. (The architect deliberately designs this sort of building, to create comfortable shaded space at courtyards especially in summers).

CONCLUSION

Residential architecture of Shoushtar is a result of harmony between nature and built environment. In this region, besides other cultural and social elements which might be involved in design, the architects have always done their best to confront with difficult climatic factors(especially high temperature), which this has been embedded in their architectural solutions such as type of plan, designing specific details and spaces, caring about building materials, compact spatial composition of their buildings and this could be a sample for future constructions in the region.

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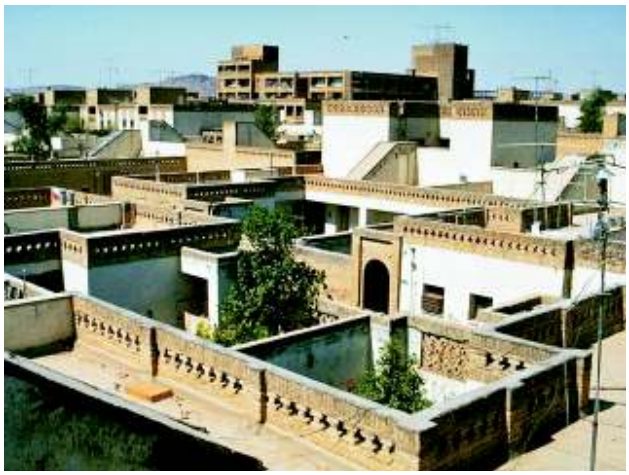

Figure 3 : A view to New-Shoushtar

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