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"The Potential of Baharaini Traditional Houses Compared with the Contemporary Buildings"

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These are preliminary lecture notes, intended only for distribution to participants.

THE POTENTIAL OF BAHRAINI TRADITIONAL HOUSES COMPARED WITH THE CONTEMPORARY BUILDINGS

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ABSTRACT

This paper deals with the history of building design and materials in Bahrain and their suitability to local climate. Passive elements in traditional Bahraini houses have been studied thoroughly, and compared with the current practice in designing buildings. Another comparison has been carried out between the building materials used in the past and building materials used nowadays. The paper shows how the people in the past did utilise the building elements (materials and design) to their maximum in order to live with their harsh climate and in achieving thermal comfort in their houses.

Introduction

The history of Buildings in Bahrain is as old as the civilisations that flourished in this island since 5000 years ago. From the remains of these prehistoric civilisations and a look at the subsequent building styles over the centuries, it is evident that each period in history has been influenced by the previous one. While absorbing some forms, modifying others, these has emerged a pure Bahraini style of architecture, which is quite unique. A style which was at its height in the late 19th and early 20th century. At that time, the people of Bahrain used to build their houses according to their needs and in harmony with the environment as well as with optimal usage of the available local building materials. In spite of

fact that Bahraini climate is hot and has long summer, some comfort was achieved in those traditional buildings by full utilisation of natural energies. Nowadays air conditioning peak power consumption in Bahrain during the summer reaches 65-75% of the total generated power.

Location and Climate

Bahrain is a small Arab State located in the midway of the Arabian Gulf. It is an archipelago consisting of more than 30 islands. The total land area is about 695 km^2. The main island is called also Bahrain, it extends 50 km from north to south and 15 km from east to west. It is surrounded by many other islands.

Bahrain lays down in the Sub-Tropical Hot Zone. Its climate is classified as a maritime desert climate. Here where the sea and desert come together, the air has a higher moisture content than it has inland, but precipitation is as low as in other desert regions, and the humidity of the air tends to reduce temperature diurnal variations. The climate of Bahrain is characterised by extremely hot summers, and relatively cool winters .

In winter (November-March) the weather is normally very pleasant with little clouds and the maximum daily temperatures frequently reach 20 ^oC to 25 ^oC. However , when strong north - westerly winds blow, distinctly chillier conditions can occur, particularly in January and February. Indeed, snow is reported to have fallen in the early 1940's and the whole country was covered with an iced frost in 1964. On the other hand, a temperature of 38 ^oC has been recorded in mid March when a south-westerly wind was blowing off the Saudi Arabian desert. These extreme instances, however, are rare. Although most of the island's average annual

rainfall of just under 3 inches is recorded in these months , the rainfall is confined to only a few days .

In summer there is little or no clouds and from June to September rainfall is virtually nil . The sunshine is very intense. In May and June there is often a fresh wind which reduces any discomfort caused by the heat. In July , August and September winds are usually light and the humidity increases . At this time , wet bulb temperatures frequently reach 30 ^{o}C .

Elements of Traditional Bahraini House

The setting of old Bahraini life was typical of the region . Houses were built along narrow alleys, as shown in figure 1. They looked inward into the courtyards, *Huwsh*, not outwards the street. Usually houses took the form of two separate sections a men's section and a women's section. The men's part includes a place of reception and business, it was called the *Majlis*.

The *Majlis* usually fronted the street, from which it was accessed by a beautifully curved door which was often left open all day for ventilation.

The *Majlis* room was the only part of the house which might have windows into the street. These windows were vertical openings with four shutters, two at the top and two at the bottom, secured with vertical iron bars. At the top, the opening had a semi circular arch fitted with coloured glass. These windows were placed on the north side to let as much air as possible and to enhance circulation within the room.

In the past some square openings were built at ground level. These had no shutters. Their position at the bottom gave some cross ventilation inside which removed the excessive humidity.

The *Majlis* was shaded by a covered terrace called *Liwan* , usually taking up the whole north side of the courtyard. The floor of the *Majlis* was covered with loose seashells. These were used for two reasons. First, because they absorb humidity during the night, making it cooler for walking and sleeping. In the daytime the humidity would evaporate producing an evaporative cooling effect. The second reason for using shells was to keep the floors always clean. Those white shells did not need to be cleaned from dust and dirt.

The women's section consists of the rest rooms of the house which were distributed around the courtyards. All rooms are normally identical in design and there was no specific room for a define use.

The main block (usually on the south, to face the north breeze in summer) was usually covered by the *Liwan* which is an archoid. In other cases the *Liwan* surrounded the courtyard on all four sides, giving shade to the rooms behind and enabling the house occupier to move easily from one room to another without exposure to direct sunlight .

The roof and first-floor *Liwan* were very important for the house occupants. They were the sleeping place during summer nights. On the roof there were some architectural features designed to produce comfort in hot weather. For example, the roof parapet was designed to give privacy to users while at the same time acting as a wind catcher. There were two types of parapets. The first, called *Badgeer* , was made by filling the space between piers with two parallel walls and a gap in between with an opening at the top of the exterior partition, as shown in figure 2. There was another opening at the bottom of the interior one. When the wind blow

and hit the exterior partition, the air will be channelled into the gap between and then escaped through the lower opening into the interior of the house. The second type of parapet was a wooden louvered screen between the roof piers which functioned in the same way as a wall *Badgeer* , figure 3. The design of the slope of these louvers is unlike that found in other countries which have higher rainfall. In Bahrain, they slope from the inside to the outside. The two obvious reasons for this are ; first, for such a design is to direct the air to enter downward rather than upwards; second is to give privacy and free movement behind the screen for the occupants.

One of the most important ventilation devices was the wind tower, *Kashtil*, which was not very common, because only rich people used to enjoy having them, figure 4.

The summer rooms were at the upper level. They were usually located at the corners of the building. The longer sides of the rooms usually faced north. They were lined with windows, each with its own ornate hand carved wooden shutters. Above each window was a semi-circular fanlight of coloured glass. People used to move from the ground floor to the first floor in summer, and back in winter.

Traditional building materials in Bahrain

With the exception of timber products, which were imported mainly from India, all the materials used in the traditional houses were available locally. Timber was crucial for the traditional masonry; it was used in making doors and windows and in forming the framework of the roof. The materials used in buildings are;

i. Mud: This was the only material with sufficient cohesion to form walls. It was mixed with straw and sometimes with wool to strengthen it.

Walls were generally very thick, usually about 50 cm. The reasons for this, are partly to have good compressive strength and partly to resist thermal gain or in another words to have a longer thermal lag.

ii. Coral stones: They were mixed with mud to form stronger and more durable walls. However, stone collecting was labour intensive and time consuming.

iii. Thin coral slabs (*Forrosh*): This material underlies the coastal waters; in some places it lies exposed, and in others is covered by several meters of sand or silt. It was mainly used to link pillars to make walls and fences and to construct the *Badger*, the mid-wall wind catcher.

iv. Gypsum (*Jus*): It is a processed sea stone. Brought from different parts of Bahrain, it was arranged in squares or rectangles of 10x20 ft. size over wooden canal like construction. The stones were piled on the location, and then palm leaves were burned under the stones. The stones were then crushed ,sifted and stored in sacks.

Gypsum was used to plaster the internal walls and only some of the external walls. A thin layer was also used on the rooftop to act as a reflector.

v. Lime (*Nurah*): Lime was used mainly to pigment the interior of the house with a brilliant white.

vi. Timber: Dressed timber was used for doors and windows. Round timber poles (*Danjal*) were used to form the framework of the roof and to support the wall above the windows. The *danjal* on the roof

is covered with mangrove slats (*Yereed*) and a woven palm-frond matting (*Mangrur*) and then by the mud.

Modern buildings in Bahrain

In 1932 oil was discovered in Bahrain. The oil era brought to Bahrain a lot of changes on many aspects of life including building materials and design techniques. New imported building materials such as cement, steel, aluminium and glass were used heavily in the booming building industry. Electricity being heavily subsidised by the state, is cheap and was and still is used excessively especially in the air- conditioning of buildings. unfortunately, modern buildings, with all its drawbacks, were imposed on the Bahraini environment. Thus it has resulted in an improper utilisation of the local buildings' materials and with complete disregard to the climatic conditions and the people needs. High rise buildings with most of their facades made of glass panelling were constructed, as shown in figure 5, allowing the solar radiation to penetrate and cause heat accumulation in buildings ,and thus, the indoor temperature will increase to a very high level beyond the comfort zone, and results in increasing the cooling load required to maintain the human comfort conditions.

Conclusion

Traditional architecture has several creative solutions for a better human comfort in harsh climates such as Bahrain. These solutions enjoy a number of unbeatable positive aspects, such as;

- They use no external energy other than the nature's forces.
- They are basically maintenance free.
- They do not pollute the environment
- They are noise and vibration free.

- They are economical to built

Lessons could be learnt from the use of traditional buildings so that all advantages in saving energy and having thermal comfort can be achieved, with incorporation of modern technology to produce the ultimate buildings design for this part of the world.

Fig. 1 Traditional Bahraini Houses Built Along Narrow Allies

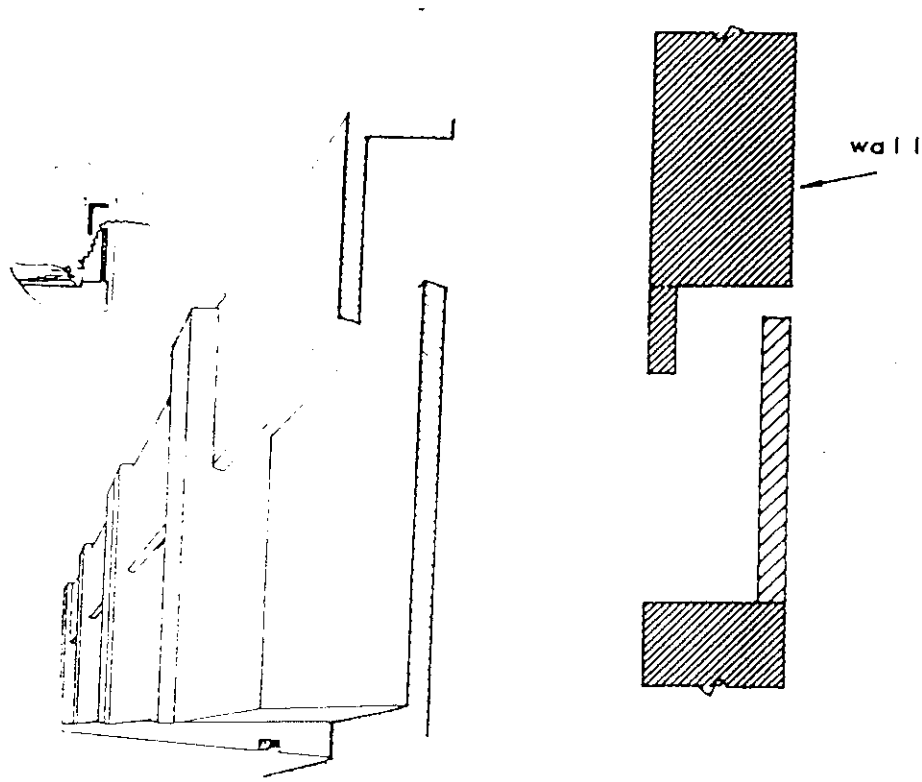

Fig. 2 The Badgeer Principle

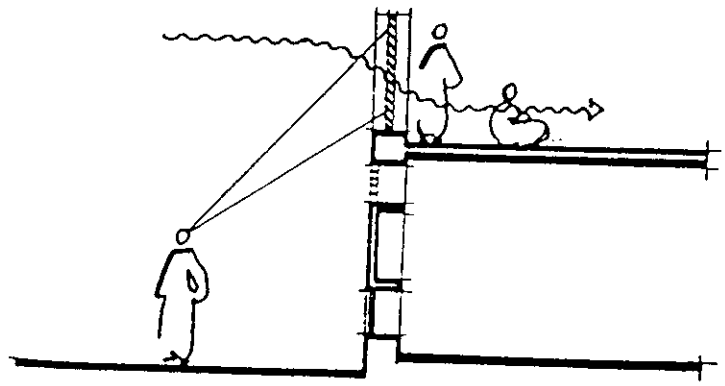

Fig. 3 A Wooden Louvered Screen Ensures Privacy And Air Inlet

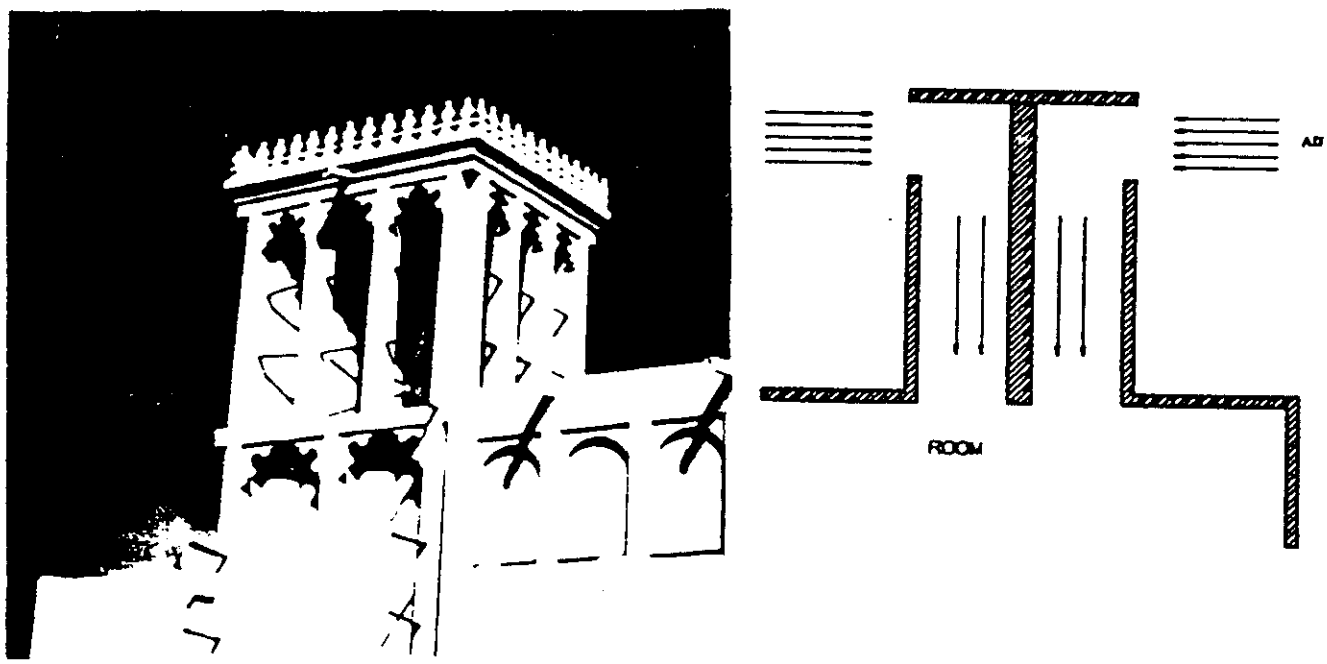

Fig. 4 The Kashtil Principle

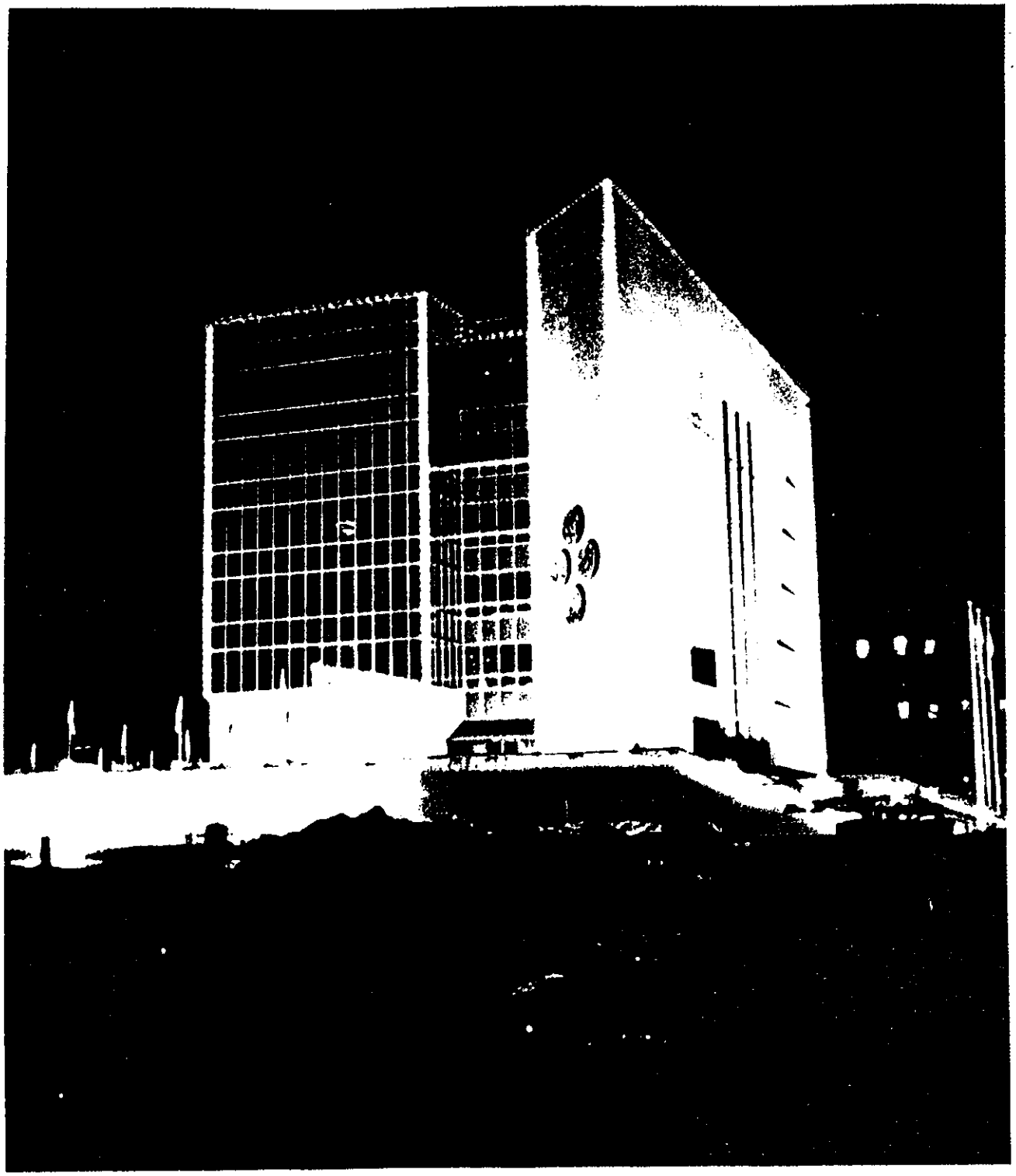

Fig. 5 An Example Of The Modern Buildings Of Bahrain With Glass facades