DESERT DESIGN IN TRADITIONAL CONTEXT: A DELINEATION ON PAKISTAN

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الخلاصـــة :

يُـنبي التراث المعماري للمناطق الصحراوية في الباكستان عن ماضٍ عريق يعود لحضارة وادي إنـدُس . فقد استُـخدمت أنظمة التبريد الطبيعية وغير المستهلكة للطاقة في المناطق الصحراوية معتمدة عدة طرق كالتهوية البسيطة داخل المسكن ، وعبور الهواء من خلال المعابر التحأرضية والصهاريج ، وتوجيه الرياح لداخل الغرف بواسطة صادات للرياح مثبتة على السطح ، وكذلك استخدام صحن الدار لتلطيف المناخ . وكل هذه الطرق تـتيح فرصة كبيرة للراحة والمحافظة على الطاقة للمستخدمين ، إذا أُخـذت بالاعتبار عند تصميم مخطط المباني .

توضح هذه الورقة الموروثات في مجال العمارة الصحراوية في مواقع وأقاليم متنوعة في هذا البلد ، وتقدم أيضاً مناقشة عن المضامين الحضارية والاجتماعية في تصميم المساكن التقليدية من أجل وضع معايير جديدة لعمارة الصحراء .

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ABSTRACT

The architectural heritage of the desert regions of Pakistan originates from a very rich past and cultural history dating back to the civilization of the Indus valley. Natural and no-energy cooling systems employed in desert design include: simple ventilation through the house; air passing through subterranean tunnels and cisterns, directing wind down into the rooms by roof-mounted wind arresters; and the use of the courtyard as a climate moderator. These all have great possibilities for providing user comfort and savings in energy if integrated well into the plan of the building.

This paper unfolds such traditions in desert architecture of various locations and provinces of this country, and presents a discussion on socio-cultural contexts and traditional house design in a search for new parameters for desert living.

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INTRODUCTION

The land of Pakistan is rich in landscape and cultural traditions. A very large portion of its 110 million inhabitants live in the countryside. Three of its four provinces are largely deserts and extreme arid. Temperatures are high throughout the country; and many locations list temperatures of over 116 F. Long hot summers are followed by short cold winters. Overall climate can be summarized by one word: 'Extreme'.

The Indus river and its four tributaries create extensive irrigation in the Indus valley, which compares favorably with the great river systems of the Nile and Tigris–Euphrates. As are the Nile in Egypt and Tigris–Euphrates in Iraq, the Indus is a ribbon of life that for much of its course flows through a true desert (Figure 1).

Half a dozen civilizations have flourished here and left their imprints. About 330 miles north of Karachi, lies one of the most ancient archeological sites — that of Mohenjodaro. The culture of Mohenjodaro was contemporary with that of Sumer in Mesopotamia. The city had paved streets and was built in burnt bricks. It has been called the first grid pattern town on earth; a plan that later diffused westward. The ancient city contained large granaries, public baths, an elaborate drainage system; and even a sewerage system [1]; (Figure 2).

The architectural heritage of the desert regions in this country originates from such a rich past and cultural history. The great diversity of the various regions of the world pertains to the fact that each place and each culture possesses unique features and particular characteristics. In our daily life we constantly relate and respond to buildings and socio-cultural experiences. This is also often found in native and traditional architecture of a region which respects very well both the established way of life of its users and the environmental conditions.

Contemporary buildings — residential and commercial — look much the same all over the world because they are designed to separate conditions outdoors from indoors, relying mainly on mechanical means and defying regional and cultural dictates.

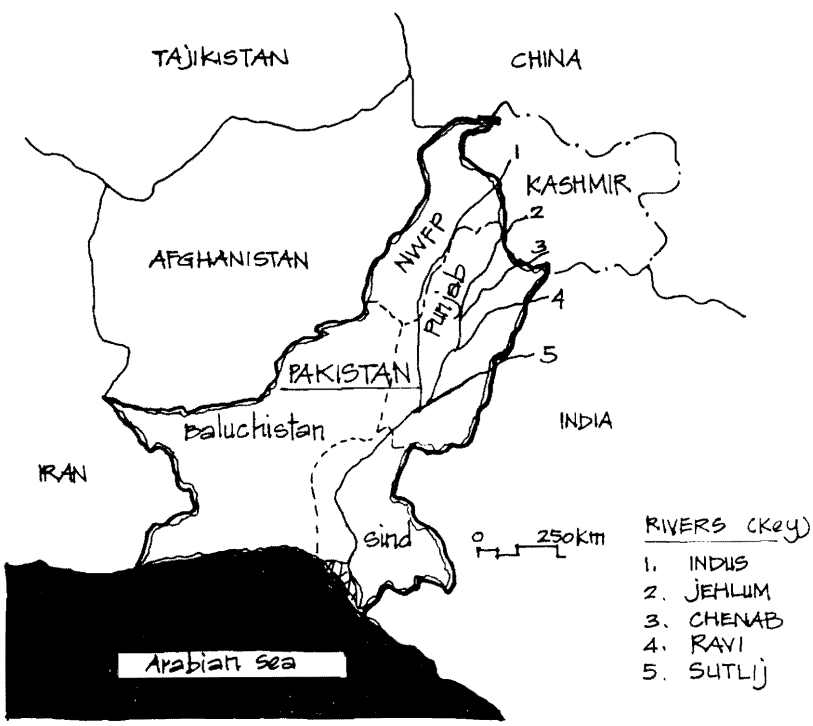

Figure 1. Map of Pakistan.

Figure 2. Plan of Mohenjodaro.
(Source: Oriental Architecture, Volwashen 1969)

Ideas in architecture and building design cannot be simply imported like standard consumer products. It is essential to study, appreciate, and comprehend the unique situation of a region and only then evolve applicable design ideas based on a deep insight into the culture and the environment [2].

My interest and current research deals with architecture and identity; a study of traditional houses and dwellings in the developing countries [3]. A special aspect of this research relates to desert living and traditional building design. This presentation will, therefore, attempt to unfold the native and traditional context for a cross section of architectural traditions as seen in various desert locations within Pakistan. The intent here is to establish understanding of desert architecture; and the discussion will focus on physical and cultural factors in a search of new parameters for desert living.

PAKISTAN: REGIONAL CHARACTERISTICS

Pakistan is bordered by India on the East, the Arabian Sea on the South, Iran and Afghanistan on the West, and China, Tibet, and the Himalayas on the North. On the political map, Pakistan is divided into five regions: Sind, Baluchistan, North West Frontiers, Occupied Kashmir, and Punjab.

Kashmir and its surrounding territories will be excluded from our discussion, since these areas are outside the influence of desert and arid conditions. This paper will present discussion in terms of the following four regions.

1. Sind
2. Baluchistan
3. North West Frontier Province (NWFP)
4. Punjab

SIND REGIONAL

Bounded by the endless sands of the Thar Desert to the east, the barren hills of Kithar to the west, and the Arabian Sea to the south, the Province of Sind is aptly named after the great river, the Indus, whose banks and flood plains are the links of life.

Patches of thick tamarisk forest are the natural flora of the region; and give an idea of how Sind must once have looked. Expanses of loose grey and white powdery sand are a source of great abrasive torture when blowing in a hot gale.

Nowhere else in the country does there exist a population of such ethnic diversity as in Sind. Followers of world's oldest religions: Islam, Hinduism, Jainism, Buddhism, and Zoroasterianism; as well as its newer ones: Christianity and Sikhism are all to be found here. Most of Pakistan's non-Moslem minorities are "Sindhis" [4].

Aboriginal folk whose way of life has hardly changed for thousands of years live along the banks of the Indus. Their houses are simple and spartan, made of bundles of river reeds just lashed together. The flood plains are inhabited by a number of agricultural castes and tribes: Sauma, Jat, Sumro, Rajput, Mohana, and many more. Villagers live in straw and adobe huts with the simplest furniture (Figure 3).

The hills of Kithar are inhabited by tough nomadic people. Here jagged ranges zigzag through stony plains and sand dunes. In summer, temperatures exceed 120 F in the shade. Architectural traditions include tribal fortified houses by the few permanent springs. Common folk follow a wandering life, shelter for them is a goat hair tent or lean-to of leaves. In the Thar desert people build conical huts made from desert brushwood. Permanent settlements and urban desert architecture is built mostly in kiln-fired bricks. In towns, houses are huddled together to seek mutual shading.

Locations near the coast and the Indus delta experience continuous breeze which is ingeniously brought into good use. The rooftops have wind-catchers (*Badgeers*) to funnel the breeze. The breeze is directed down the windshaft into the rooms below for an effective cooling function. The housing layouts which are climate responsive and provide comfort in desert living have the following features:

1. Heavy walls and well insulated roofs
2. Street design which facilitates air movement
3. Sunken rooms and subterranean living
4. Roofs and terraces which provide summer night sleeping and outdoor sitting.
5. Wind arresting devices; and well placed wall openings for through ventilation (Figures 4 and 5).

BALUCHISTAN REGIONAL

In area, this is the largest province, accounting for 42 percent of the total land, with a population much less than that of the city of Karachi alone. Baluchistan lies outside the monsoon system; the climate is thereby exceptionally dry.

The province is exposed to strong winds which are ferociously hot in the summer and bitterly cold in the winter. Extremes of temperature are thus added to the general aridity. The temperatures along the coast reach 90 F; while in the Sibi plains temperatures regularly reach 120 F in the shade. The climate combined with the natural features of the barren hilly landscape forms one of the most daunting environments.

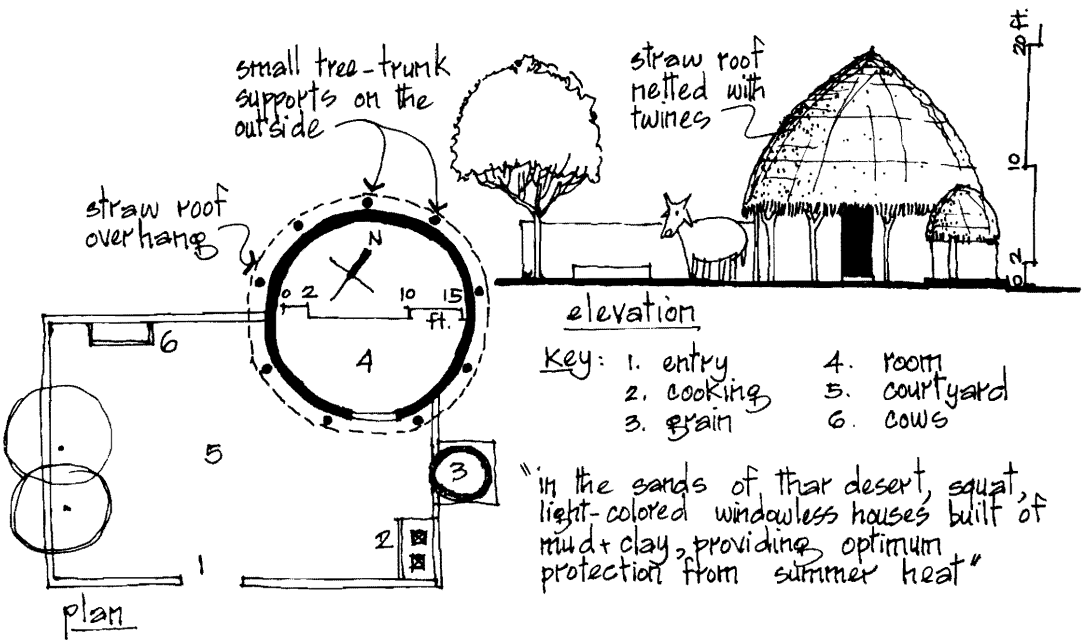

Figure 3. Straw and Adobe Dwelling of Rural Sind.

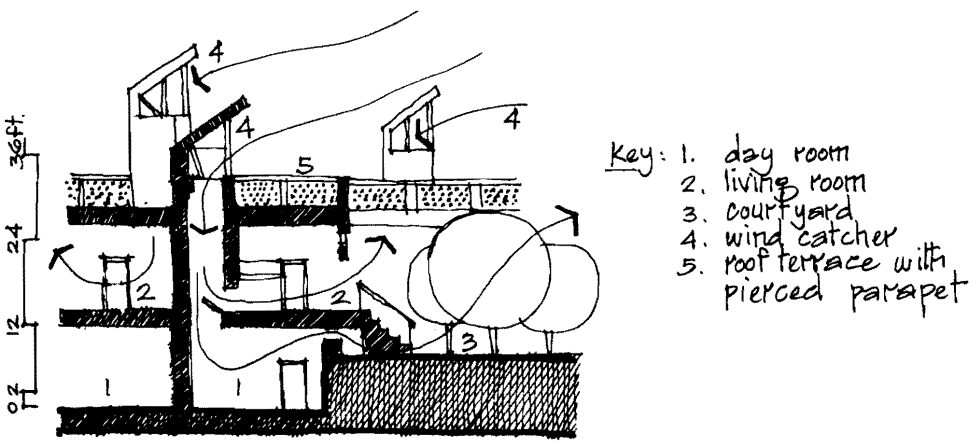

Figure 4. Section of a House in Sukhar, Sind.

In spite of the intrinsic hostility of its landscape and climate, site finds have confirmed that Baluchistan was inhabited in the Stone Age.

Fishing has been the mainstay of economy for Baluchis living along 420 miles of the Makran Coast. Due to its isolation from the rest of the country, sea-links with Sultanate of Oman and the surrounding Arabian Coast have been important to the region [5].

Inland, the rain is so sparse that the traditional way of life for Baluchi and Brohui tribes has always been nomadic. The need to escape extremes of climate and to locate new grazing grounds for goats and sheep involves movement over great distances. Black goat skin gives the nomad tent its distinctive appearance.

The Baluchis and Brohuis are desert nomads and live a life similar to the Bedouin. They wander across the face of the desert without fear or favor following the camels and ragged flocks of sheep and goats. They move in small groups, often just one man, his wives and a handful of children. These elemental communities commence their day's journey each morning led by the tall bearded man, and the women following behind on heavily-laden camels. To the rear of the column, there are four to five savage dogs nipping at the legs of the heavily-fleeced sheep that are the column's principal source of wealth.

The cloth for their barrel-vaulted tent is made of goat hair. Five breadths are used for the average tent; three to span the roof and one each for the walls. The vaulted hoops that make up the frame are made of two pieces of bent wood tied together. The number of such hoops can vary with the size of the tent. In winter, plaited mats plastered with straw are set up to keep out the wind and cold. In spring, plain mats are used; and in summer the tent is left open. The use of the barrel-vaulted frame for the black tent offers certain advantages (Figure 6). The hoops give the tent cloth a stay to rest on so that less tension is created in holding it up. The space under a semi-cylindrical shelter is more useful than that of a ridge-roof structure. For this reason this design has been adopted for the lightest back-packing tents such as Stephensen's Warm-a-lite tent [6].

Baluchistan has age-old trade and migratory connections with Sistan in Central Iran. Therefore, its architecture and traditions show strong resemblances to those of cities like Isphahan, Yazd, and others.

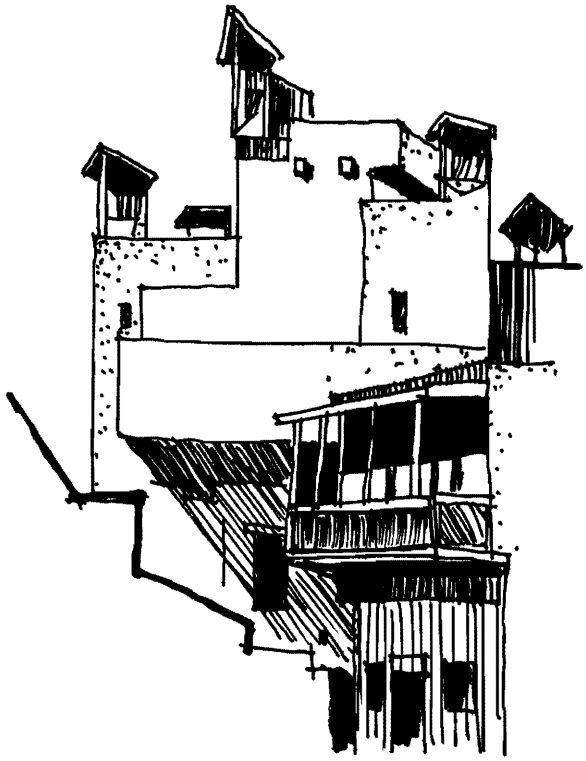

Figure 5. Wind Catchers in Hyderabad, Sind.

A traditional desert design feature uses an ingenious system of underground tunnels for irrigation called *'Karaiz'*, which also provide clean and cool drinking water to settled communities. Similar types of subterranean tunnels called *'Qanat'* can be found in Afghanistan and Iran (Figure 7).

NWFP REGIONAL

North West Frontier Province lies along the border between Pakistan and Afghanistan. The arid part of this hilly region is very different in character to the neighboring Himalayas. The Hindu Kush range, as it called, lies beyond the reach of the monsoon, resulting in a distinct lack of natural vegetation. Precipitation is only found in the hills and high altitudes, leaving the valleys as dry as bone and very hot in summer. The mountains are simply huge monoliths of granite which rise vertically straight out of the valley floors; and the result is a high altitude desert.

The climate is extreme. Summers are dry and intensely hot; and the winters become bitterly cold due to the north winds. The predominant color of the landscape gave us a new word in English: *khaki,* derived from the native word *khak* for dust.

The majority of people who live in this region belong to the Pathan group of tribes. Their names: Wazir, Mahsud Bangash, Khattak, Afridi, Yusufzai are surrounded by legend [7].

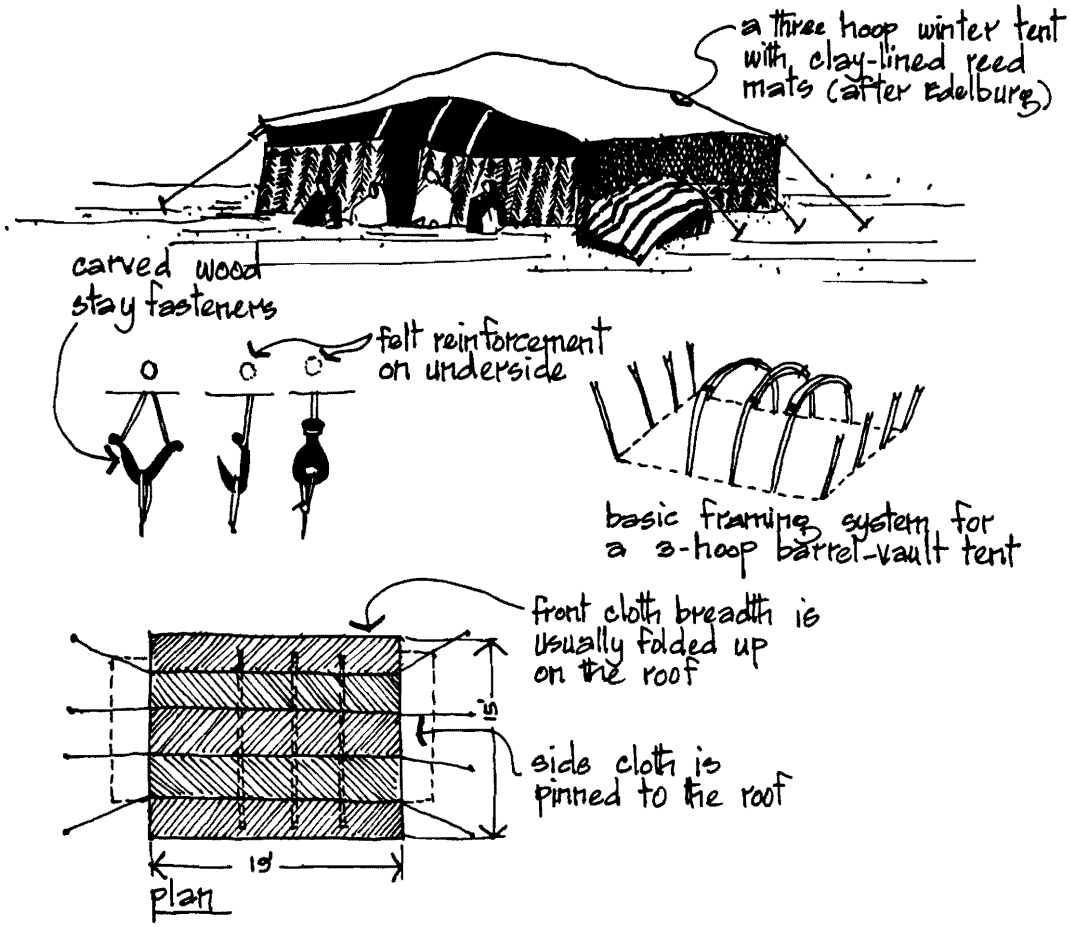

Figure 6. A Baluchi Barrel-Vaulted Tent.

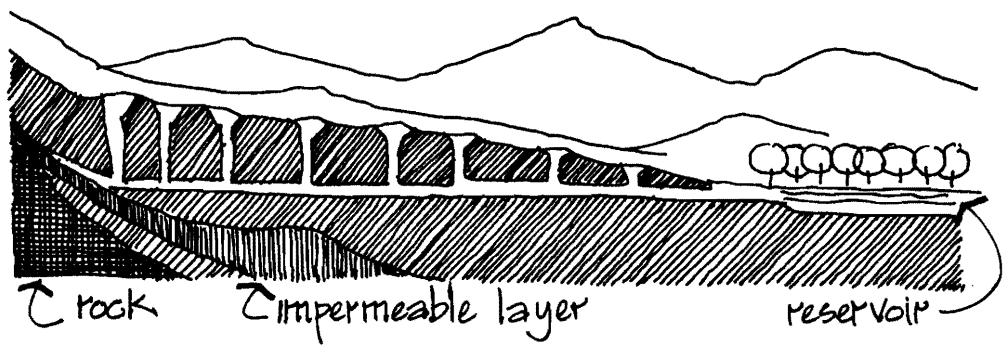

Figure 7. Section of a Karaiz in Quetta.

The tribal areas are arid, hilly tracts whose economy is based on animal husbandry. The people live in widely dispersed and fortified hamlets, each inhabited by a distinct group of kinsfolk and claiming territorial limits. Authority rests with the elders and when the occasion demands they summon a tribal or inter-tribal councilor or *'Jirga'* to establish law and debate issues. The decisions taken by the Jirga are enforced by a tribal militia or *'Lashkar'*. Peshawar is the largest city of the region. It was founded by the Kushan kings of Gandhara over 2000 year ago. There are other cities from Turkey to China, but for character and traditions this is *the city* of Central Asia.

The common building material is clay: used in the form of mud and kiln fired brick. Scarcity of wood limits its use only to doors and windows. Room sizes are generally small and are fixed by the available roof spanning members. Many traditional houses are topped with vaults and domes built with sun-dried mud bricks – a tradition brought here from Afghanistan. Rough-cut stone walls and mud walls are usually two feet or more in thickness; and the exterior face may taper to the top (Figure 8).

The architecture of this region bears resemblance to that of Afghanistan due to tribal connections [8]. The villages on the hills and slopes are defensively positioned and strategically located. Square and round watch towers are a constant feature of the hills and the valleys. Houses are small, crude structures of undressed stone with low doorways grouped together and bounded by an outer wall. This kind of defensive architecture is dictated by ever present fear of inter-tribal attacks and skirmishes.

The roof system employs wooden beams, tree trunks, thatch, and mud insulation. The local architecture responds extremely well to climate, cultural, and site conditions. Rural houses are mostly single storied; and houses belonging to blood relatives and tribal relations are grouped together leaving open spaces for courtyards and special family events (Figure 9).

Pathan houses in the hills and the slopes are constructed of stone layered with mud and strengthened with wooden sleepers laid horizontally in the walls at regular courses — a design capable of absorbing the shocks of the region's frequent earthquakes. The wooden sleepers in the masonry walls act as cushions.

The extended family tribal houses consist of two parts. Behind the main gate and high defensive walls are the guest sleeping rooms, a day room for the guests in usually perched on top of the gate; and then family houses are arranged around inner courtyards.

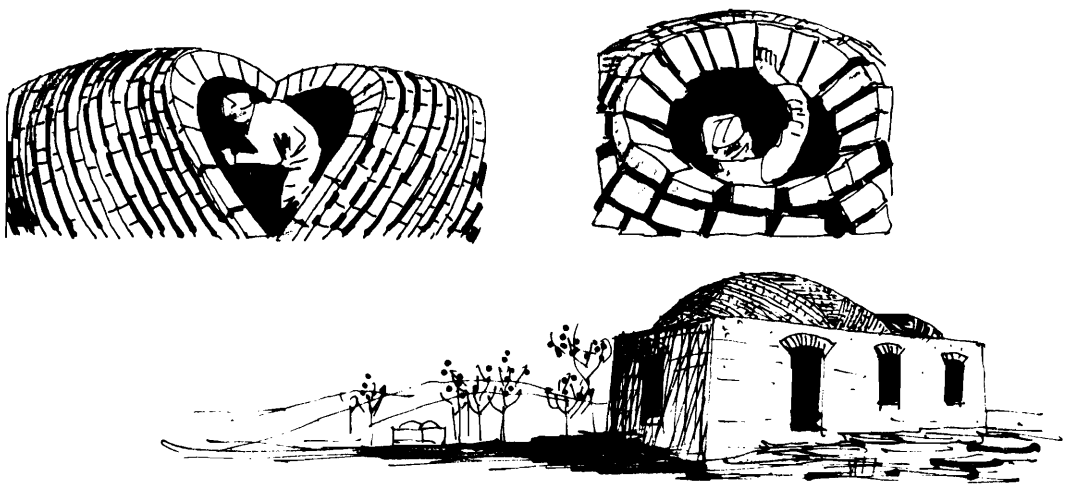

Figure 8. Building of Mud Vaults and Domes in Peshawar.

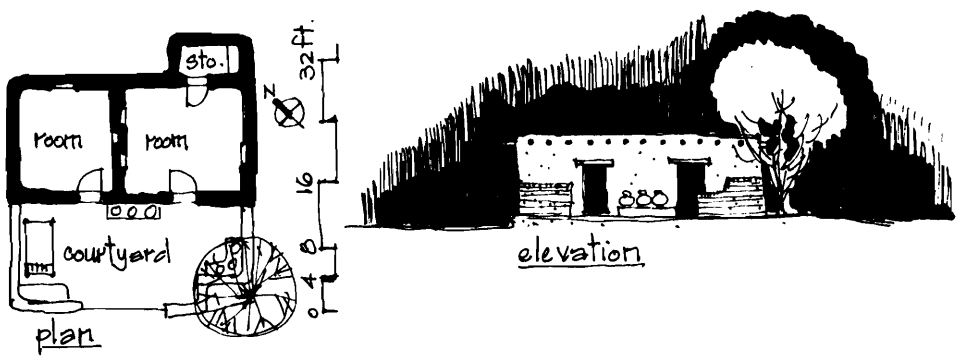

Figure 9. A Single Family Pathan House in Landi Kotal Area.

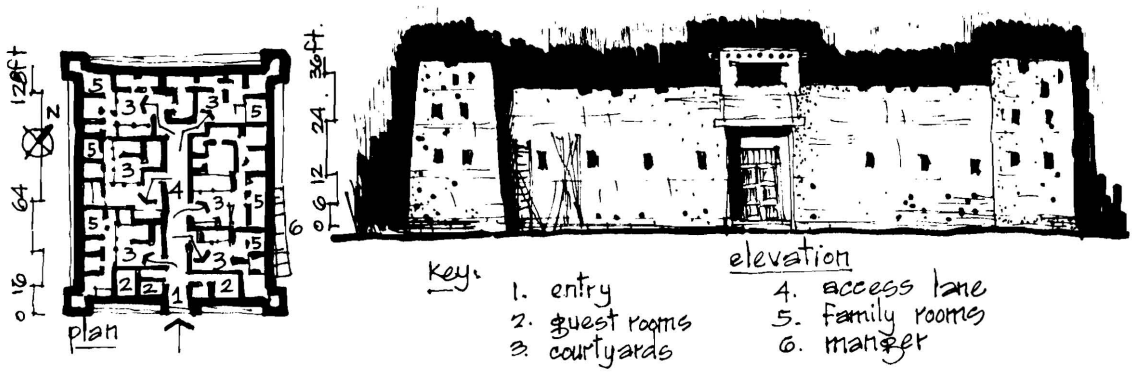

Figure 10. An Extended Family Tribal Strong House in Khyber Pass Valley.

These are closed to outsiders so that the women can go around looking after their duties; and have no need to withdraw or veil. (Figure 10).

PUNJAB REGIONAL

Punjab is crossed by five rivers. The name Punjab is derived from two words: *Punj,* meaning five; and *Aab* meaning water. The rivers have played their part in converting Punjab into the richest and most fertile province of Pakistan.

Before the turn of the century, most of Punjab was desert or semi-desert. The rivers were dangerous since they flooded and also changed courses when swollen each year. Just how dramatic the changes in courses of rivers was, can be seen in Lahore, where the river Ravi once flowed by the walls of the Mughol Fort. Now, its course is a couple of miles away. In the past, people in Punjab have been constantly on the move. Many of the cities and towns are relatively new. Old towns were washed away by flooding rivers and replaced by new towns on safer ground. Some have just died. Bhera, on the banks of river Jehlum, used to be a flourishing place. There, one can still visit two and three storied courtyard houses with carved wood doors and finest wooden balconies looking into the streets and overpasses called *'Sabatain'* [9] (Figure 11).

Summers are long and scorching hot, day-time temperatures can reach 108 F mark. In a relatively short duration, monsoons bring very heavy rains. There are sudden strong thermals and violent dust storms in the late summer months. Occasionally storms would hang overhead for days dropping tons of fine dust; and the whole environment looks like a big dust bowl.

Figure 11. A House Bridge or Sabat in Bhera.

The main building material in villages is unfired mud brick; and the walls are finished by the application of mud and hay plaster. The walls are very thick for greater time lag and provide insulation against the extremes of prevailing climatic conditions. The roof is made of wooden beams and purlins, with reed matting and covered with an insulative layer of mud. Clay is the most abundant building material and most widely used in all types of buildings. Brick kilns can be seen in the near vicinity of any town.

Punjabi houses are inward looking: built around a courtyard, securing the privacy of family life. In urban limits, houses are built in fired red brick. On the average wall thickness is about 18 inches. Basic planform is still a courtyard type which is very successful in regulating family traditions within its walls and possessing a unique spatial quality. The courtyard, thus provides a small but congenial outdoor space within the house (Figures 12 and 13).

The courtyard house can be seen as an earth-sheltered living space. Thick walls act as an above-ground earth shelter while the courtyard provides the required daylight and airchange. Many houses, when grouped together and sharing as many as three exterior walls and leaving only narrow alleys in between, create an environmentally consistent solution. The building heights vary from one to three floors. The entrances are arched in brick and have large wooden doors; and the windows have glass and fly-screen shutters. Compared to other regions, houses in Punjab exhibit a greater use of wood as a material. Ventilators are usually placed above the windows to release hot air stacked near the ceiling. Some vents are framed in beautiful marble screens, *'Jaleez'*. In the old quarters of walled — *'Undroon'* — Lahore, houses have elaborate wooden balconies called *'chajjaz'* or *'mashrabiyyaz'* or *'shamashil'* which cover the face of upper floors (Figure 14 (*a*) & (*b*)).

Such cantilevering balconies can be found in many other cities of Pakistan; and also in cities like Jeddah, Cairo, Mosul, and Delhi indicating the spread of influence and possible trade links. The desire for privacy in closely massed houses and need for cross ventilation for evaporative cooling produced the overhanging balconies. Some of these balconies are work of art and craftsmanship in terms of meticulous carvings in wood and geometric designs. Other exterior decorations include glazed tiles, perforated masonry in parapets, and screens [10].

The courtyard of a Punjabi house acts as a ventilator and lightwell. In the months of July and August, diurnal range in temperature can reach 35 F; and the courtyard takes full advantage of this diurnal range in the following manner:

1. At night the cool air descends into the courtyard and moves through the wall openings into the surrounding rooms. Walls, floors, and spaces are thereby cooled and remain so until afternoon.

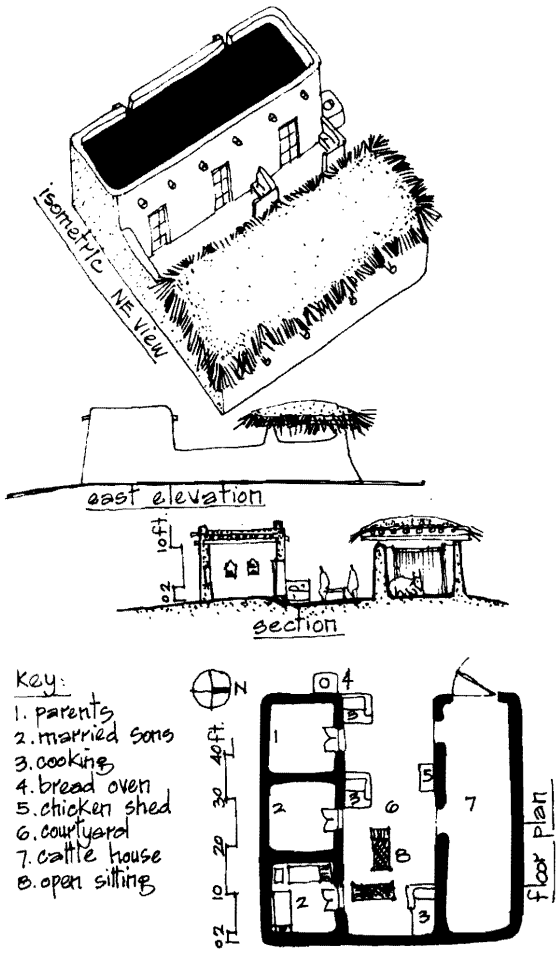

Figure 12. A Punjabi Mud House on a Farm at Dugranwali.

2. At noon the sun shines directly above the courtyard. The air begins to rise and resulting convection currents move the air in the surrounding rooms affording further comfort. The thick heavy walls with an average thermal time lag of 10 to 12 hours are excellent insulators to the very high ambient temperature at noon. Therefore, the house remains protected from any heat gain during the day.

3. In the last stage the courtyard floor and inside of the house become warmer resulting in further convection by late afternoon and early evening time. The houses are mutually protected by shadows in a bundle configuration, and as the sun sets in the desert, the temperature falls sharply. The courtyard begins to irradiate to the clear sky,

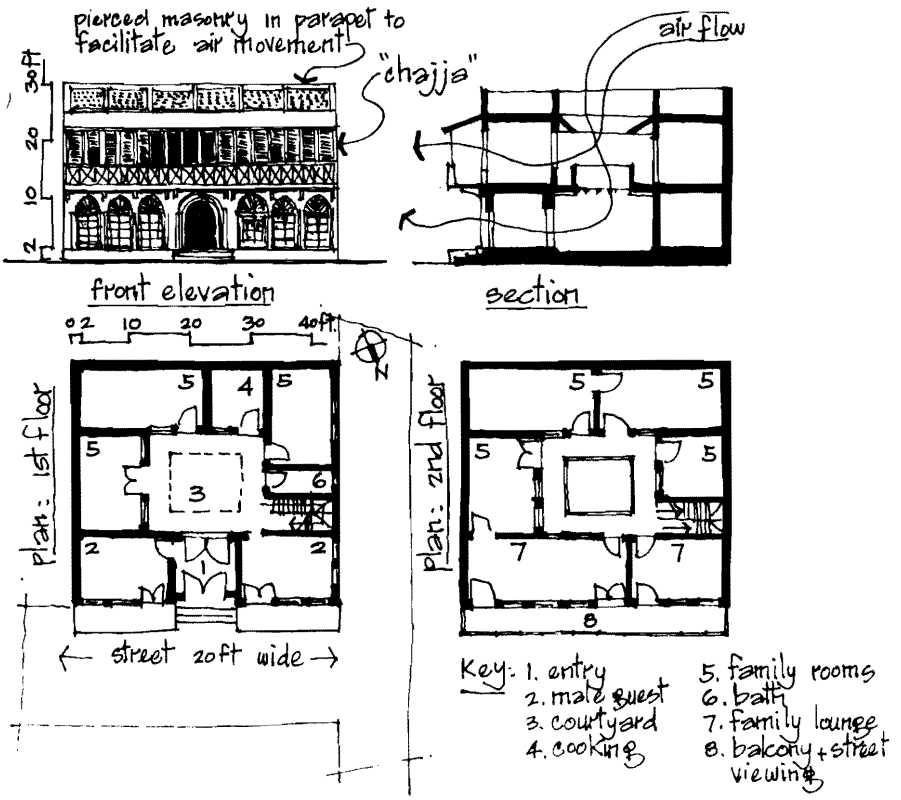

Figure 13. A Courtyard House in Anarkali Area, Lahore (1912 c).

and the cool air descends again into the courtyard and the repetition of a new climatic cycle begins [11].

Since the turn of the century, houses in Punjab have been using an all-natural evaporative cooling system. The system is called *'khus khus'*. It uses no energy and is quite efficient in hot dry months of the summer. Khus is a screen made of absorbent twigs from a desert bush. These screens are soaked in water and hung on the outside of windows. The air passing through the wet screen exchanges its heat for evaporating water and produces a resultant cooling effect.

Such screens are now, being used in a packaged system called "Desert Cooler". Desert cooler has an array of Khus screens and a supply of water to keep them wet (Figure 15). An electric motor drives a fan or blower which forces air through the damp screens and into the room. Desert coolers prove efficient and energy saving cooling specially for the developing countries where energy costs have become unaffordable [12]. The native but creative mind has given us such energy saving devices for producing comfort. It would take a sensitive designer to integrate the potential of these devices into contemporary design.

SUMMARY AND CONCLUDING THOUGHTS

This discussion on the regional desert design has revealed that the characteristic architecture is a direct result of physical, climatic, and cultural aspects.

The intrinsic technical skills found in climatic solutions, use of appropriate materials, and the superb response to socio-cultural needs which have evolved should be appreciated. Most cities in Pakistan are under the influence of a desert climate, and similar cultural and social aspects. The courtyard house is, therefore, found here as a desert protoarchitecture.

The courtyard plays an important role in local living style. It is a venue of intimate life for the family, as well as functioning as a climate moderator. The exterior walls of houses are shared walls and face narrow lanes; and thus reduce their exposure to inclement conditions. In essence, desert architecture and traditional settlements successfully integrate buildings, life and daily activities in a well adapted,

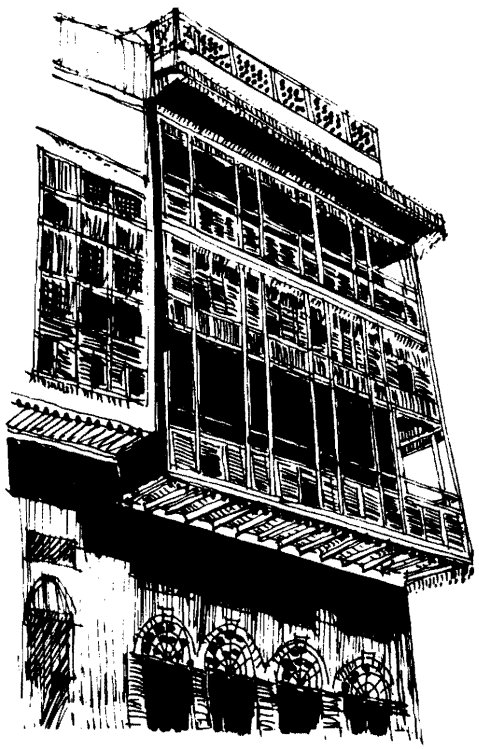

Figure 14(a). Wooden Balcony or Chajja in Lahore.

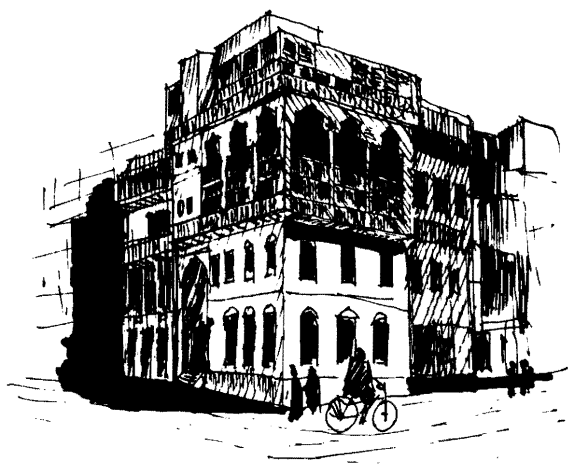

Figure 14(b). Wooden Balcony in Sargodha.

functionally balanced, and climatically protected environment (Figure 16).

Pakistan is still, a predominantly rural country, with the majority of population tied to the agriculture. However, rapid progress and urbanization has forced people to move from the rural areas to towns; and the members of tribal societies are pushed to seek seasonal work in more prosperous regions.

An ever increasing middle class is widening the distance between the poor and the rich. It is always the poor in the society who cling to the traditions; and their building design and methods of construction fall more into the realm of an actual sector of the total culture than into that of the ritual elite.

The middle class is commonly found ready to divorce all traditions in an effort to achieve a new identity and a status of modernity [12]. The use of imported models in business, education, economic, and political systems may be rightly applied for modernization; but to a great extent contradict the established ways of life. This conflict undoubtedly finds its immediate expression in the built environment.

Natural and no-energy cooling systems have been in use, in this part of the world, for over a thousand years. These systems include simple ventilation through the house, air passing through the underground tunnels and cisterns for cooling water, and funneling wind down into the rooms by a variety of roof-mounted wind-catching devices. These all have great possibilities for providing user comfort and savings in energy, if integrated well into the plan and functioning of the building.

The regional design and their architectural traditions as presented in this paper, are the elements of a very rich and environment sensitive desert architecture. On the contrary current building programs are unwary and not at all sensitive to the dictates of the environment [12]. The original and ingenious derivatives of design found in these regions of Pakistan have a whole lot to offer to any perceptive designer, who is willing to learn from the highly-evolved prototypes in desert architecture.

ACKNOWLEDGEMENT

The author acknowledges the support received from KFUPM in the research work and in the production of this paper. This paper is a partial

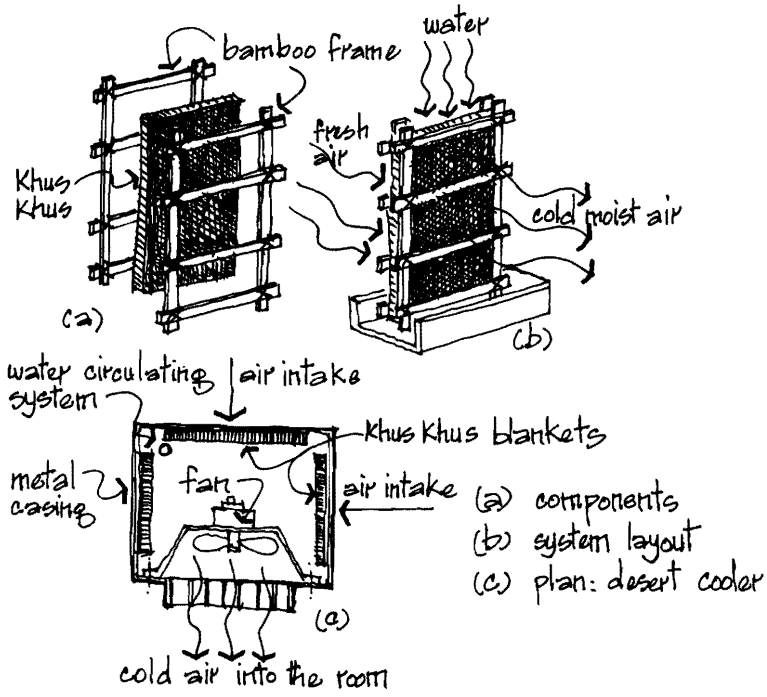

Figure 15. Khus Khus Desert Cooler.

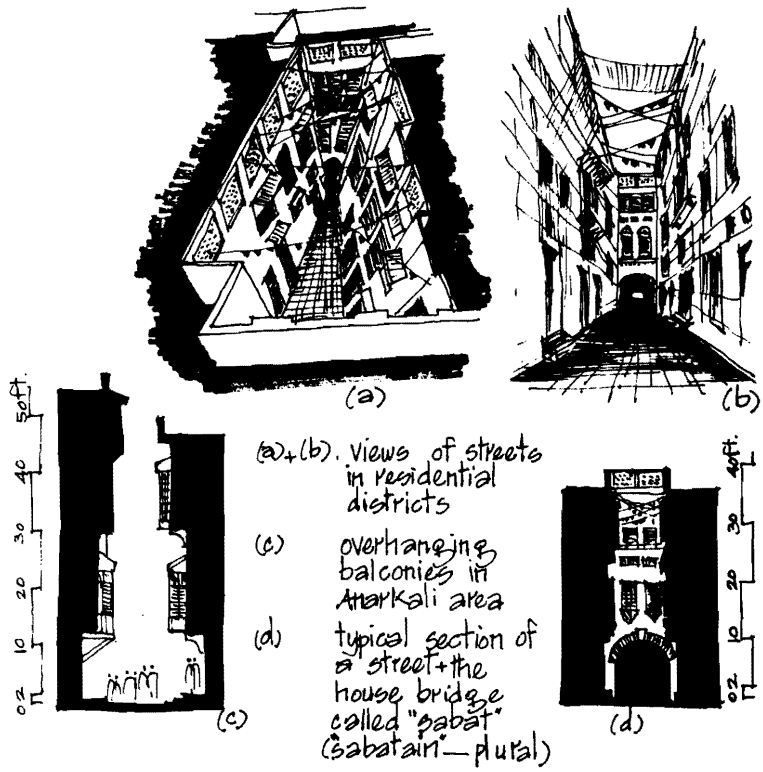

Figure 16. Depictions of Residential Streets in Old Lahore.

outcome of research work undertaken during a sabbatical leave from the College of Environmental Design at King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia. An earlier but different version of this paper was submitted to the symposium on Design for Desert Living, University of Arizona, Tucson in July 1991.

All plans and drawings are original and produced by the author from his field work and observations unless another source is mentioned.

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Paper Received 8 December 1991; Revised 30 June 1992.