

A 'vernacular approach' to re-shaping the built environment in arid-zones

Hanaa Mahmoud Shokry

Higher Technological Institute, 10th of Ramadan, Egypt

ABSTRACT: Essentially this paper advocates the adoption and use of the traditional fabric resulting from dynamic generative processes vs. the use of static blueprints of 'proto-type houses' that produce fabricated built environments. The paper also discusses the components of the vernacular houses in the Egyptian Oasis and how they are utilized for re-shaping the new settlements. The study tries to set some design criteria to ensure that the changes that will occur would maintain the character and sense of place of each new desert settlement. The methodology of the study uses the analytical approach as well as a field survey of a certain place, 'Al- Wahat' Egyptian Oasis, to identify the traditional built form to show how the impact of social life and physical conditions generated the sense of place. There are some challenges that we must face if we are to escape from dilemmas of our present model of development and turn towards a new – traditional paradigm which shows greater respect for the harmony with nature. This paper is also valid for other countries of the arid zone.

Conference theme: Urban design studies

Keywords: traditional fabric, vernacular houses, Egyptian Oasis, desert settlement, social life

INTRODUCTION

Viewing the city as a process and a product is an effective analytical, evaluation and planning tool. The specific field of research is traditional mud brick architecture in the New Valley Region (*el-wadi el-jaded as called in Arabic*), in the Egyptian Western Desert, which includes many ancient human settlements in the form of towns, villages and oasis. Recently, the most significant shift in thinking is to consider the building as a whole. From this perspective we should examine how the site, form, and materials can be used to reduce energy consumption but also to maintain comfort. There are traditions that go back to the beginning of human society and yet they are still alive and will exist perhaps as long as human society does; Steele (1988)

Objectives of the study

The study aims to develop systematic research on traditional indigenous highly ecologically sustainable building technologies. Concerned with the failure of contemporary environments, architects have turned to the traditional environments for answers even to modern problems, to observe their forms and use, analyze their rules and patterns to study their physical and social structure.

1. VERNACULAR ARCHITECTURE

1.1. What is the vernacular approach?

The goal of this paper is to clarify what the vernacular

approach is, and by doing so shed light on how it is different from the common processes on development currently used in many parts of the world. Vernacular architecture tends to evolve over time to reflect the environmental, cultural and historical context in which it exists. Although the study addresses the context of settlements in the Egyptian Oasis, the insight gained is applicable to new development projects as well as it is valuable for formulating policies for housing projects.

The norm in most cultures is that each has its processes that were shaped by the morphology. This is what we currently refer to as 'vernacular architecture'. Modern processes applied at many parts of the world are completely different.

The specific area considered within that region is the Baharia Oasis (290 km SSE of Cairo, 180 km W of Al-Menia), and its village of Al-Qasr. This settlement is characterized by a compact structure of mud-walled alleyways, narrowly separating houses with elaborately-carved wooden support beams and contains a wealth of vernacular architectural examples that eloquently represent ingenious methods and techniques to cope with the harsh environment prevailing in the region.

The traditional vernacular form of buildings and settlements embodies the folk experience of many countries. The adaptation to the climate and culture requirement of a particular community has taken place subconsciously over such a long period of time that a building procedure is eventually taken for granted as the appropriate solution to the community's immediate needs. Close study of the vernacular building form in

the Egyptian Oasis, therefore reveals much wisdom which has only recently been ignored under pressure from the internationally accepted high technology and the politically and economically attractive image of modernism

1.2. Why choose the vernacular approach?

The dialogue between architecture and nature is as old as architecture itself. Many modern architects have studied vernacular buildings and claimed to draw inspiration from them; including aspects of the vernacular in their designs. In 1946, the Egyptian architect Hassan Fathy was appointed to design the town of NEW Gourna near Luxor. Having studied traditional Nubian settlements and technologies, he incorporated the traditional mud brick vaults of the Nubian settlements in his designs. (Steele 1990) It was the first recorded attempt by an architect to address the social and environmental requirements of building users by adopting the methods and forms of the vernacular. Almost twenty years after the Gourna, Fathy participated in the planning of the Bariz Village, sixty kilometres south of the Khargah Oasis (Fig. 1). He used the traditional village typology itself with its winding streets and introverted forms as a guide, with the reassurance that in villages like Old Khargah nearby, these tactics worked to offset the harsh climate.

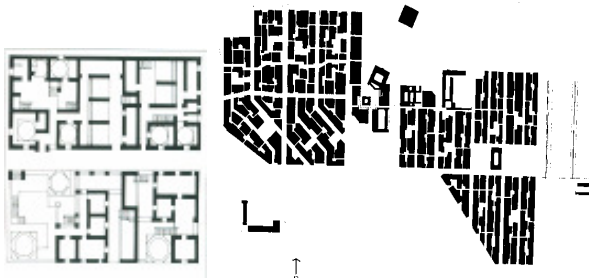


Figure 1: Lay out of Bariz Village and a group of houses designed by Fathy at the Khargah Oasis, 1963. (Steele 1990)

1.3. The Baharia Oasis

The Western Desert is characterized by hyper arid climatic conditions with rare rainfall and extremely high temperatures. Golany1982., defines such arid zones as those areas where the average rate of evaporation is higher than the average annual rate of precipitation, where temperatures between day and night vary greatly, and where high degrees of solar energy radiation are experienced, especially during the summer (Rimsha1982). The Baharia Oasis (28° 30 N 31°5 E) is one of the five principal oases(Siwa , Baharia Farafra, Dakhla and Khargah), the nearest one out of Cairo, a large depression covering an area of flat, clay plain, bounded to the north by a steep limestone escapement (Fig. 2). The southern, western and eastern boundaries of the oasis are less distinct, as the gradually rising floor of the depression disappears beneath the shifting sand dunes of the

surrounding desert. The Baharia Oasis is some 95km west to east and 42 km maximum wide with oval shape. The population is about 31,482 (2006), settled in 14 ancient villages (al-Qasr, and Baweti, are the largest).



Figure 2: Location of the oasis on map of Egypt. (GOPP 2006)

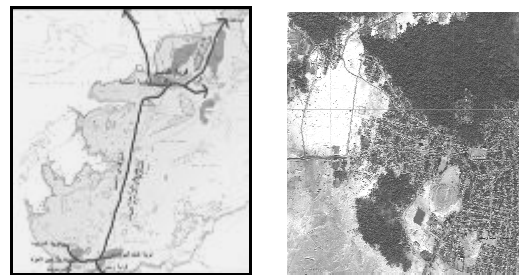


Figure 3: Maps of Al-Qasr Village 2007. (GOPP 2006)

The local economy is based in agriculture and there are no known mineral or other viable resources. The capital is Al-Qasr, which has been the main town since at least the eighteenth dynasty, about 1.500 BCE. The Baharia Oasis has had a continuity of settlement for about the last 8,000 years but only since 2,500BCE has it been politically tied to the Nile Valley (De Fillippi 2006) (Fig. 3 and 4).



Figure 4: The entrances of the Al- Qasr.

2. URBAN FORM

The traditional Arab town represents a level of sophistication in urban form; the original settlements have a clear-cut organization which defines the use of space and determines the distinction between public, semi public, and private areas, varying in degree of accessibility and enclosure. Narrow streets together with the high-density buildings of two or three stories create a situation where, for most of the day, the buildings shade each other as well as the streets. The house surrounded an open space forming cool,

pleasant microenvironment and a blank face and entrance door to the narrow public streets. The domination of pedestrian have resulted in a close network composed of these streets, occasionally punctuated by larger spaces used for social and religious purposes. The social system requires both segregation of domestic life of and participation in the economic and religious life of the community. The ancient villages of the Western Valley were developed according to the typical features of the Islamic desert defensive architecture. That design was made of a compact fortress with concentric and radial connecting streets. This allows internal communication within the village. Mud brick walls surrounding the village, closely packed buildings and houses connected one to another by narrow alleys. The entrance of the village was allowed by more than one gate. The harsh conditions of the hyper arid desert environment imposed to adapt life to these conditions; narrow, often covered and shaded streets, avoid the heat of the sun and extreme brightness and provide a ventilation shaft, buildings are internally ventilated by a vertical and cross stream of fresh air thanks to a system of apertures (as shown in Fig. 5 the use of the topography of the oasis). Houses are divided into separate living spaces for summer or winter, and for day or night to accommodate the different temperatures.

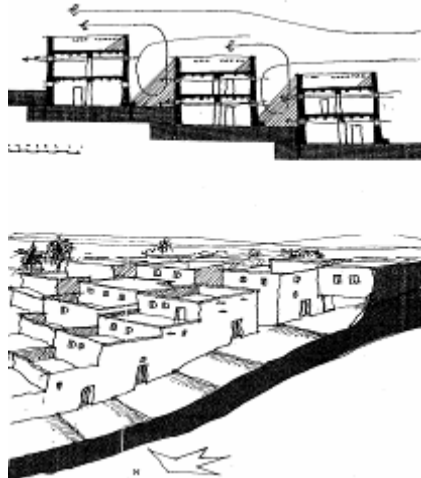


Figure 5: The traditional village typology of the Baharia Oasis. (Hamad 1996)

2.1. How buildings work

Because the buildings look inwards and the majority of rooms face the courtyard, they are closely packed and share common boundary walls (often on three sides) thus reducing the amount of wall surface exposed to solar radiation.

2.2.1. Strategies

In hot weather, when the external temperature is high, too much heat may enter the space. If this heat can be absorbed by the fabric of the building, the peak air temperature during the day will be less. If night time

ventilation is possible, the heat absorbed by the fabric of the building can be lost at night when the temperatures are lower (Thomas 1999). In hot regions, evaporative cooling is induced by accelerating airflow through and across spaces; temperatures are reduced by ensuring that direct sunshine cannot penetrate the building, and the thermal capacity of massive structure is used to insulate and take up heat during the day and release it at night when it is cooler. Control at the building envelope is necessary because solar gain, temperature and wind speed vary so much

2.2.2. The building envelope

One of the most significant influences on vernacular architecture is the micro climate of the oasis. The building must be able to cope with the variations in temperature (Fig. 6) and be altered by their occupants according to the seasons. On a very hot day in the desert the air and sand are both likely to be hotter than a person's body; the body is therefore heated by the sand on which one stands, by the air and the sun. Depending on the exact air and body temperature, the only cooling mechanism may be evaporation through respiration and sweating these basic physical processes apply both to humans and buildings (Thomas 1999).

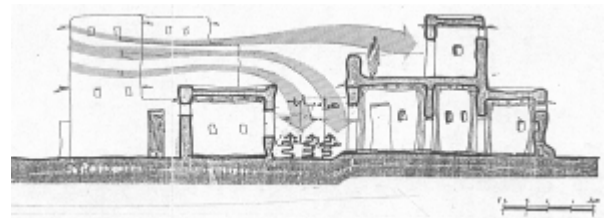


Figure 6: Air ventilation at the two stories of a traditional house for summer and winter days. (Hamad 1996)

2.2.3. The building "body"

The building body is highly affected by heat (internal and external). This is related to the thermal conductivity of its materials. Dense constructions have higher admittance; these absorb more energy for a given change in temperature as shown in Table 1. Normally, the heat flow into a building from the outside is approximately cyclical. Architecturally, the key requirement is to incorporate high-admittance materials in the building and expose them in an appropriate manner.

3. URBAN FORM RULES

Examining the oasis built-form as a product clarifies how a complex and sophisticated built form is achievable with a simple set of physical organizational components (Fig. 7 and 8) and a related mechanism of the essential urban elements found in most cities of the Islamic world are:

a- The courtyard building: The basic module used for housing and public buildings", the ratio of building area

to its plot is 1:1 (Hakim 2007).

b- *The street system*: street systems are primarily of two types; the through, open-ended street, which was considered a public right of way and had to be at least wide enough for two packed camels or mules to pass; and the cul-de-sac which, according to Islamic law is considered to be the private property of the people having access from it to their front doors. An important feature in streets and cul-de-sacs is the exterior finaa, (a width of about one meter adjoining the edge of a building and extending vertically along surface of the façade to which the inhabitant has certain rights for using it) (Shokry 1987).

c- *The elements above the street*. The elements usually found above the street were a *sabat*, a room bridging the street, and the buttressing arches spanning between walls on either side of the street to provide structural strength and support for the opposite wall (Shokry 1987). An important attribute of this built – a form element was that it integrated physical components of form and function into its elements. Other elements like *skifa*, (entrance lobby with entry doors placed so that no one can see directly into the courtyard from the outside), with two *mastabas*, (built-in benches provided in the skifa, traditionally used by the male to receive visitors), and open courtyard located usually in the centre of the house.



Figure 8: Covered streets at Al-Qasr, *sabat*.

Table 1: Admittance and density of selected construction elements. Source: (Thomas 1999)

Items	Admittance (w-m2k)	Density (kg-m2)
220mm sold brickwork, unplastered	4.6	170
335mm sold brickwork, unplastered	4.7	1700
220mm sold brickwork,+16mm light weight plaster	3.4	1700 for brickwork, 600 for plaster
200mm sold cast concrete	5.4	2100
75mm lightweight concrete block +15mm plaster on both sides	1.2	600 for concrete, 600 for plaster

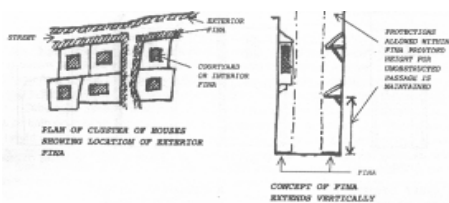


Figure 7: The *finaa* and the *sabat*, concept 1. (Hakim 2007)

3.1 General Rules;

The physical factors that shaped the traditional Islamic City, particularly at the neighbourhood level, were the same at oasis built- form. Another important component of the built-form, that can shape the context and compatible with the ethical/ legal norms, the rights and responsibilities of the inhabitants,

First, heights of buildings, tend to be uniform, the reasons of this are; 1- roof terraces are a potential location for people to overlook the private domains of adjacent neighbours, 2- owing to limitations of traditional construction methods and building materials, constructing a building higher than two or three stories was discouraged and in some cases was impractical.

Second, location of exterior doors and windows, it is difficult to determine now, accurately which buildings were built before others in the traditional fabric of the oasis, however, the general rule (doors and windows facing the public –right-of-way were traditionally viewed as either "old, or recent", as a result of the sequence of building events) is to respect the rights of older established building.

Third, the structure of the village, consist of a system of neighbourhoods as relative independent units. Although the quarter is a closely knit group, providing consciousness of social identity and security, there is always a balance between the self – sufficiency and isolation and quarter's participation in the community and economic affairs of the village as a whole.

Fourth, a comprehensive fabric, single buildings are conceded as part of a comprehensive fabric, never as isolated structures, and the repetition and variety of basic architectural typologies produce the lively of built form. If the fabric is disrupted or the sense of wholeness and consistency of life vanish, The buildings with the fabric, together were coherence with the physical environment.

Fifth, privacy gradient, houses within a unit can be accessed through semi- public alleys (*hara*) which lie behind a large gate with a wooden lintel with carved inscriptions and decorations, and which mark the transition from the private spaces (of the house) and the public street. Extended families are sharing a narrow alley (*zoqaq*) as an autonomous community.

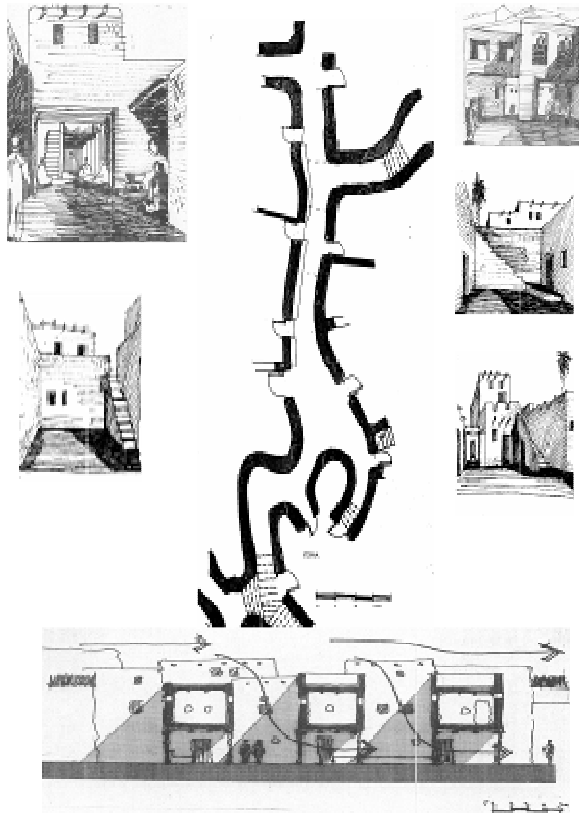


Figure 9: (Harat-Al-Sywhah) and its urban spaces, at Al-Qasr Village.

4. HOUSING TYPOLOGY

Houses are compact with a closed outer face. The layout is similar in most of the villages, except in Al-Qasr, where they are exceptionally tall and built in a more urban style. Plans are about 5-6 m width and the upper one is usually smaller, and sometimes, it extends over a street below creating the sabat, (which is a room spanning the street or occasionally the cul-de-sac) (Fig. 10); however it could be a succession of rooms creating continuous coverage and tunnel effect over the street. Secondly, there is a pedestrian requirement for coverage and protection from the sun.

The first house investigated in Al-Qasr is of "Abdel-jawad Khalaf- Allah" and is located at the Mahdy Awad quarter (Fig. 11 and 12). The house has a ground floor, one story and a roof terrace connected by two staircases, also serving as a ventilation shaft through the construction of perforated wooden steps. The total area of the house about 200 m² and has a central court about 22m², it contains the typical elements of local building tradition, not only in terms of their use of materials and techniques, but also from the standpoint of the interior layout and the distribution of the environments.

The size of the building indicates a social status and wealth above average compared to the rest of the local community. The first typical house element is the primary entrance passage. The skifa is a secondary

entrance corridor or lobby with entry doors placed so that nobody can see into the house from outside (De Fillippi 2006). The family had lodgings for male and female, rooms for servants, storage spaces, a living room at the ground floor and upstairs. The terrace at the highest level gives peoples an opportunity to sleep outside during the hot summer nights. The major percentage of ground floor use for services areas shows the necessity to store food, the requirements for cooking and washing facilities, and often to have space for a home bakery.



Figure 10: Rooms extends over a street below created the sabat, covered streets at Al-Qasr Village.

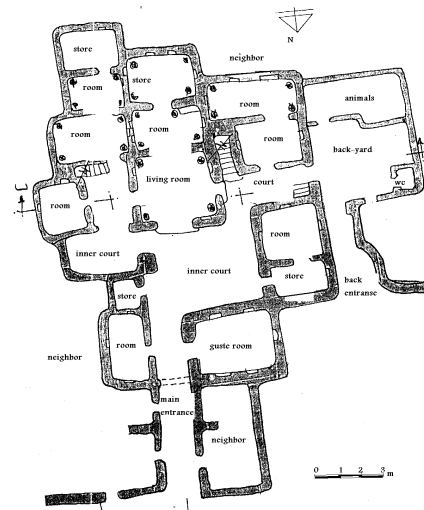


Figure 11: Abdel-jawad Khalaf- Allah"- house in Al-Qasr 'ground floor' plan. (Hamad 1996, and update by the author 2007)

In general, the house contains three main parts according to the privacy gradient and function. The first part is the entrance sector, hostess and male, with private entrance. The second sector is for living and sleeping in winter days with private entrance usually around the central court. The third sector is for services and utilities, around the back yard with minor entrance if it could be possible. The upper floor is using as a sleeping room in summer days.

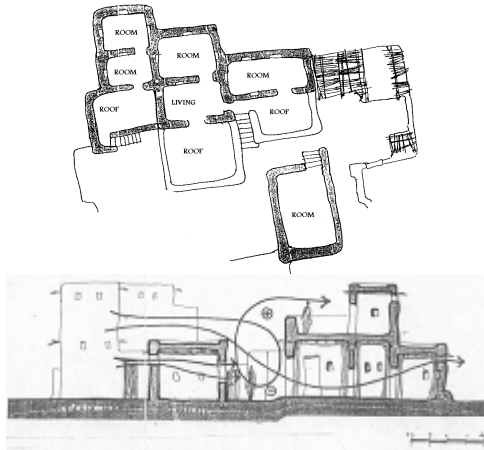


Figure 12: " Abdel-jawad Khalaf- Allah" upper floor and section. (Hamad 1996, and update by the author 2007)

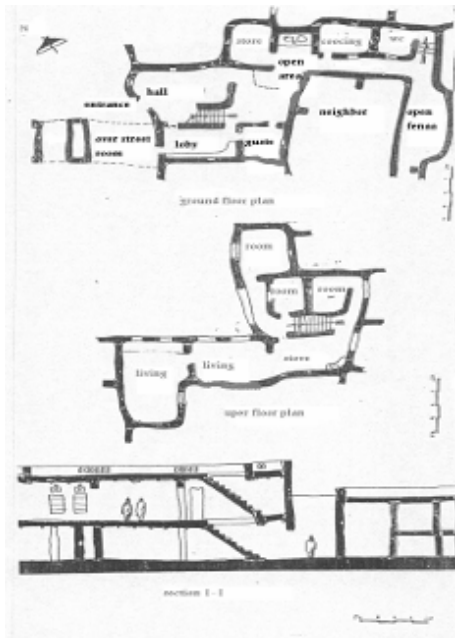


Figure 13: "Abdullah and his brother Abdulkader house in Al-Qasr (ground floor, upper floor and section) with a room spanning the street. (Hamad 1996)

The few secondary rooms surrounding the main areas provided valuable shade and insulated the walls from external heat.

The second house investigation in Al-Qasr is of "Abdullah and his brother Abdulkader" and it is also located in the Mahdy Awad quarter (Figure 13). The house has a ground floor, one story and a roof terrace connected by one staircase, rooms and all spaces, albeit of limited size, were used in different ways in relation to the climatic conditions. The open spaces used during the night in summer, while the areas under cover were the best place for spending the day, shielded against direct sunrays and are naturally ventilated.

4.1. Building techniques

Sun dried mud brick, sometimes mixed with straw was the building technique used most widely in this area. This best fits the local conditions, the need to reach appreciable heights over small surface areas and to reduce progressively the masonry wall thickness.

Brick, usually measuring 21x12x7 cm, masonry bears witness to builders' great mastery in using bricks and creating particularly sturdy structures. (De Fillippi 2006) The outer walls are laid in double rows, reaching 50 cm of thickness, to improve structural and heat accumulation capacity. Upper stories and interior walls are laid in rows of one brick and a half. This material kept houses internally cool in summer and warm in winter. This technique is also used for roofs, cornices and internal partitions, to obtain lighter-weight structures and be able to create more complex elements, such as arches, bas-reliefs and ornate decorations.

Mud and straw plastering were applied by hand on the wall surface. This material ensures perfect bond to the support, is elastic, and can absorb expansion and shrinkage phenomena. The outer coat of plaster protects the brickwork and can be renovated whenever necessary. Its colour endows these buildings with an appearance that blends in perfectly with the landscape.

5. TRANSITION FROM TRADITIONAL TO MODERN

In 1960 the Egyptian government started the New Valley Project at The Western Desert. New modern towns were built on the European planning models to support the increase in population and better use space in the name of efficiency and development.

The new towns, built of corrugated steel, cinder block, and reinforced concrete, now sit next to the older villages and are ordered on a grid pattern with wide streets and public squares. The public and private may be clearly marked in the plan of the new settlements, as is the intended function and ideological intent of space. But these designations tend to breakdown with traditional use of private/ public areas.

Al-Qasr today is a dilapidated village, housing in bad conditions. The prefabricated production methods have produced unacceptable solutions both in environmental and human terms (Fig. 14). These reinforced concrete panel and box systems are being suggested as solutions, with the implicit assumptions that providing housing is predominantly a production problem and that technology can produce the necessary units in a volume which will put the operation on an economic basis. The simple fact that 6in of reinforced concrete is the worst possible building skin to put between a human being and the external environment of the hot-dry regions is usually brushed aside. The economic assumption that building on a large scale is, by definition, bound to be cheaper per unit than smaller scale operations using traditional methods have also been found to be untrue when total cost are taken into consideration.

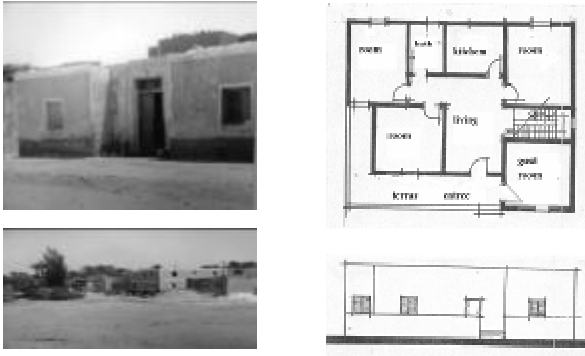


Figure 14: Example of a new house in Al-Qasr built by the owner (ground floor, and elevation) using concrete.

6. LESSONS FROM THE OASIS STUDIES

Viewing the city as a process and a product is an effective analytical design tool. It can best be appreciated by viewing the dynamics-of building as affecting the neighbourhood level:

- 1-The outside door must not be located opposite houses; a door must not be located adjacent to an existing neighbour's door.
- 2-The height of a window sill on the ground level facing a street is determined from the exterior, it should be approximately 1,75m from the surface of the street. This dimension is above eye level of an average man.
- 3-The exterior finaa; space on both sides of an existing door it extends vertically alongside the walls of the building.
- 4-The court, internal courtyard, or, and the back yard are basic element of a building is named finaa or *hoshe*.

6.1. Design principals

In the developing countries, most existing conditions and experiences are inherited from past generations and some may go back to ancient time. It is impossible to outline one or even a few forces without considering all comprehensively. The study of ancient civilizations in arid zones reveals a close relationship between the ecological equilibrium and the quality of social order, (Rimsha 1982) in the past, the survival of civilization in arid zones depended primarily on man's understanding the delicate environment and establishing equilibrium between society and that environment. The conditions result from socioeconomic, political and other forces rather than from climatic conditions.

6.2. Influences on the vernacular

Vernacular architecture is influenced by a great range of different aspects of human behaviour and environment, leading to differing building forms for almost every different context. Despite these variations, every building is subject to the same laws of physical, and hence will demonstrate significant similarities in structural forms.

Although Islam is not the predominant religion in every

hot, dry area; its teachings serve to emphasize the reality of life in such place.

6.3. Was the holding of a balance between tradition and progress ever more difficult to achieve?

The inner suburbs of every urban centre in the developing countries, such as in Egypt, now contain square miles of boxes made from reinforced concrete and solid burnt brick, built solely for structural stability and outward appearance and designed by builders who never thought of the environmental consequences to the occupants. Close examination must be made of the way in which people live and work both inside and outside their houses. It is better to keep daily travel distances short so that motor transportation is needed only for less frequent, longer journeys. It is better to think of the environment in terms of people first, and their relationship to one another and to community. Equilibrium between the forces of tradition and progress must be sensibly maintained if respected human values are to survive.

Modern techniques developed in the world have been adopting without due consideration of their suitability rational analysis of the technical and thermal problems. However, rational thinking alone is not enough; for housing in common with all forms of architecture expresses cultural and emotional needs which cannot be totally satisfied by a technically and thermally correct solution.

The satisfaction of cultural and emotional needs is the most elusive and difficult task for the architect. An obsession with the image of international modernity or traditional techniques and motifs or the scientific analysis of environmental problems will not provide the solution. Awareness of the environment and of the economics and social history of the area in which he working, and love for the people who will use his buildings together with the qualities of modesty and sensitivity, would seem to be the essential attributes for a designer facing this seemingly impossible task.

What is needed now is a new pattern of urban development allowing for the controlled circulation or motor traffic, while maintaining the density of the traditional layout.

6.4. Climate and the ideal house

1-The ideal house for such conditions would be sited with its major axis running east-west, so that the longest walls facing north and south would be shaded either by the overhang of the main roof, by a lean-to terrace roof, or by applied shading devices.

2-window openings, also shaded, would be small enough to give adequate capable of being firmly shuttered against dust storms and pilferers.

3- The roof would have a reflective top surface to minimize heat absorption and a construction incorporating some sort of insulation, most likely its intervening air spaces. (Thermal admittance is defined as the percentage of energy a material can radiate away after it is absorbed).

4. The surroundings would be laid out with as much surface vegetation and tree planting as feasible in order

to lessen glare, encourage air movement, and break up the ground surface to reduce reradiated heat.

CONCLUSIONS

Vernacular built heritage can be seen as "the essence of sustainability", being constructed with local materials and the minimum waste of resources. The traditional system has a great deal to offer to learn for our contemporary period and for the future. Cultural heritage is a non – renewable resource, vernacular architecture is the fundamental expression of the culture of the community, at the local, regional territory and at the same time, the expression of the world's cultural diversity. Due to homogenisation of culture and global socio-economic transformations, vernacular architectural and urban forms all around the world are extremely vulnerable, generally, ascribed to an overwhelming attitude towards modernization and inadequate cultural changes.

Building envelopes need to be durable, aesthetically pleasing, weather tight, structurally sound and secure. Psychologically, views out are very important. Environmentally, the questions that need to be addressed are; how they respond to solar radiation, how ventilation is made possible, how heat loss is minimized. The envelope will, to a large extent; determine how the internal environment is affected by the external one. Skin is a major component: external forces meet internal ideals at this point. The building and its site are a landscape of possibility, with the skin (or skins) the mediator between in-ness and out-ness. This has to be one of the major commitments for who works on housing projects, and on heritage conservation.

ACKNOWLEDGEMENT

This paper presents the results of the survey carried on the Egyptian Oasis during April 2007, by the author with a group of architecture colleagues and students. This study is also based on an academic research (Msc Thesis edit by Mahmoud Tarek Hammad 1996). Photos and drawings are by the author.

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