



## The Formation Of The Interior Space To Adapt The Ecosystems

### "Analytical study of the environmental elements in the Bawiti City in Bahriyah Oasis"

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### Abstract

The concept of adaptation of environmental systems in design depends on the determination to reformation the elements of interior space in accordance with the changing nature of the surrounding environment , buildings are usually equipped of several components and systems serve as control devices which controls the interior designer to determine the dimensions of the holes and the size and height, lighting and shadows, intent to cause desirable internal conditions that are compatible with the surrounding environmental control systems.

The building is considered the point of contact between the inside and outside, and the place which allows energy ,materials , living organisms to pass inside and outside through mechanical and electrical construction systems, and other building systems, creating an internal environment that supports the needs and activities of human and responds to weather conditions that's why it is considered to be Dynamic border that interacts with the external natural energy and interior environment.

### Keywords:

Ecosystems- Environmental Adaptation-Bawiti City - Bahriyah Oasis.

**Statement of the problem:** lack of reaching to compatible environmental interior design and imposes that there is a direct correlation between environmental systems, ventilation and lighting within the interior space

**Search Assumption:** There is an integration relationship between the efficiency of the creation of the interior space and being adapted to ecosystems and efficiency between functionality and increasing productivity.

**Objectives:** Identification of natural and technological techniques that can reformat the internal space according to the circumstances surrounding the environmental and study environmental outputs that are compatible with the interior design elements in spaces to achieve an interior Design environmentally compatible.

**Methodology of the research:** the analytical study of the environmental elements in Bawiti area in Bahriyah oasis .

**Search limit:** Residential constructions in Bawiti City in Bahriyah Oasis.



## **1-Some consideration affected the architecture character of Bawiti Like :**

The architecture character of old Bawiti was designed to provide the best characteristics of each of the concepts of the nature of buildings and architectural elements and features of the site, climate, activities and also the urban character including the interaction between the environment and human additions and between the site and the buildings , and also have included several components (considerations) such as (location - topography - Vision directions - trees - water - the prevailing climate - the sun - natural lighting and humidity - wind ... etc) Including:

### **1-1-Temperature:**

Bahriyah Oasis climate is characterized like the rest of the desert areas of high heat, reaching the highest degree of heat in June , July, and August and, while the less degrees of heat in the month of January,

### **1-2-Rain:**

Although the Bahriyah Oasis is a non-rainy, but we can not say that they are non-existent rain, as the rainfall rate reaches 14 mm / day, but in 1994 the rain poured suddenly reaching the amount of rainfall in this month 16 mm<sup>3</sup> during this month.

### **1-3-Humidity:**

Moisture is medium during the year, ranging between 50 and 60%.

### **1-4-Wind:**

- Negative effect is that the wind blow from the south and west, in the period from March to June, a dry winds and with high heat and loaded with dust, sand and gravel, and increase speed of up to about 60 km / h, and this wind lead to deface buildings and cover the roads with sand, also lead to carving the walls and affect the lower parts of the ancient walls that are built with materials of the local environment especially the outer surfaces of the walls where the cast earth and lime components is affected negatively.

- The positive effect of the wind is in the summer, where the proportion of the original and sub north wind reach to 70% , where the windows and the doors are headed toward the north for ventilation and tempering the temperature.

## **2-Development stages in Bawiti Residential Buildings:**

According to the field research of Bawiti City site , it has been monitoring the three types of architecture that bawiti passed by which are the old urbanism, modern urbanism, mixed urbanism between the ancient and modern:

### **2-1-The First Phase:**

-It was the old hereditary Urbanism,

-Urban starts at this stage near the locations of water wells and that were used in agriculture and household uses also, and the mosque was the first building in this phase where it's position was next to the old wells of Bawiti .

-Consists of a set of buildings of one or two floors , and sometimes up to three floors, these buildings are separated from each other by narrow streets.

-Residential constructions at this stage used materials available in the place of construction adopted,



these materials showed high efficiency in construction in the desert areas for their ability to isolate heat and acoustic effects on the constructions , and this materials are earth clay and sand stones of the walls and the trunks of palm and olive trees that are covered with a layer of clay mixed with straw, the natural environment has left a big positive impact on the architecture of this stage in the form of the building and the distinctive architectural character of the area.

## **2-2-The Second Phase:**

-Is the Urbanization created since the thirties of the last century until the sixties which is in response to developments in social life and population growth and the stability of some immigrant families to oases during that period .

-During this phase the building materials depended only on the local environment, and did not depend on any other materials from outside the oases except cement only in rare instances, for constructing some governmental buildings , reception rooms for senior families, dignitaries, traders and notables of the community.

## **2-3-The Third Phase :**

-Starts since the seventies and until now it was the stage of collapsed architecture due to not depending on raw materials of the environment.

-Population growth steady and high literacy rate has led to changes in some of the social concepts and the disappearance of the extended family and the emergence of independent family home, and after the electricity entered to Bahriyah Oasis since 1982, which led to the use of air conditioners.

-As for the building materials have changed completely. using modern building materials such as iron and cement bricks and limestone and cement, but after the roadbed had been finished the use of such modern materials in buildings had increased not only governmental buildings but also residential ones , where it does not take advantage of the local environment but only sand and became all the other building materials exotic of outside the desert environment, reinforced concrete were used in the work of foundations and , it has also become final finishes quite similar to what is in any other city in the valley and delta, where used cement mortar in interior and exterior paints oil, faience tiles and ceramics with distinctive colors Foreign decorations.

## **3-Some architectural solutions appropriate for the environment in the traditional architecture in Bawiti:**

Residents tried a number of methods to adapt the urban form and internal geometry of the buildings with thermal contrast between summer and winter, and work on their sense of comfort, and depending on the thermal properties of the walls, ceilings, construction materials and openings and heat treatments as follows:

### **3-1-Design Considerations**

Containment of the building is wrapping the building structure, including contents of the building like windows , any types of openings , etc around the inner courtyard of the building to achieve the thermal comfort proposed and also to achieve privacy and also to create shadows from the sun rays.



### **3-1-Planning considerations:**

- Designing buildings compact to each other and characterized by being adhesive to each other so to be less exposed to the sun that creates shaded pathways and design the streets to be perpendicular to the movement of wind carrying dust.
- Design surface at the site with a slight tendency to get rid of rain by choosing a location on a hill high semi-flat and near water sources and agricultural sites
- The roads are perpendicular to the prevailing wind directions and the streets between those blocks are also upset and sprains and some roofed parts, which in turn leads to cold air landing to the bottom of the hot air and rise to the top during the day.

### **3-2-Architectural considerations**

- Architectural processors reflected on the distribution of the residential communities where we find groups of buildings gathered on the hills for protection from the cold northern winds and overcome the ranks of palm trees to purify the wind out of the sand and take advantage of the sun in the south-east winter.
- An external wall on the roofs of buildings is designed between 105 and 2 meters of mud-brick or palm leaf, to reduce solar radiation and provide shade and privacy of the population.
- Building big fence up to 60-80 cm, which reduces the internal space, but it works successfully on the acoustic insulation as well as thermal and raw materials have a large thermal capacity (cast earth or limestone).
- Design Openings small-sized at high level in the buildings and the internal use of the courtyard, which also works on soothing atmosphere inside the building.
- The existence of the yard adapted to the climate as well as the achievement of the physical functions and ventilation and temperature regulation inside the building with increased shading internal spaces and the internal yard resulting in humidity and cooler night until noon, then pull the hot air from the living rooms to higher level meanwhile, replaced by cold air from the bottom of the yard.

### **4-Evaluating the direct correlation between "environmental systems, ventilation and lighting within the interior space" result in a reality adhered study as follow:**

When the proposed design is created in proportion to the requirements and possibilities of households in the region and also the climatic factors and the environmental considerations for the city of Bawiti city in bahriyah oasis while maintaining the architectural character of the city , the location of the residential construction has been selected in the contemporary construction site which is represented as the second phase as shown above where It combines between thr ancient and modern architecture pic (1).

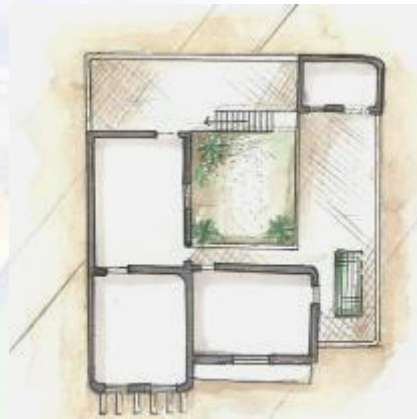


The map showing the location of the proposed model, source: google earth

4-1-The area of the proposed model is 140 m<sup>2</sup> and consists of a ground floor and first floor contains (entrance-hostess-corrall- Courtyard- lounge-room-store-oven-kitchen-bathroom-roof - wooden seat) as shown in pic.(2) , (3).



PIC (1) PLAN OF THE GROUND FLOOR



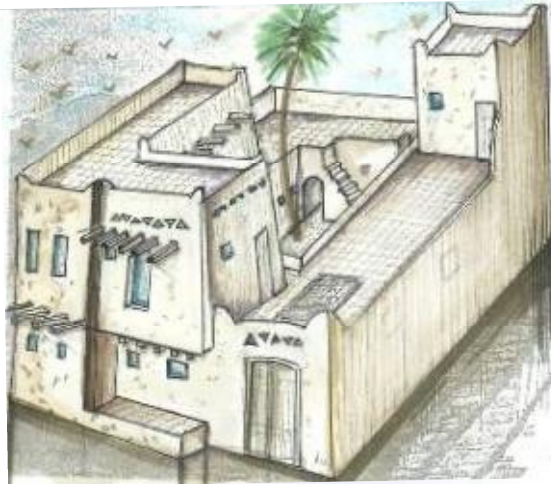
PIC (2) PLAN OF THE FIRST FLOOR

4-2-Appearance of outcropping elements and fine features in the building façade such as Claustrium , and also using the bench as functional design pic.(4)



Pic.(4) elevation of the proposed model.

4-3-Pic. (5) shows the proposed integrated design, indicating the idea of containment to the inside where all the elements of the building wrapped around the interior courtyard and outcropping of the building blocks to provide as much shadows as possible, using local materials compatible with the external environment.



Pic.(5) perspective of the proposed model

### 5-The steps followed by the proposed model to result in a reality adhered study:

5-1-Bulleted compact construction : the residential block shows solidarity & unity for the purposes of protection from the sun and the eyes of strangers and bulleted compact term is derived from the existence of the internal yard within each block pic. (6) as it is displayed in the building of the proposed housing.



Pic.(6) shows the plan of complexes of buildings models in Bawiti city with the compact manner and the internal yard to achieve the greatest shadows.

5-2-Containment into inside: as it is displayed in pic. (7) where different building blocks appear in different sizes wrapped around the center of the internal courtyard.



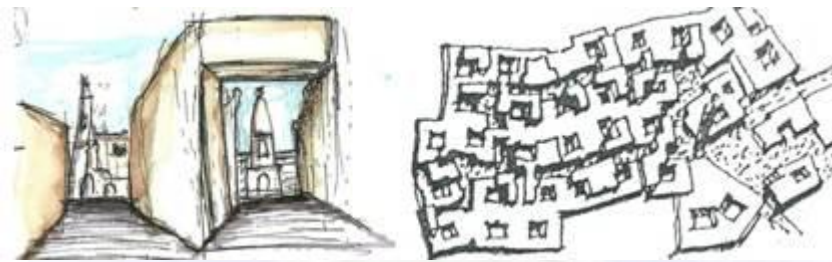
Pic.(7) Containment into inside sample

5-3-outcropping: in the blocks and the façade of the building where the building appear as if it is a form of cubes varies in sizes and dimensions, pic.(8) also designed the door at the right of the building and leads to a corridor with an opening in the ceiling for ventilation .



Pic.(8) façade of residential buildings in bawiti city.

5-4-Shading: Using Urbanism style peppered with twisted alleys and narrow streets to create shades as much as possible, pic.(9).



Pic(9). Shows layout of buildings in Bawiti city and Sketch showing the shading system in the narrow streets.

5-5-Inner courtyard: the idea of a yard, is using two courtyards, one is exposed to daylight for sunrays to fall on it and heat the air while the other is shaded with openings and keep air cold causing ventilation according to difference in pressure pic. (10).



Pic.(10)shows the elevation of the proposed design with the entry and exit of mutual wind between yard and openings .

5-6-Openings: are required to insulate, keep out cold/wind and let warm sun rays in during winter time, provide shade and let the cool breeze in during summer time. It is made from timber olive trees which are of local materials in the Bahariya oasis pic(11).



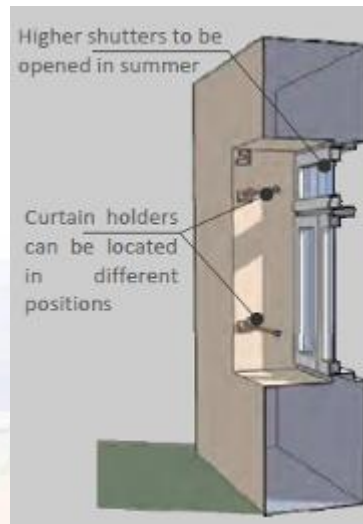
Pic.(11) the proposed window in the residential building



5-7-curtains design of palm fronds has been proposed with two holders for curtains installation to be moved either in the upper unit or lower depending on the direction of sun's rays and temperature and also to control lighting pic (12). And the form of (13) shows sector shape of the window explaining the two shutters and installing units of the curtains.



Pic.(12)



Pic.(13)

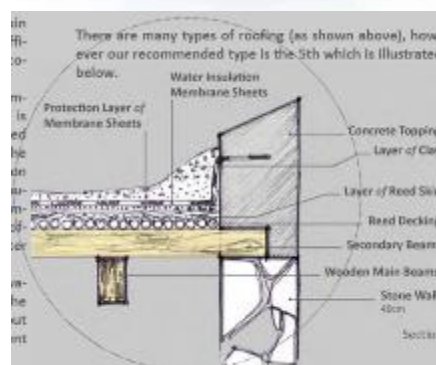
5-8-Walls: The use of environmental construction materials (primarily clay - limestone), which impose load-bearing walls construction with thick walls depending on the proposed raw brick where brick is formed manually with dimensions 10 x 15 cm molds where the first step is the fermentation of the clay present in the construction site where the building will be built, and takes a period of 3-4 hours then add sand to the clay with ratio 3clay : 1sand and then left to dry in the sun and then stack to create walls of the building and then the brick is pasted by mortar from clay and sand which are the same raw materials used in construction and covered by plaster coat .

5-9-Ceiling:

- Palm fronds is thermally very efficient because it is hollow inside. A layer of palm skin is preferred to lie between the palm fronds and the insulation membrane sheets to fill the small tight spaces between palm that are seen from below. The wood/palm/skin combination is very efficient, economic and ecofriendly.

-The first layer of membrane sheets (Bitumen) is spread to protect the palm from being burnt with the fire needed for installation of the second layer of insulation. Nails are not recommended, because they often cause holes that water could pass through.

- A layer of previously watered clay is spread at the top to direct the water out of gutters that compliment the roof slope pic.(14)



Pic(14) sec. in the ceiling showing the palm fronds and the way of installing.





### 5-10-Floor:

using natural irregular rocks in flooring as a traditional building technique and pouring mixture of cement between spaces of the rock pic.(15).



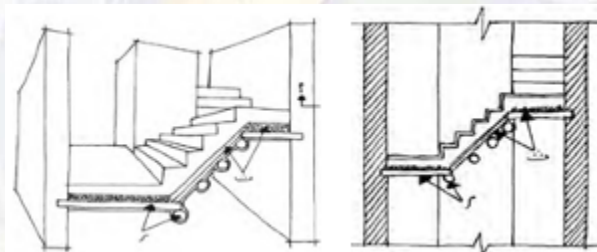
Pic.(15) rock flooring

### 5-11-Stairs

-The construction of the stairs starts from the first step with tendency by the veins of the trees which its diameter is determined according to loads and the type of building.

-After placing the trunks of large palm wood( main bridges) with the specified tendency for each group of stairs and putting the veins horizontally for each landing part in the stairs , then cover these large trunks with small branches (perpendicular to the direction of the large veins , where the small branches are placed horizontally in the landing parts of the stairs and diagonally in places where the stair will be placed and grouped to put mud on them).

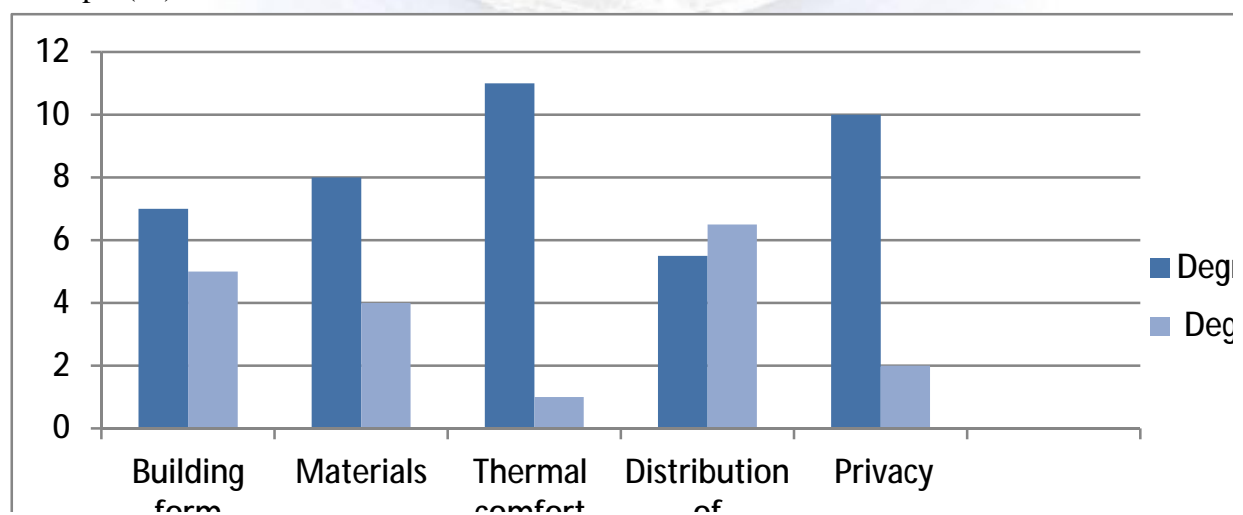
-Small branches are full and well covered by a layer of clay , where the stairs are formed from and the clay layer is terminated by solid stone cut as required and ended by layer of substance similar to cement above the form Pic(16) .



Pic.(16) shows sec. and perspective of the proposed stair

### 6-Survey:

Experimental sample of ten families was selected for questionnaire to know the degree of acceptance and rejection of the architecture units of the proposed design of the residential building and the result was as follow pic.(17)



Pic.(17)



As a result of changing the culture of the citizens and its distance from the extended family system and the youth independence way of living away from the families and because people are accustomed to the use of modern materials such as concrete and cement, and not get used to the traditional form of buildings in ancient times result in the high rejection rate of the families in the survey while thermal comfort got large percentage of acceptance because of the use local materials and the architecture elements that have helped to compatibility with the outside environment climate.

### Results:

-The architecture character in old Bawiti City is designed to provide characteristics of each of the concepts of the nature of the buildings and architectural elements and features of the site, climate, and culture activities and includes the interaction between the environment and human additions and location between the buildings and activities.

-Using traditional compact, twisted and narrow streets, inside the design of the containment building and prominence in the design of the building blocks.

-Using raw brick materials in the construction of walls is considered the local building where the house saves temperature degree especially in the summer compared to the concrete housing that have proved that it is extremely hot in the summer.

-Using bearing walls system is the most appropriate construction systems which depends mainly on the thickness of the walls, which are useful in thermal insulation.

-Establishment of flat roofs depends on the use of wood of palm trees either in the case of non flat ceilings contracts and cellars are used.

-Depending on the courtyard having openings and windows in the building work on the difference of pressure between the hot and cold air to create wind flow inside the residential construction.

-Architectural foundations are created from stones available in the environment and but foundations differs in construction between the Interior and exterior walls even the walls having openings either doors or windows and designing built-in seats created from the same materials of the wall also strengthen the foundations, while in stairs also local materials are used like stone and trunks of palm wood.

### Discussions:

1- Awareness at all levels of the importance of traditional architecture in the Bahriyah Oasis, where they represent a valuable heritage architecturally compatible with the environment and desert climate of local raw materials with the possibility of the use of compatible technology.

2-Employ the results of the study in modern architectural formations in desert countries, to eliminate the architecture of concrete problems that do not conform with environmental and climatic conditions in the desert architecture.

3-We have to give attention to Bawiti City in Bahriyah Oasis region by maintaining the old urbanism with all it's components and create it with methods developed in the framework of the plan which is working to develop environmental requirements firmly on urbanization in the future so the designer can have it as a base in his designs such as local character studies and climate processors and local materials.

4-Encourage the use of local environmental status of the construction materials in building only one or two floors, and try to find a technical way for these materials to increase the durability and to afford heights of more than two floors.



5-Encourage the use of palm stems and palm leaves covered with mud mixture and sand and the cast earth , lime in constructing roofs in more than two floors, and developing it with the possibility to be used with more heights.

6-Separation of pedestrian streets and streets of vehicle traffic so that the pedestrian streets should be narrow and winding to increase the areas of shading for protection from the sun's rays and the work of the streets of the passage of Vehicles should be straight and wide and in a specific range within the city in a minimalist, as the architect Hassan Fathy did while planning the village of Paris in kharga oasis.

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