PART 1
ON HOUSING UNITS

PAPER 1  A MODULAR PATTERN FOR THE DESIGN OF HOUSING PROJECTS
             DR. NASAMAT ABDULKADER

PAPER 2  FLEXIBILITY OF SITE DEVELOPMENT IN HOUSING PROJECTS
             DR. NASAMAT ABDULKADER

PAPER 3  HOUSING FOR A NEW SETTLEMENT IN SINAI
             DR. NASAMAT ABDULKADER

PAPER 4  USERS PARTICIPATION IN LOW COST HOUSING - A CASE STUDY
             DR. NASAMAT ABDULKADER
PART 1  PAPER 1

IAHS- FIU WORLD CONGRESS ON HOUSING
NEW TRENDS IN HOUSING PROJECTS
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A MODULAR PATTERN FOR THE
DESIGN OF HOUSING PROJECTS

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A MODULAR PATTERN FOR THE DESIGN OF HOUSING PROJECTS

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ABSTRACT

Industrialized techniques of construction have been introduced to the Egyptian context during the last decade. Accordingly a new approach to the design of housing projects seems to be highly needed. Such an approach would help the designer to take into consideration the constraints of industrialization, mainly calling for standardization and modular coordination, and yet allow the generation of various dwelling designs. The objective of the present paper is to show the steps that have been undertaken in order to reach a systematic approach to design.

INTRODUCTION

Since the SAR group had an already established systematic approach to design, it has been decided that the adaptation of the SAR approach to the Egyptian context would be most helpfull. In order to achieve such an adaptation, the following steps have been undertaken and will be briefly discussed in the present paper:

1- An analysis of plans and configurations of some housing types used in existing housing projects. The analysis allowed identifying the similarities and differences between dwellings.

2- The design of a modular pattern allowing the regeneration of analysed housing types without neglecting the constraints of industrialization.

3- A demonstration showing the use of the proposed modular pattern for the design of housing types.

ANALYSIS OF PLANS AND CONFIGURATIONS OF EXISTING HOUSING TYPES

The SAR method is based on the determination of so-called "zones" where certain specified functional spaces are located, and "margins" which separate these "zones", thus allowing maximum/minimum
variations in the dimensions of the functional spaces. The
structure of such zones can be traced by means of a methodical
analysis of existing plans. For instance, figure (1) shows the
analysis of two types of traditional plans commonly used in
Egyptian housing projects. A closer look to the analysed plans
helps identifying some common features between them, for instance,

1- The depth of the building is occupied by two parallel
rows of functional spaces, or, using the "SAR" language
two α zones. This is due to the fact that, according to
Egyptian by-laws, all functional spaces, including
kitchens and bathrooms, should be naturally lit and
ventilated.

2- The Areas of dwellings vary from one design to the
other.

3- The areas of functional spaces also vary and probably
reflect some socio-economic standards of the users.
However, a kind of relationship between the dimensions
of the functional spaces and the total depth of the
buildings seems to be respected, i.e. when the dimen-
sions of the spaces are relatively small, the total
depth of the building is less than when the same spaces
are larger. The total depth is usually more than double
the width of the rooms parallel to the facade.

4- The orientation of the facades could vary leading to
buildings with two perpendicular facades.

Accordingly, if any modular pattern of "zones" and "margins" is
to be suggested, it should satisfy the following criteria:

1- It should allow getting functional spaces of different
dimensions directed to different strata of the society
depending on the variations of the socio-economic con-
ditions.

2- It should allow having dwellings of different areas
directed to different users.

3- It should provide the possibility of suggesting various
internal design for dwellings of the same area.

4- It should allow the redistribution of areas of dwellings
within time if some demographic changes call for that
level of flexibility.

5- It should allow the generation of different housing
types: row houses, walk-ups, towers, etc.

6- It should allow the provision of different building
configurations: T shape, L shape, H shape, etc.

7- It should allow a flexibility in the arrangement of
external layouts.

THE PROPOSED MODULAR PATTERN

It is believed that the modular pattern should reflect the con-
figuration of the building. Accordingly, the total depth of a
building should be easily retraceable on such a pattern, which
means that the 2 α "zones" should be well expressed as well as
the margins separating and surrounding those zones.

The analysis of traditional designs showed that the two α zones
are not equal in depth. The α zone for services (kitchens and
bathrooms) is much smaller and could be half the $\alpha$ zone for other functional spaces (bedrooms and living rooms). Such an asymmetry is logical but would complicate any suggested modular pattern. For the sake of simplicity, and in order to provide unequal $\alpha$ zones, it has been decided to suggest first a zone distribution offering 2 equal $\alpha$ zones as shown in figure (2) then subdivide one of the $\alpha$ zones into a smaller $\alpha$ zone for services and a second margin adjacent to the middle margin separating the $\alpha$ zones. The proposed zone distribution is subdivided into "sectors" and the "supports" or the permanent elements in the building are located on the boundaries of those sectors occupying the whole depth of the $\alpha$ zones. Each sector could be designed differently and would provide different combinations of functional spaces as shown in figure (3).

If the pre-established zone distribution is drawn in a repetitive way (i.e. alternative bands of zones and margins), a linear pattern is obtained. Such a pattern would allow having a layout of linear buildings. Such buildings could be shifted to each other causing variations in their total configuration and creating different spines. The one directional modular pattern would act as a guide regulating shiftings between buildings.

However, in most of the layouts, a one directional modular pattern is not enough. There is a need to have a two directional modular pattern to allow switching the directions and configurations of buildings. In order to reach such a two directional pattern, there were a need to find out a relationship between the spans of the sectors (perpendicular to the zone distribution) and the total depth of the building. It has been noticed that, if the same zone distribution previously established is drawn in the perpendicular direction as well, the following dimensional relationships could be achieved:

1- The span of a sector could be equal to an $\alpha$ zone and a margin.

2- The total depth of the building consisting of 2 $\alpha$ zones and 3 margins would be more than double the spans of the sectors which coincides with the finding of the previous analysis.

Accordingly, such a two directional tartan grid, as shown on figure (2), could be most usefull for the generation of different building configurations and layouts.

Up till now, only the shape and proportions of the modular pattern have been discussed not its dimensions. As mentioned earlier, this pattern should help generating various sizes of functional spaces for users of different socio-economic conditions. Accordingly, it is believed that this modular pattern should be a stretchable pattern that could have different dimensions. For instance, as shown in figure (2):

1- The sector span could be equal to 3.60, the zones and margins being equal to 2.40 and 1.20 ($2.40 + 1.20 = 3.60$).

2- The sector span could be equal to 3.90, the zones and margins being equal to 2.70 and 1.20 ($2.70 + 1.20 = 3.90$).

3- The sector span could be equal to 4.20, the zones and margins being equal to 3.00 and 1.20 ($3.00 + 1.20 = 4.20$).
4.20).

4- Or any other combination of dimensions.

Thus, the possibility to change the dimensions of the modular pattern gives a flexibility in having apartments of different areas attributed to different sectors of the society.

In order to show the potentialities of the proposed modular pattern and its capacity to generate various housing types, building configurations and layout, two examples will be discussed next with an emphasis on the levels of internal and external flexibility provided.

**GENERATION OF DIFFERENT HOUSING TYPES USING THE PROPOSED MODULAR PATTERN**

The following two housing types have been selected to serve as examples:

A- a walk-up (4 stories high) having a staircase serving two apartments on each floor level. It is an adaptation of the traditional example previously analysed in figure (1).

B- A tower having a vertical core of circulation serving four apartments on each floor level.

For each example, the following points will be discussed:

1- The internal flexibility i.e.
   - The possibility to have various areas of dwellings,
   - The possibility to have different mixes and percentages of dwellings having different areas,
   - The possibility to have different internal designs for dwellings of same area.

2- The external flexibility, i.e. the possibility to achieve variations in the building configuration leading to the variety of external layouts.

**TYPE "A" : A WALK-UP WITH A STAIR ACCESS SERVING TWO APARTMENTS**

Internal flexibility: Figure (4) shows that for a determined distance between the stairs (equal to five structural modules in this particular example), it is possible to have apartments of different areas (ranging between 30 m² and 120 m² for the given example) with fixed location for the kitchen and bathroom. Thus, even for two subsequent floors, the areas of two apartments could vary without disturbing the location of the technical part (kitchen and bathroom). Such a possibility gives the opportunity to have different mixes of large and small apartments. Moreover, the possibility to increase or decrease the percentage of apartments of a certain area could be achieved by the variation of the distance between the vertical cores of circulation: for instance,

1- If the distance between the stairs is equal to three structural modules, the areas of dwellings could range between 30 m² and 60 m².

2- If the distance between the stairs is equal to four structural modules, the areas of dwellings could range between 30 m² and 90 m².
3- If the distance between the stairs is equal to five structural modules, the areas of dwellings could range between 30m² and 120m² and so forth.

This example shows only the variations in areas in case a 3.60 structural module is used. Other variations in areas would be achieved in case a 3.90, 4.20 or 4.50 structural modules are used. Different options for the design of internal spaces could be suggested as well.

External Flexibility: Figure (4) shows that the same housing type could create a spine having different configuration. It also shows the possibility to switch the direction of the spine 90° creating a corner, thus allowing the urban designer a great flexibility for the arrangement of the layout. As mentioned in the description of the modular pattern, the variations in the configuration of the spine is happening according to certain rules. For instance, in case the 3.60 module is used, any shifting in the building line will be equal to 3.60 in order to follow the pre-established structure of the modular pattern.

Fig.(1): Analysis of traditional designs
Fig. (2): Zone distribution

Fig. (3): Alternative designs for the sectors.
Possible areas of dwellings between two vertical cores of circulation.

Possible increase of the area between two vertical cores of circulation.

Fig. (4): A walk-up with a stair access serving two apartments
Fig. (5): A tower with a vertical core serving four apartments.
TYPE "B": A TOWER WITH A VERTICAL CORE SERVING FOUR APARTMENTS.

Internal flexibility: as shown on figure (5) the flexibility in dwellings area is only achieved in the distance between the vertical cores of circulation. The end apartments will have fixed areas. Similarly to type (A) the possibility to have different mixes and percentages of apartments of a certain area is achieved by varying the distance between the vertical cores. For each dwelling area, different designs could be suggested.

External Flexibility: Different grouping could be achieved by the use of this type. Interesting variations could also result from having the stairs on the same direction or in opposite directions leading to different building configurations.

CONCLUSION

The analysis of traditional designs according to the SAR method was much helpfull in the identification of the similarities between existing designs. Based on such an analysis, it was possible to develop a modular pattern that could serve as a tool for the designer. It enables him to generate different designs that could be built either traditionally or using the industrialized techniques of construction presently spreading in Egypt.

The proposed modular pattern is designed in such a way as to provide different levels of internal and external flexibility. By internal flexibility it is meant the possibility to have dwellings of different areas directed to different socio-economic levels of the society, the possibility to have different mixes of these dwellings, and to have varied internal designs for dwellings of the same area. By external flexibility it is meant the possibility to have different housing types with different external configurations leading to varied layouts.

In order to show the flexibility of the developed modular pattern it has been used for the redesign of two traditional housing types. The chosen types just served as a mean for the demonstration of the design methodology, the same exercise could be repeated for many other housing types.

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PART 1   PAPER 2

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FLEXIBILITY OF SITE DEVELOPMENT IN HOUSING PROJECTS

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ABSTRACT

The development of new housing schemes is usually undertaken according to different strategies of action:

- land parcellization could be recommended in a certain scheme, the plots are to be developed by private owners according to pre-established building regulations,
- a whole mass housing project could be developed by the private or public sector, the completed dwellings are available to the user,
- or a mixture of the two strategies

The decision related to the adoption of one strategy or the other is rather difficult and subject to modification during the development process:

- a parcellized land could be developed as a mass housing project,
- or a block reserved to a mass housing scheme could be parcellized and developed by separate owners

INTRODUCTION

The dynamics of the development process call for the existence of an inherent flexibility in the planning of housing layouts.

Such a flexibility should allow switching from one strategy of action to the other without clashing with the main features of the layout especially the location of infrastructure, densities, floor area ratio and so forth.

The present paper discusses the guidelines that ought to be
considered in order to allow such a flexibility in action. This is achieved by an analysis of the features of housing types to be developed on separate plots, the features of housing types to be selected in a mass housing project and, consequently, the common features in the two cases allowing the smooth switch from one strategy to the other.

I. FEATURES OF HOUSING TYPES IN PARCELLIZATION SCHEMES

In parcellization schemes, the suggested areas for plots will probably have an impact on the intervals between lines of infrastructure serving such plots. For instance, in case small plots having an area less than 150m² are to be developed, the intervals between lines of infrastructure will probably be less than in case large plots having an area of about 700 m² are to be developed. Standards for the recommended routes of infrastructure for plots of different areas have been lately developed (1) and the following intervals have been established:

- in case small plots less than 150m² are required, the intervals between lines of infrastructure could be equal to 36.00m.
- in case medium size plots ranging between 150m² and 450m² are to be provided, the intervals between lines of infrastructure could be equal to 54.00 m,
- in case large size plots ranging between 350m² and 700 m² are recommended, the intervals between lines of infrastructure could be equal to 72.00m.

The building regulations for the development of separate plots will not be the same for plots of different areas. For instance, if a 50% coverage area is suggested for plots of 700 m², such a percentage wouldn't be recommended for plots of 150 m². The building regulations will vary for plots of different areas and consequently will have an impact on the main features of the housing types to be designed. In order to show such an impact, two cases will be discussed:

1- features of housing types on plots less than 150m²
2- features of housing types on plots of 350m² to 700m²

In case small plots less than 150m² are to be developed, the depth of such plots will vary between 12.00 and 15.00 meters.

The facades being usually narrower than the depths, the building regulations for such plots will probably allow having attached buildings. The percentage of covered area could range between 60% and 70% of plot area. The open spaces (30% to 40%) represent a court located in the back side of the plot. Such regulations will have the following impact on the housing type:

- the depth of the house will range between 8.40m and 10.5 m, which means that a double aspect dwelling could be designed.
- the height of the house will be restricted. The two back to back inner courts will provide a distance ranging between 7.20 and 9.00 meters. Thus buildings two to three stories high could be recommended in order not to overshadow ground floors.
On the other hand, in case large plots of 350 m² to 700 m² are to be developed, the depth of such plots will vary between 30.00 and 33.00 meters. The suggested coverage for such plots is usually 50% to 60% of the area. In case attached buildings are allowed, the depth of the house will range between 15.00 and 19.80 meters. A 19.80 depth in Egypt is usually not designed as a double aspect dwelling. The Egyptian bylaws call for the natural lighting and ventilation of internal spaces (including kitchens and bathrooms). Thus, a 19.80 depth cannot be occupied by only two functional spaces, each overlooking a facade. In this case, a court or pocket (having a minimum dimension of 3.00 m) is suggested in the mid-distance of the 19.80 depth, and two single aspect dwellings are designed, each overlooking one main facade and an inner facade on the court or pocket. The depth of such a building will then vary between 22.80 and 24.00 m.

The suggested coverage area will then have an impact on the depth and height of the suggested housing types:

- deep buildings will be suggested with small courts and pockets for the natural lighting and ventilation of inner spaces.
- the open spaces representing 40% to 50% of the plot will partly occupy the back side of the plots. Two back to back open spaces will probably range between 15.00 m and 18.00 m. Thus, four to five floors could be suggested.

The same analysis could be repeated for back to back plots of various depths.

II. FEATURES OF HOUSING TYPES IN MASS HOUSING PROJECTS

A similar analytical approach could help in identifying the main features of housing types for mass housing projects. In such projects, the cluster is usually considered as being the basic molecule that governs the layout. Such cluster usually consists of a group of buildings overlooking the smallest open space in the hierarchy of open spaces provided for the scheme. In such a cluster, the minimum total depth consisting of two parallel rows of buildings and the space in between will vary according to two factors:

1- the height of the buildings
2- the depth of the buildings

Impact of The Height Upon The Minimum Depth of The Cluster:

Providing a minimum distance allowing privacy between two rows of buildings, such a distance will remain constant for a certain height of such buildings (one, two, three stories). However, in case high rise instead of low rise buildings are considered, such a distance will probably vary in order to prevent the overshadowing of dwellings at lower floors. This means that the total minimum depth of a cluster consisting of 2 stories buildings will probably be less than a cluster of 12 stories buildings.

Impact of Building Depth Upon The Minimum Dimension of The Cluster:

As mentioned earlier, Egyptian building regulation and bylaws had an impact on the design of housing types. In order to provide
natural lighting and ventilation for all functional spaces in the dwelling, two categories of housing types emerged:

1- the narrow housing types
2- the deep housing types

By narrow housing types it is meant dwellings having two aspects. The stairaccess serving two apartments on each floor level is a typical example of such narrow types. The total depth of the dwelling (consisting of two rows of functional spaces) would vary between 7.20 and 12.00m. Other examples of narrow buildings are: row houses, gallery types...

By deep housing types it is meant dwellings having a single aspect. The stairaccess serving four dwellings on each floor level is a typical example. In fact, as an abstraction, a deep building could be considered as two narrow buildings linked to each other through the vertical core of circulation and separated by the minimum allowable distance for inner courts or pockets for the natural lighting and ventilation of functional spaces (3.00 m in Egyptian bylaws). The total depth of deep building would then vary between 21.00 and 27.00 meters. Other examples of deep buildings are court houses.

In case only narrow buildings are used in a cluster, the minimum depth of such a cluster will probably be less than the minimum depth of a cluster using a mixture of narrow and deep buildings or a cluster consisting only of deep buildings.

III. FLEXIBILITY OF SITE DEVELOPMENT

The previous analysis showed that:

- In parcellization schemes, the areas of the plots, the intervals between the lines of infrastructure have an impact on the building regulations suggested for the plots. Such regulations would lead to some recommended characteristics of the housing types in terms of their depth and height.

- In mass housing schemes, the depth and height of the housing types have an impact on the minimum depth of the cluster and consequently on the distance between the lines of infrastructure serving such a cluster.

Such a relationship between the intervals of lines of infrastructure and the suggested height and depth of housing types could serve as a key to the possible change in strategies of development. It means that, in case a parcellization scheme is converted to a mass housing project, the housing types selected for the project and forming the clusters should be within the preset regulations for plots development in order to get advantage of the predesigned infrastructure. It also means that, in case a site reserved for a mass housing project is parcellized, the building regulations for the suggested plots should allow the best use of the previously studied routes of infrastructure and create at the end of the development the same clustering effect foreseen for the mass housing project.

Accordingly, if a relationship is established for the intervals
between lines of infrastructure and the recommended depths and heights of housing types, the planner and designer could easily switch from one strategy of development to the other.

Based on the previous analysis, the following guidelines could be suggested:

1- In case the intervals between lines of infrastructure are equal to 36.00 m:
   - In parcellization schemes, 60% to 70% of the plot could be built, buildings are of the narrow type, their height should not exceed two to three floors.
   - In mass housing schemes, narrow buildings are recommended (row houses, town houses, stairaccess serving two apartments) their height should not exceed two to three floors.

2- In case the interval between lines of infrastructure are equal to 54.00m
   - In parcellization schemes, 55% to 65% of the plot could be built. Buildings are of the narrow type, their height should not exceed four to five floors.
   - In mass housing projects, two cases are possible:
     - narrow buildings are used, height not exceeding four to five floors,
     - a mixture of narrow and deep buildings could be used, height not exceeding four to five floors.

3- In case the intervals between lines of infrastructure are equal to 72.00 m:
   - in parcellisation schemes, 50% to 60% of the plot could be built. Buildings are of the deep type, their height should not exceed four to five floors.
   - in mass housing projects, deep buildings are recommended (a stairaccess serving four dwellings is an example). Their height should not exceed four to five floors.

**CONCLUSION**

A change in the strategies of development for housing projects could always occur. A parcellization scheme could be developed as a mass housing project and vice versa. The switch from one strategy of development to the other could be done smoothly in case well studied guidelines are given to the designer and planner. The present paper is a trial in this direction. It helps recognizing the common features of the housing types for parcellization schemes and for mass housing projects. Such common features are mainly related to the heights and depths of the housing types on one hand and to the intervals between lines of infrastructure on the other hand.
Areas of plots less than 150 sq. meters: narrow buildings not exceeding 2 to 3 floors.

Areas of plots ranging between 150 & 450 sq. meters: narrow buildings not exceeding 4 to 5 floors.

Areas of plots ranging between 350 & 700 sq. meters: deep buildings not exceeding 4 to 5 floors.

Fig. (1) Recommended depths and heights of buildings in parcellation schemes.
Fig. (2): Recommended depths and heights of buildings in mass housing schemes.
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HOUSING FOR A NEW SETTLEMENT IN SINAI

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ABSTRACT
New settlements in desertic areas are encouraged by the Egyptian Government in order to increase the area of agriculture land. It is believed that the inhabitants of such a settlement will participate in the construction and expansion of their houses. Such an attitude seems to be in harmony with the pattern of life in rural areas where people do have the time to participate in the construction activity. In order to assure such a participation, it is recommended to provide small standard components easy to erect instead of just providing the traditional building materials. Based on the discussion of design criteria, the present paper proposes alternative designs for expandable houses that could be erected with standard components.

INTRODUCTION
The present policy of the Egyptian Government tends to direct the newly graduated university students to work in the development of desertic areas in order to increase the area of agriculture land. In order to implement such a policy, pilot projects are to be started soon in five different areas. The one considered in this paper is located in Sinai on the East Bank of Suez Canal. 3000 acres of land will be given to 200 university graduates, each having 15 acres. The population of the new settlement will consist of the university graduates coming from Urban areas as well as farmers coming from rural areas. What would be the main features of the housing scheme for such a population? This is in fact the main objective of the present paper.
It is believed that the design of the housing units and housing groups for
such a population will be affected by certain political, technical, economic
and socio-cultural factors. Those factors and their impact on the design will
be discussed in this study.

BASIC CRITERIA OF DESIGN

From The Political Point of View:
It is believed that it is not possible to offer a large house either to the
farmer or to the graduate. Such a large house would be:

First, too expensive for them and beyond their affordability to pay,

Second, too large for the average size of the families at the beginning
of their migration.

Perhaps, it would be better to give them the concept of a house that could be
expanded within time according to the needs and resources of the family. In
this case, the inhabitants of the new settlement will participate in the
construction and expansion of their houses. Such an attitude seems to be in
harmony with the pattern of life in rural areas where people do have the
time to participate in the construction activity.

From The Technical Point of View:
In order to assure the participation of the user in the expansion of his house,
it is recommended to offer him small standard components easy to erect instead
of just providing the traditional building materials. Such small elements
could be a system of beams and hollow blocks for the slabs, or a system of
small hollowed slabs, or any other elements that could be easily handled with
(or even without) simple equipment.

In order to take advantage of the suggested simplified method of construction,
it is recommended to offer a variety of designs that respect the same
structural module either for the farmer or the graduate house.

From the Economic Point of View:
In order to minimize the cost of the infrastructure of these houses [electricity,
water, sewage, etc...] it would be recommended to build them on narrow and
depth plots. Such plots should in the same time have an area that is sufficient
to build the house and provide a private vegetable garden for the user.

From The Socio-cultural point of view:
It is not recommended to propose one single design for the farmer house or the
graduate house. A variety of alternatives would allow a better personalization
of the housing unit and the surrounding environment.

All recommended variations of design should take into consideration the socio-
cultural pattern of the graduate or the farmer life. They should allow the
various levels of privacy needed to undertake the daily activities.
From the Environment Point of View:

In order to have an appealing image of the village at its early stages and in order to protect its general environment, it is recommended to start building all housing spaces overlooking the streets; the expansion of the house would happen inwards in the back garden.

Based on these criteria, various housing types have been designed as will be discussed hereafter.

**MAIN FEATURES OF THE HOUSING TYPES**

Housing Types for Farmers and Technicians:

General Characteristics of the House:

Those houses are mostly directed to people originally coming from old rural areas. The analysis of the traditional houses in such areas enabled the recognition of some common features that should be respected in the new designs. For instance:

- The housing spaces overlooking the streets are always reserved for the entrance and the reception room (Mandara). They are never used for bedrooms or services (kitchen and bathroom).
- The bedrooms and service core are always on the inside having their openings on an inner court.
- The inner court is always provided in these houses not only for the ventilation of inner spaces but also to be used as a functional space in which many of the daily activities of the housewife are taking place such as food preparation and laundry washing. Accordingly, this court is usually in direct relationship with the kitchen and bathroom.
- The roof is always accessible with a stair usually located in the inner court. The roof is used for many purposes such as storing grain, hanging laundry, piling dry wood, etc.

Based on these features and on the previously analysed and identified set of criteria, it has been decided to chose the U shape for the design of the farmer and technician house. This U shape helps creating the prescribed inner court. The houses are built on plots of about 300 m² to 380 m² having a facade of 8.40 and a depth ranging between 36.00 and 45.00. Each plot would allow building a house of about 100 m² and leaving a vegetable garden of about 200 m² to 280 m². The plot is overlooking two parallel paths: one is reserved for pedestrians and the main entrances of the houses, the second is reserved to vehicles and domestic animals. Specially in case the barns are located within each plot because usually the traditional farmer insists to keep his animals in his house.

As for the design of the houses, the structural spans have been standardized in order to be able to use standard components for erection. The facade of the plot allows building two structural spans 4.20 each. In spite of that standardization, three different concepts, each generating 6 different...
designs, have been suggested. The farmer or technician could choose any of the 18 designs and build it with the same standard components.

- In the first conceptual design, a strong relationship is established between the service core (kitchen and bathroom) and the inner court. The 6 alternative designs mainly vary in the details related to the location of the stairs leading to the roof and the shape and proportion of the entrance.

- In the second conceptual design, as shown on figure (1), the location of the service core allows a strong relationship between the kitchen, the inner court and the vegetable garden in the back. Different alternative designs are suggested within that concept.

- In the third conceptual design, the location of the service core allows a strong relationship between the kitchen and the vegetable garden. Again, different alternative designs are generated within the same concept.

The 18 designs have been evaluated in order to select two of them to be built as prototypes at the early stages of the village. The chosen designs have the service core in connection with the back garden in order to be able to use the back street for the infrastructure (water, sewage, etc.) and keep the front street clean for the pedestrians. The chosen designs provide in front of the house an open space that could be used for social meetings. The area of the ground floor after completion is about 82 m²; a second floor could be added in case the family is largely extended. Figure (2) shows one of the selected designs.

Different Stages of the House Expandability

Various alternatives could be suggested regarding what should be given to the user at the beginning and what could be left to be completed in a later stage. For instance:

- First option: Only the entrance and reception room are built at the beginning in order to control the environment of the street. The service core is also completed but the rest of the spaces are left to the user to be built later on.

- Second option: This option is much similar to the first one but adds a closed bedroom to the user in order to give a better incentive for the migration to the new settlement.

- Third option: In this option it is recommended to complete the roof of the ground floor and to finish only the entrance, the reception room and the service core.

It is believed that the third option has many advantages: first, it assures the realization of the pre-studied U shape; it helps the rapid expandability of the house because it is much easier for the user to build a wall than to erect a roof.

Housing Types for the Graduate:

General Characteristics of the House:

The type of daily activities for a graduate family coming from an urban area would probably differ from the activities of farmers originally coming from
rural areas. For instance, the concept of an inner court in the house is not needed once there is a private garden for the outdoor living. Accordingly, a different housing type is needed for the graduate, this housing type is a kind of attached town houses two stories high. Two examples of this house have been designed, one of them could be built on the same plot of the farmer house having a facade of 10.80. Both designs are respecting the same structural module used for the farmer house and could be erected by the same standard components.

The first type consists of a ground floor having a living area, two bedrooms, a kitchen and a bathroom outlook the back garden and a staircase leading to the first floor. The area of each floor is about 100 m² as shown in figure (3).

The second type consists also of a ground floor having a living area, two bedrooms, a kitchen and a bathroom outlook the back garden and a staircase leading to the first floor. However, the staircase is not in the middle of the house as in the first type. It is located near the entrance so that in case the owner would like to rent the upper floor to a separate family he could do it without risking his own privacy. The area of each floor is about 100 m².

Different Stages of House Expandability:

It is believed that the minimum house to be provided to the graduate should consist at least of a living room, a closed bedroom and a service core. Accordingly, and in order to protect the image of the street as previously suggested, the ground floor could be built without the second bedroom outlook the back garden; this room could be completed in a later stage.

MATERIALS AND METHODS OF CONSTRUCTION

As for the building materials to be used, the investigations showed the existence of stone quarries near the site that could provide the material for bearing walls. In the same time, a new factory on the East Bank of Suez Canal will start producing shale bricks within six months. This factory will equally produce other small components from the shaly material: such as T section reinforced beams and special hollow blocks for the roof as well as reinforced columns.

According to this information, the vertical load bearing elements for the houses could be:
- Bearing walls built with stones or shale bricks.
- Prefabricated columns on equal spans.

The horizontal bearing elements could be:
- Prefabricated beams with hollow shale blocks in between as shown on figure (4).
- Small hollowed concrete slabs.
As for the non bearing facades of the houses, they will be built either with stone or with shale bricks. In both cases, the facades will be left without plastering. Accordingly, as shown in figure (5), the elevations of the houses express the idea of using exposed materials. The lintels for doors and windows are prefabricated concrete elements designed to span the opening and be left without any plastering.

CONCLUSION

The study just showed some possible design variations. Many others could be suggested respecting same modules and using same building elements.
FIG. (1)
Second Conceptual Design For The Farmer House
FIG (2)
First Prototype Of The Farmer House
FIG (3)
First Prototype Of The Graduate House
FIG (4)
Use Of Bearing Walls, Prefabricated Beams and Hollow Blocks
FIG (5)
Suggested Elevations
PART 1  PAPER 4

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USERS PARTICIPATION IN LOW COST HOUSING - A CASE STUDY
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USERS PARTICIPATION IN LOW COST HOUSING
A CASE STUDY

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ABSTRACT

El-Obour City is one of the planned new towns expanding around Cairo. The city is 25 km northeast of Cairo Center. Some 15000 persons are presently employed in the industrial area 2 to 5 km of El-Obour City. The majority of these workers commute from Cairo. It is believed that housing for these workers will provide the nucleus for the first district to be developed in El-Obour City. The objective of the present report is to discuss the main directions that could have an impact on the design of the residential areas for this district.

INTRODUCTION

The housing scheme for the first district is directed to low income settlers that should be accommodated in El-Obour City without relying on heavy government subsidies. Thus, if users would prefer to invest in their own houses, they should get the opportunity to participate in the development process with guidance and help from the development agency.

It is believed that in order to allow such a participation, the following aspects should be taken into consideration:

1- The Economic Aspect
2- The Organizational Aspect
3- The Technical Aspect
4- The Environmental Aspect
5- The Social Aspect

Each of these aspects is briefly discussed next in order to understand its implications on the design process for the first community.
THE ECONOMIC ASPECT

The possibility to reduce the government subsidies could be easily understood when the various phases of a development scheme are clearly identified. Such phases could be:

- The provision of the necessary infrastructure
- The erection of the main bearing elements of the housing unit
- The internal and external finishing of the units.

Each of these phases could be achieved according to an incremental process.

In order to reduce the government subsidies, it is preferable to limit its role to the execution of phases that need to be done by a large body such as the provision of the infrastructure. As for the subsequent phases of development, they could be financed by the users according to different scenarios; for instance:

- In case small plots are provided, the government financial contribution at the early stages of development could either be limited to the provision of the infrastructure or extended to the erection of a basic core of a limited area.
- In case flats are provided, the government financial contribution at the early stages will probably be larger than in case of small plots since the government will have to give the infrastructure as well as the bearing skeleton of the buildings.

The economic study presented by Wheaton, W.C., at Core Housing Seminar (1), recommends the provision of long-term mortgage financing at realistic interest rates. The study shows that users are ready to invest in the expansion of their dwellings and such investment is usually much higher than what is expected from people with limited income. The informal sector in Cairo is a very good example of this situation. However, the organizational mechanism of the process needs to be understood to assure the active participation of the users.

THE ORGANIZATIONAL ASPECT

In order to allow users participation in the development process, it is necessary to understand the existing organizational process that is governing the informal Housing in Cairo. The Dames and Moore/ABT/GOHBR study (2) undertaken in 1981 helped identifying:

- The sources of finance for the process
- The sources of labour
- The sources of materials and components

The study showed that the user is not usually building with his own hands and prefers to hire small contractors and unskilled labourers to do the job. The same remark was indicated by Wheaton, W.C., (1). According to him, in a growing country like Egypt with little unemployment, it is quite common for low income settlers to have two jobs (a morning and an evening one); in such a case, the user will not have the time to participate physically in the building process.
Fig 1
Small Components of Expandable Houses
The Dames and Moore/ABT/GOHR study (2) showed the size of operations undertaken in the informal sector [most of the time just adding one room] which are in harmony with the capacity of the small contractors in this sector and with the amounts of savings of the settlers.

The understanding of the organizational process in the informal sector shows the importance of the creation of a body that would play the same role for the development of the new settlement. Such a body could help the users on two levels:

- **On the design level:** the body could provide the users with a catalogue of alternative solutions for the plots or flats with precise information on the cost of achieving such designs in different phases. The body could as well enlighten the user on the various sources of finance that could help him building his housing unit.

- **On the execution level:** the body could help the users and the small contractors to get the necessary material and components. It could even give higher services to the small contractors by allowing them to hire some equipment to help achieving the work in a better way.

However, if the expandability process is accomplished in a traditional way as for the informal sector, there is a risk to create messy sites that destroy the image of such a new settlement. This point leads to the discussion of the technical aspect of the process.

**THE TECHNICAL ASPECT**

In order to encourage the expandability process with as little damage as possible for the existing building and without creating messy sites, it is recommended to provide some standard small components instead of just providing the traditional building materials. Such small components could be a system of beams and hollow blocks, a system of flat or vaulted slates or any other components that could be easily handled with (or even without) simple equipment. (see figure 1):

- In case houses on separate plots are to be built, components should allow spanning some acceptable room sizes. Structural modules of 3.50, 3.90, or 4.20 could be recommended. Plot sizes will probably be a multiple of such modules and the smallest plot could have a facade of 5.40 \( [160 \times 180] \) or 7.20 \( [3.60 \times 2] \).

- In case flats are to be provided, the load bearing structure could be erected first and the internal subdivision of the flats and the closing of the facades could be achieved by the users according to an incremental process. Standard small components for the partitions and the facades could be provided to the users and small contractors to minimize the risk of a messy image all around the project. (see figure 3).

However, the provision of standard prefabricated components is not the only measure that should be taken to protect the general image of the growing settlement. This leads to the discussions of the environmental aspect of the process.
Fig 2.
Expandable Houses
THE ENVIRONMENTAL ASPECT

An appealing image of the growing settlement could be achieved in case the following measures are considered:

- In case small plots are provided, it is recommended to start building all housing spaces overlooking the streets. The expansion of the house could happen inwards in the backyard of the plot [see figure 2].

- In case flats are provided, the buildings could either have completely finished facades from the beginning [which increases the initial cost of the flat] or could be left to be finished by the user with standard components that assure the harmony of the complex.

- On the layout level, the environmental quality of the settlement could be assured in case public open spaces are minimized and private open spaces are maximized.

THE SOCIAL ASPECT

The diversity of users needs has to be reflected in the designs to be suggested to them. Variety of designs is crucial for such users in order to insure their personality. Accordingly, it is recommended in such a project to develop a catalogue of alternative solutions either for the plots or for the flats of similar areas.

CONCLUSION

It is believed that the design and planning of housing for the first community should minimize the government subsidies by encouraging users participation in the development process. Such a participation could be very active in case an organizational process is established allowing the users to take the appropriate decision at both the design and execution levels. The concept of an expandable house or flat could give an appealing image of the settlement at its early stages of development in case some measures are considered such as:

- The provision of standard components assuring a better quality of the buildings.

- The firm control of the first phases of the development overlooking the streets.

- The assurance of a large variety of options giving an appealing architectural character.

REFERENCES


2. Informal Housing In Egypt, ABT Associates, Dames & Moore, GOHBR, Egypt, January 1982.