IN-USE MODIFICATION
OF EXISTING PUBLIC HOUSING
IN CAIRO, EGYPT

by

SAMIA ABOU EL FETOUH TOLBA SAKR
B.Sc., Cairo University, Egypt, 1969

Submitted in Partial Fulfillment of the Requirements for the
Degree of
Master of Science in Architecture Studies
at the
Massachusetts Institute of Technology
February, 1983

Samia About El Fetouh Tolba Sakr, 1983
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Department of Architecture
December 15, 1982

Eric Dluhosch
Associate Professor of Building Technology

John Habraken, Chairman
Departmental Committee on Graduate Students
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( Page 68 )
لا غالب إلا المهملة
This thesis is dedicated to my husband, Mohammad.
In-Use Modification of Existing Public Housing in Cairo, Egypt

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Samia Abou El Fetouh Tolba Sakr

Submitted to the Department of Architecture, Massachusetts Institute of Technology, February 1983, in partial fulfillment of the requirements for the Master of Science in Architecture Studies degree.

ABSTRACT

The primary goal of this thesis is to analyze and evaluate existing public housing in Egypt, with the aim of:

1. Modifying existing conditions, and
2. Developing alternative design concepts to meet with present and future user demands.

The thesis is divided into three major parts, each part containing several chapters. Part I gives a brief background on the housing situation in Egypt; when it was first perceived as a problem and how the government interceded to solve it. A description of the present situation with the housing issue is presented revealing areas of the problem. Part II deals with a specific case study, of a public housing project in Cairo, chosen as a prototypical example of post-occupancy and post-construction evaluation. Part III advocates an alternative design approach to remedy the existing situation by introducing some degree of flexibility/variability. This was provided through proposing an additional space or spaces to be connected to the existing structures. In addition, technical systems suitable for implementation are studied for both minimum and maximum spans proposed.

Thesis Supervisor: Eric Dluhosch
Title: Associate Professor of Building Technology
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Lastly, but not least, my family contributed greatly to this thesis; my parents continuous concern and support for my educational goals, and my sister Hoda's assistance during our stay together in Boston, sustained and helped me during the course of this work. Especial thanks are due to my husband Mohammad who championed my efforts and to my daughters Nevine and Moushira who endured quietly my stay in the United States.

Without the help of concerned mentors, family and friends, I would not have been able to undertake this study.
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INTRODUCTION

The need for decent housing for low income groups is most urgent in developing countries like Egypt. In Egypt, there was, and still is, a program carried out by the Ministry of Housing to fulfill these needs.

Actually, these new projects have done a great deal to improve the living standard of the residents who have lived in them but -- unfortunately -- one may still detect many serious inadequacies in both their planning and architecture. Aside from such purely functional aspects, if the efficacy of contemporary architecture in Egypt is ever to be considered an important issue, then public housing has to be part of that central issue.

In past housing projects in Egypt there has been considerable neglect of a careful consideration of all the social factors in the design of such dwellings. This, of course, is not to be attributed to the lack of social research on housing issues, but rather to the lack of communication between researchers and the authorities who are responsible for designing and building urban housing.

If we stop to compare the dwellings of the old quarter of Cairo and the new housing projects, we notice that, despite the noticeable deficiencies of the old dwellings, they did provide the inhabitants with an adequate social setting that fit well the lifestyle and social habits of that population. Marketplaces, shops, coffee houses, mosques, crooked narrow streets, dead end small streets, exterior public courts, interior private courts and privacy provided by the layout of the houses, are some of the features that make the old quarter of Cairo much "friendlier" to the habits of the residents than the stark ambiance of the new public housing developments.

A point to be noticed while comparing these two categories of housing is the separation between public services and private accommodations in the new projects, while in traditional old housing one may find a complete integration between housing and its requisite service elements or functions; the new housing projects, not unlike many places in the rest of the world, have been following the trend of rigidly separating the various land uses and functions. The outcome of such an approach is a drab and monotonous appearance that lacks the richness and vitality that traditional housing integrated with its
Like many public housing projects in different countries of the world, public housing in Egypt lacks its own character. This is, in fact, due in most cases to the bland and, technically as well as functionally, standardized type of housing plan used for each single project. Economy is often used as the reason for using standardized designs for public housing, but actually a reduction of the cost of housing construction does not necessarily have to conflict with using more diversified housing types. Even prefabrication does not necessitate a single type of housing since prefabrication (small or large components) of more than one housing unit are possible.

In addition, the layout of housing plans must also recognize the social needs of the population that will occupy it. In the case of Egyptian low income groups, we find that -- as a rule -- there are very strong kinship ties that hold these people together and, therefore, any housing plan should anticipate these trends and respect this fact. To achieve such goals, houses should be designed in such a way as to define communal spaces that should be shared by several families. Such groupings of houses will help to support the integrity of the social unit of which the whole pattern of a given neighborhood is made up.

The stressing of satisfying the social needs of the people does not imply the neglect of the economic factors involved; on the contrary, economy always plays a major role in low cost housing, in the definition of standards, the choice of building materials, as well as the determination of other factors that are of importance to such projects. On the other hand, to building economically is not the same as building cheaply. Economy should not be used as an excuse to provide houses that fail to satisfy the essential needs of the residents.

The success of any housing development should not only be measured by the number of people housed, but rather to the degree to which these new homes fit the needs and fulfill the requirements of its residents, despite the obvious need to house large numbers of people as well.

To identify some of these aspects of housing for low income groups in Cairo, it may be of value to investigate an existing project in terms of evaluative research in order to be able to define appropriate criteria for future solu-
tions to low income housing, i.e., such evaluative research should test the existing environment socially, physically and environmentally, and from the real users' point of view:

"It is more important to organize the elements in the physical environment and their relationship starting with user needs and the desired social structure of the society than to develop further technology from the technical point of view."1

Evidence shows that throughout the world, modern architectural and planning ideals have failed whenever the architects disregard the social and aesthetic values of the user. Assumptions about how people live or how they should live have in the past been made largely by architects, when in reality he or she is often only expressing his or her own values and views.

In such cases, as for example in mass public housing projects, architects and planners believed that they could or should "educate" the residents and "improve" their existence by changing the way they "ought to live" by modifying their physical environment. Change was determined and assumed to be for the better, but primarily in terms of the decisionmakers' values. They ignored the fact that there are significant differences between the ways different groups both use and perceive their homes, their neighborhoods and even cities." Exclusion of the importance of traditional behavior patterns from any of the designs presented often ended up in extreme alienation between users and the environment provided, eventually leading to vandalism or serious neglect of the buildings and sites provided.

"The purpose of planning and design is not to create physical artifacts but a setting for human behavior."2

The gap between the concepts of designers and the expectations of the eventual users of the designed environment has been developing historically. In primitive times individuals built their own shelters, builders and users were one and the same. The model was developed from the following concept:

"Primitive, ... built by all. Pre-industrial by tradesmen and later to Highstyle and Modern, designed and built by means of ... specialists."3

Late industrial development in environmental design began when rural migrants flooded into the major cities of Egypt. These people concentrated mainly around factories and other places of employment in the cities. Governments, factory owners and corporations contracted with designing firms to construct building areas for
large numbers of people to inhabit (i.e., industrial paternalism).

In such large designs, the designers usually have two clients, i.e., the paying client and the actual user client (see Figure 1, pagell). In public housing projects, the gap between the designer and the user-client is in fact so large that the user client has no choice and no control in any of the decisionmaking. This situation is very complicated and there are few channels open for communication between designer and user clients to occur, since the latter are usually unknown to even the paying client, which in the case of Egypt, is usually a governmental firm.

"The slum clearance and public housing projects of the 1930's were striking social experiments for which we have no formal outcome records. At that time the architects, builders and social planners thought they knew what they were doing; they were not aware that they were experimenting with one alternative among many possible ones. We missed that chance. Now we can only look with regret at the row after row of identical highrises, all repeating the same mistakes, and wish that there had been a deliberate variation in the alternatives generated by the planners and architects, plus some outcome measures."4

This paragraph describes the exact situation of public housing in Egypt, as in any other country that has gone through the development of public housing projects as a rapid solution to housing shortage. The critical point is to see what can be done (aside from registering regret), what alternative solutions can be achieved regarding the renovation of existing housing, modification of the existing design approach, and the establishment of responsive guidelines for future designs.

To achieve any of the previously stated alternative solutions, familiarization with the users' living patterns must be considered, including post-construction evaluation and related research of existing public housing.

Such post-construction evaluation will act as feedback to designers (and to the paying clients) of such buildings; in terms of the client-user. Post-construction evaluation also provides information and data about changes that have occurred in behavioral patterns as users adapt to their new environment. Rapoport states, in his book House, Form and Culture, that:

"There is a link between behavior and form in two senses; first, in the sense that an understanding of behavior patterns, including desires, motivations and feelings, is essential to the understanding of built form, since built form is the physical embodiment of these patterns and, second, in the sense that
Designer-User Relationships at Different Periods in History

1. PRIMITIVE PHASE
   ONE ACTOR IN DESIGN PROCESS
   Wealthy client-user
   Master mason or builder who draws up plan

2. CRAFTSMAN PHASE
   TWO ACTORS IN DESIGN PROCESS
   Wealthy client-user
   Professional architect interprets need of client
   Contractor

3. EARLY PROFESSIONAL PHASE
   THREE ACTORS IN DESIGN PROCESS
   Professional architect represents client
   Architect has to please client and not real users

4. LATER PROFESSIONAL PHASE
   MULTIPLE ACTORS IN DESIGN PROCESS
   Users are separated from fee paying client
   Client often on institution represented by a committee
   Engineer
   Architect
   Building contractor
   Subcontractor

5. CONTEMPORARY PHASE
   Subcontractor
   Engineer
   Contractor
   Institutional clients
   Local and state federal agencies
   Landscape architect

Fig. 1
form, once built, affects behavior and the way of life."

This statement is of great importance, because a house is not just a shelter to protect the inhabitants from external danger but has, in each culture, become a special place where many diverse activities take place, forming a rich living pattern, which changes from one society to another.

It is one of the major objectives of this research to:

1. **Identify and formulate specific Egyptian user needs and requirements related to lower income categories in public housing;**

   and,

2. **Interpret these technical requirements in terms of appropriate technical solutions.**

   Post-construction evaluation of an existing public housing project thus should be of great help to any future designer; it will act as a feedback mechanism for future intervention in actual physical and social environments. The steps followed in this evaluative research will be as follows:

   1. Assumptions of designers of public housing;
   2. Actual user needs (i.e., what is wanted);
   3. Discrepancies between 1 and 2;
   4. Identification of location of problems;

   5. Identification of possible generic solutions, i.e., new or modified design criteria;
   6. Selection of one sample solution (technical implementation and prototype development).
METHODOLOGY OF THE RESEARCH

In order to gather data on user needs, four methods were followed:

1. Face-to-face interviews;
2. Observations;
3. Questionnaires;
4. Study of photographs and drawings.

Investigation began with a study of the background of the housing issue in Egypt; how it started to be perceived as a problem, and when; how did the government come to interfere by providing public housing projects; and how did (available) public housing design concepts and policies evolve.

The second part deals with a survey of an existing public housing project by evaluating its existing physical and social environment. These houses were built approximately thirty years ago and it is of some interest to find out how the original house plans and designs have been adapted by the users as a result of the rapid change in the socioeconomic status of their residents. Questions such as: What part of the house has been changed? How did the space composition and dimensions of the design influence the inhabitants' past and present life? How does the particular lifestyle or living pattern of these occupants affect the way in which these people have modified their homes?

To be able to carry out the investigation with all these questions in mind, both formal survey and informal observation methods were adopted. Observation and interview techniques were utilized to help develop and test hypotheses about environmental and related behavior problems in public housing projects.

Since it is impossible to observe every instance and to find all the people or situations that have a certain characteristic, it was very essential to take a selected sample of people, places and events, to say something about the overall, larger group. The survey took the form of a semi-structured interview, based on a previous pilot study, to provide an objectifiable social and architectural perspective of the whole situation. On-the-spot observations of the interiors of buildings and the site were made by the author, while participants' comments on the interiors of the houses were collected from the users by means of informal, relatively unstructured interviews. Interior and exterior photographs were taken wherever possible, to comple-
ment and document the situation, and to illustrate the comments and observations made.

The specific task of this field survey could be summarized as a prototypical, but restricted example of a post-occupancy and post-construction evaluation.
1. BACKGROUND

1.1 National Context of Egypt and the Cairo Region

1.2 Brief Overview of the Housing Situation in Egypt

1.3 Present Situation
1.1 National Context of Egypt and the Cairo Region

Egypt has an area of 386,000 square miles, making it approximately the size of California. Its population is 42 million (1980 census) and has a growth rate annually of 2.1%. Only about 10,000 square miles of this area is cultivated although this area should increase to 12,500 square miles eventually as a result of the Aswan Dam project.

99% of Egypt's population is compressed into 3.8% of the total land area, in the Nile Valley and Delta, making the population density there 700 persons per square mile, one of the highest in the world. The proportion of the population living in rural areas is decreasing as job opportunities in the urban centers are drawing more and more people into the cities. Cairo, with a population of 8.4 million, accounts for 18% of the total population of the country while Alexandria, the second largest Egyptian city, has a population of 2.5 million.
Luxury housing of the old Cairo

Integration of shops with housing in the old districts of Cairo
1.2 A Brief Overview of the Housing Situation in Egypt

1.2.1 Introduction to problem

The present state of housing designs in Egypt, both in the urban and the rural contexts, is the result of consecutive generations of the population influenced and affected by social, economic and political circumstances. Until the end of the nineteenth century, the urban Egyptian family (of the upper class) built large family houses that satisfied well their needs at that time. Palaces were built by rich families with very high ceilings, huge rooms and courtyards (see Figure. 2). Individuals were encouraged by the government to build apartment buildings of two to three storeys and, given the existing construction technology, usually reached a maximum of four storeys.

The quality of these buildings differed according to the affluence of the owner of the building, i.e., luxury dwellings, medium level types and very simple buildings for the lower income groups. Most of the houses were owner-occupied according to the custom where each family lived together in a private dwelling.

During the first half of the twentieth century, a policy of leasing started to be introduced officially, and private capital was encouraged into the housing market, as an investment with a guaranteed rental income. Until the first half of the twentieth century most of the housing stock was considered a private concern and was decided upon an individual and private basis by each person according to his own means. Housing was not officially perceived as a significant social problem until after the 1952 revolution, with the introduction of Arab socialism and accelerated industrialization. In 1961, new socialist laws were proclaimed and the subsequent promulgation of other laws, controlling and decreasing rents, all added up to measures which discouraged the private housing market and which led to its eventual stagnation. Housing production lagged far behind population growth and the rapidly accelerating urbanization that was taking place at that time, and has been continuing ever since.

When Egypt embarked upon such a rapid change in its socioeconomic and political situation, a new class of people emerged, which had not existed before, i.e., that of the industrial laborer and other wage-dependent workers. Initially,
The period between 1952 and 1961 witnessed great concern on the government's part with two types of housing, i.e., public housing and industrial housing.* Housing became a national issue and was accepted as the responsibility of the government.

The first company established by the government to build public housing was the "Development and Popular Housing Company" (DPHC). Banks and insurance companies were its shareholders. The government participated with investment capital of half a million pounds (Egyptian) (LE), and offered loans of more than ten times the amount of this capital (i.e., five million Egyptian pounds). The main objective of this public company was to carry out all the works related for the provision of public housing, such as:

1. Acquiring land necessary for public housing projects and erecting the buildings, and also the responsibility for renting or selling these houses to interested or eligible persons.
2. Responsibility for constructing public housing projects and all works related to the development of such sites.
3. Supervising all the aforementioned aspects related to the provision of housing.
The organization of economic life in Egypt is officially founded upon socialist principles, and since 1952 the regime has consistently honored in word, and occasionally in deed, an overriding concern for social and economic equity. To promote equity, the major capital and productive resources of the nation were placed under state management and ownership in 1961.

In 1961, under the Republican Degree No. 1899 of 1961, among other things, the "General Egyptian Housing and Development Organization" (GEHDO) was formed to supervise the organization of Heliopolis Nasr City and Maadi suburbs, as well as the already established DPHC and "El Shams Modern Construction Company. The "Public Housing Cooperative Society" was also formed by the same decree.

1.22 Public housing in Egypt

As the density figures presented in the appendix tend to confirm, there is a housing shortage at all income levels in Cairo, but the most severe deficit occurs within the low income sector.

The gap between the urgent demands of the city's lower classes and the state's ability to provide housing constitutes the most serious element of Egypt's urban crisis. The guidelines for low cost housing in Egypt are based on two assumptions:
1. That the construction cost of a low-income unit should not exceed one thousand Egyptian pounds.
2. That monthly rent for such a unit should not exceed 20% of the average monthly income of the household that inhabits it.

In 1973, the Ministry of Housing estimated that it cannot rent well-constructed, low cost units at less than ten Egyptian pounds per month with any hope of recovering their initial investment. According to these figures, the lessee would have to earn fifty Egyptian pounds per month in order to pay no more than 20% of his monthly income in rent. The Central Agency for Public
FIGURE 3 Industrial-Housing in Egypt 1957-58
MAP 3  URBAN GROWTH IN EGYPT
Mobilization and Statistics has ascertained that about half of Egypt's urban households earn less than 50 Egyptian pounds per month. The amount of low cost housing constructed and managed by the government of Cairo, until 1968, was 21,642 dwellings. It has risen slightly after that, but the exact number of existing units at the present has been difficult to determine.

Some of the principal sites for public housing are Zeinhom, near Old Egypt, the Workers' City of Imbaba, and slum clearance projects in Bulag (Amiria), Rod al-Farog and Sahel (see Map 4).

Another important factor to be noted is that until 1975 there was no provision to set aside a portion of collected rents for the maintenance of public housing, which accounts for their obvious neglect. In order to remove maintenance responsibility from the governates, and as a result of a decree issued by then President Sadat in 1978/79, many of the housing units in these projects were transferred to owner-occupied status. This was done to encourage residents of public housing to better maintain and improve their dwellings. Unfortunately, this decree should have been established twenty years ago, before the buildings had reached their present deplorable state.

1.23 Description of public housing projects building in Egypt in the period 1954–1973

The first public housing projects to be built in Egypt were mainly in Cairo and Alexandria, representing as such the two major cities with the highest urban populations in Egypt. The DPHC was the first firm with the total responsibility for design and construction of public housing projects, as well as for the development of the sites.

From 1954 to 1961, approximately 7,500 units were built in both Cairo and Alexandria by the DPHC alone. After that period the responsibility of building public housing was transferred to the different governates of Egypt.

Most of the first public housing projects were walk-up apartments, built in Cairo and Alexandria, and were constructed on sites that had developed into very old and deteriorating slums. Such is the case for the Zeinhom housing project in Cairo, as well as El-Kabarry and El-Laban in Alexandria.

Public housing projects were either four
MAP 4 PRINCIPAL SITES OF HOUSING PROJECTS IN GREATER CAIRO REGION
General view of the two-storey single family houses in the district of Helmeyat El Zaytoun, Cairo.

Aerial view of the same type showing the private backyards.
or five storey walk-ups or two-floor single family row houses (Figures 6 and 7). The first public housing project built by the DPHC consisted of single family row houses built in 1954 on new sites provided on the fringes of Cairo, in Imbaba, Helwan and Helmeyat-el-Zayton (see Map 4). These two storey houses ranged from 71.50m² to 86m², each floor being approximately 37.44m²** and the width of fronting facades ranged from 3.50m to 5.50m. Each house was provided with a private backyard.

A major goal was to provide as many units as possible and high density communities of approximately 191 persons per acre were created. Service facilities such as shops, schools, hospitals, mosques and public playgrounds, accommodated by these sites, were restricted to a minimum, and in some cases, represented only 8.9% of the total area of a community layout (see Figure 6).

Later on, in 1956, the idea of building four and five storey walk-up units evolved; it was perceived by the officials in the Ministry of Housing to be more economical, since they would serve a greater number of families given the same land area. Unlike the row house site plans with their dense stacking, the walk-up

FIGURE 6 SITE PLAN OF TWO STOREY ROW HOUSE

EXAMPLE OF TWO STOREY HOUSES IN ZAYTOUN, HELWAN AND IMBAB. Area of apartment is 72.75 m²

FIGURE 7
FIGURE 8

PUBLIC HOUSING IN EGYPT

SHOUBRA, CAIRO
residential blocks were placed relatively far apart to provide so-called "public" open spaces for the occupants, since no private yards were provided for each unit. This resulted in a ratio of 68% open space (including street areas) to only 23% of built-up area (see Figure 9). Each residential block consisted of two apartments per floor.

Public housing was designed with variable dwelling sizes, comprising one, two, three and four room units. All units were provided with kitchens and, in some cases, with bathrooms, as well as one or two rather small balconies. Apartment sizes ranges from 25m² to 65m² with an average of 52m² (see Figures 9, 10, 11). As far as the most desired size of apartment is concerned, it was observed that the three-room apartment was in heaviest demand. The reason for this preference can be explained by two social phenomena:

1. The suitability of these units to the demands of the extended family which is very common in low income categories;

2. This size unit is most suitable for a five-person family size, which is the average size of most Egyptian families in the lower income groups.
### Public Housing for Low Income Families

**Nasser Housing Project**

<table>
<thead>
<tr>
<th>No. of floor</th>
<th>Location</th>
<th>Living Area</th>
<th>Bedroom Area</th>
<th>Kitchen Area</th>
<th>Balcony Area</th>
<th>Corridor Area</th>
<th>Total Area</th>
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<td>Shoubra, Helwan</td>
<td>11.10m²</td>
<td>9.14m²</td>
<td>2.10m²</td>
<td>2.13m²</td>
<td>2.8m²</td>
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<td>12.16m²</td>
<td>12.62m²</td>
<td>4.79m²</td>
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<td>3.05m²</td>
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<td>5</td>
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<td>10.88m²</td>
<td>10.62m²</td>
<td>4.51m²</td>
<td>3.66m²</td>
<td>6.62m²</td>
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**Figure 10**
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<th>4</th>
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<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Area of livingroom</td>
<td>10.88m²</td>
<td>6m²</td>
<td>6m²</td>
<td>6.66m²</td>
<td>6.6m²</td>
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<tr>
<td>Area of bedroom</td>
<td>12.80m²</td>
<td>10.20m²</td>
<td>12.00m²</td>
<td>12m²</td>
<td>12.02m²</td>
</tr>
<tr>
<td>Area of kitchen</td>
<td>4.53m²</td>
<td>3.84m²</td>
<td>3.84m²</td>
<td>4.00m²</td>
<td>4.04m²</td>
</tr>
<tr>
<td>Area of bathroom</td>
<td>2.80m²</td>
<td>2.80m²</td>
<td>2.30m²</td>
<td>2.44m²</td>
<td>3.21m²</td>
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<tr>
<td>Area of balcony</td>
<td>5.18m²</td>
<td>4.07m²</td>
<td>4.99m²</td>
<td>6.03m²</td>
<td>4.7m²</td>
</tr>
<tr>
<td>Area of corridor</td>
<td>3.76m²</td>
<td>3.26m²</td>
<td>4.00m²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Area</td>
<td>44.97m²</td>
<td>39.9m²</td>
<td>40.45m²</td>
<td>25.10m²</td>
<td>25.85m²</td>
</tr>
</tbody>
</table>

**FIGURE 11**
FIGURE 12 Public Housing in Egypt
1.24 Basic Data  -  Economic Aspects

Since the main housing shortage was and is in low cost housing, maintaining low construction costs has been a major factor in all stages of these building projects. Beginning with the design stage, these projects were assigned to public sector design firms, with construction assigned to public sector construction companies, to maintain minimal labor costs and other expenses. Standards were also kept very low and, in fact, if compared to private construction in the informal sector, they may be considered substandard. Thus housing provided by the government became not only economical but "cheap." The haste and speed which characterized the construction practices of these projects left no time for any serious developmental research or in-depth studies for any of its many design and construction aspects. For example: what should be the most appropriate materials to be used; which combination of apartment sizes should prevail; and many other equally important questions.

As long as material was cheap, it was considered acceptable for the project, regardless of performance, durability, maintenance or other functional or environmental inadequacies. The cost of early public housing single-family units ranged from L.E. 370 to L.E. 430, (71.5 m$^2$ - 86m$^2$). The cost of 1 m$^2$ of construction, including land value was L.E. 5.20 (1958).

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>% of Total Cost of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>structure (wall)</td>
<td>73 - 74 %</td>
</tr>
<tr>
<td>sanitary</td>
<td>10 - 10.5 %</td>
</tr>
<tr>
<td>timber</td>
<td>14 - 15 %</td>
</tr>
<tr>
<td>electrical</td>
<td>1.5 - 1.9 %</td>
</tr>
</tbody>
</table>

Walk-ups in Cairo cost L.E. 7.0 per 1 m$^2$ and L.E. 8.0 per 1 m$^2$ built in Alexandria, respectively.
Methods of financing public housing in Egypt in the period 1956 - 1969

There are two types of public housing financing in Egypt, depending on whether the housing is for private ownership or for rental:

A. Financing public housing for private ownership
   1. An applicant desiring home ownership is required to make a down payment of L.E. 100.
   2. The state provided a non-repayable subsidy of L.E. 100 per dwelling.
   3. The remainder of the capital required was provided from the budget of the Ministry of Social Affairs. This was lent to the developer at 4% interest, annual interest
4. Necessary infrastructure was developed and financed by the public sector.

B. Financing public housing for rental

1. Projects, including land, building and utilities, were exclusively financed by the state through local governments. Funds were obtained from the central bank at a rate of interest ranging from 1% to 3% annually. This investment had to be amortized within twenty years, in equal annual installments.

2. Necessary infrastructure was developed and financed by the public sector.

3. Rents were estimated on the basis of actual costs. In many cases, the cost of land and utilities for low income groups was not included in the final costs, but assumed by the state, and thus was considered as a subsidy from local governments, using local resources.

The different governorates of Egypt are responsible for the provision of public housing, each according to its needs. They finance their housing programs out of the budget of the Ministry of Reconstruction and State for Housing and Land Reclamation.

When public housing programs started in 1952, after the revolution, rents were fixed according to the ability of the occupant. Costs were not taken into account. It was established that L.E. 1.50 per room plus L.E. 1.00 for hall, landing etc. was the price which could be demanded from a family in the low-income sector. Accordingly, the monthly rent for a two-room flat was L.E. 4.00 and for a three-room flat, L.E. 5.50.

The Ministry could not state which specific considerations were made in fixing these rents, e.g., the production cost of housing, average income, size of family versus income, etc. Rather there is the policy that this represents more of a "symbolic" value affordable by all the tenants.

Financing schemes of the public housing sector

Newly-built flats are now offered for sale from the start. This decision is based on the assumption that the owners will maintain their own property and thus lessen deterioration of the buildings. In order to give an idea of the financing scheme of more recent projects, the following examples will illustrate the methods:

1. The Al-Shabab Project, with "One-fourth of Salary" financing scheme.
This project is situated in Nasr City and is for newly-married civil servants with a minimum salary of L.E. 40 monthly. The areas of the flats vary between 40 m² and 65 m². The selling prices were fixed on the basis of the following costs per m²:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>L.E. 2.75</td>
</tr>
<tr>
<td>Connection of utilities</td>
<td>5.50</td>
</tr>
<tr>
<td>Site preparation</td>
<td>5.00</td>
</tr>
<tr>
<td>Construction cost</td>
<td>75.00</td>
</tr>
<tr>
<td>Contingency (10% of L.E. 88.25)</td>
<td>8.82</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>L.E. 97.07 /m²</strong></td>
</tr>
</tbody>
</table>

The buyer pays one-fourth of his monthly salary to pay off the selling price. The repayment time is identical with the remaining years of service.

Example of a "one-fourth of salary" financing scheme:

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchase price of flat</td>
<td>L.E. 4,000.00</td>
</tr>
<tr>
<td>Remaining years of service</td>
<td>30 years</td>
</tr>
<tr>
<td>Monthly salary</td>
<td>L.E. 40.00</td>
</tr>
<tr>
<td>Monthly payment</td>
<td>L.E. 10.00</td>
</tr>
<tr>
<td>(1/4 of L.E. 40.00)</td>
<td></td>
</tr>
<tr>
<td>Total paid after 30 years</td>
<td>L.E. 3,600.00</td>
</tr>
</tbody>
</table>

Necessary paid-up capital L.E. 400.00 (4,000.00-3,600.00)

The amount of the necessary paid-up capital depends on the purchase price of the flat, the remaining years of service, and the amount of the basic salary.

Technological aspects

Most, if not all, of the public housing projects in Egypt are constructed either by means of wall-bearing systems for two-storey single family houses, or by reinforced concrete column and slab systems with either block or brick infill for walk-up dwellings.

Prefabricated systems were never used in the early stages, even though they could have probably been very helpful in terms of speeding up production. Industrialized methods were seen as far too expensive in comparison with the conventional and well-known monolithic method. Also, in the early 1960s, labor was available at considerably lower wage rates, thus a real and urgent need for prefabrication was not perceived at that time.

Materials used for most public housing were of the cheapest kind and locally available. Cement tiles were used for flooring in all rooms, plasterwork for ceilings and walls, while doors
and windowframes were made of wood supplied from local sources.
1.3 The Present Situation

As mentioned before, the housing projects of the '50s and '60s were planned as a quick remedy to alleviate existing housing shortages. Large numbers of dwelling units were built with little planning, limited resources and inadequate information, without proper research, based on inadequate studies and poor statistical data concerning actual family needs.

Even a casual observer of the present state of housing in Cairo will see the obvious fact that housing still looms as a major concern and that the problem has far from disappeared. Demand for (public) housing is still increasing day after day as a result of continuous and ever increasing rural to urban migration. Land values are also continuously increasing, thus making it impossible to provide economically feasible public housing in any major city with affordable rents for much of the population.

With the country embarking on the so-called "open-door" policy, (i.e. re-introduction of private sector initiatives), very significant changes have occurred in terms of economic behavior and developmental factors since 1975. These may be characterized by the following:
1. Generational adaptation to urban modes of behavior;
2. Marginal income versus actual disposable income;
3. Introduction of modern technical and industrial modes of production and consumption;
4. Aspirations and expectations (television, newspapers etc.) of an increased living standard by the population.

The high percentage of working women in the cities has become a common phenomenon. In Cairo alone women represent 11% of the total population working directly within the economy (see Table 10).

This factor, coupled with the so-called "open door" policy which encouraged private enterprise, has contributed greatly to the economic development of many of those once categorized as "low income" families.

The new urban generation, whose parents may have come into the city as rural migrants twenty or more years ago, have now adapted to new urban modes of behavior. Their close and continuous contact with urban life in schools and universities has helped to modify and reinforce their expectations for increased living standards in order to cope with their future life in the city.

The economic and behavioral developments that have resulted from the above mentioned factors should thus provide the designer with new insights into the design and planning of public housing.

Introduction of electrical appliances to relieve the work of the housewife, necessitates that provision be made for including these or other fixtures in the design of bathrooms and kitchens.

The existence of a television set in almost every household calls for the need to design the livingroom in such a way that the whole family may sit and watch television together. Universal education in public schools or the university creates the need for intimate spaces to study in (nooks or quite spaces).

The gradual change in attitudes and behavior which the early rural migrant has to undergo to become a city dweller needs to be met with a type of development that reflects and permits a "staged" adaptation of the plan to his or her changing needs. i.e.,:

- in the early years, a semi-rural way of life prevails, while urban adaptation calls for a progressively upgraded and functionally adap-
tive type of dwelling to meet future needs and requirements.

In other words, what is needed is an adaptable and flexible dwelling. Since it has been observed that the change in the socioeconomic status of such rural/urban migrant families occurs now faster than the virtual functional space life of any plan, housing should be designed initially in such a way as to be able to adapt or adjust to meet these dynamic aspects of future and ever-changing needs. Thus, housing design must become dynamic in terms of tractability, adaptability, growth and change.
2. THE RESEARCH
2.1 Case Study Area
2.2 Description of Case Study Area
2.3 Present Physical Conditions of Case Study Area
2.4 Present Social Conditions of Study Sample
2.5 Description of the Interior of the Dwelling Unit
2.6 Summary of Observations
2.7 Summary of User Requirements
FIGURE 15  General view of the ZEINHOM HOUSING PROJECT, CAIRO
2. THE RESEARCH

2.1 Case Study Area

The site chosen for the case study was acquired by the government for redevelopment after clearance of a deteriorating slum area. It was prepared to accommodate a public housing project for low-income families. This project, known as the Zeinhom Housing Project was implemented between the years 1957-58. Full responsibility for design and construction of the residential blocks and for planning and development of the site was given to the Development and Popular Housing Company (DPHC).

The site is situated south of Cairo (see Map 4); initially it was on the fringe area of the city, but is now accessible to the city center by public transportation and motorways, since it is located...
between two major roads leading to two major districts in Greater Cairo, Heliopolis and Maadi.

Public transportation has helped considerably in facilitating journeys to and from work for the occupants, even though in many cases, private car ownership has now become economically feasible for many households.

The Zeinhom Housing Project represents a typical example of public housing to be used as a proto-typical study case for several reasons:

1. Existence of severe maintenance problems

2. The great potential of this site for post-occupancy modifications and improvements

3. Unused open site areas that are greatly needed by the residents are potentially available but are currently wasted and misused

4. Socio-economic development in Egypt calling for a higher quality of life in the cities

5. The continuous increase in land cost, coupled with existing housing shortages, encourages the utilization and better design of all "wasted" spaces
2.2. Description of Case Study Area

Total area acquired for this project is 94000 m$^2$ which is almost 23.5 acres. The whole project consists of 48 four-storey residential blocks. All residential blocks are 7.84 m$^2$ wide but their length may vary from 33m and 50m to 66m.

There are four types of residential block: Type A which is 33m long, Type B which is 50m long, Type C which is 66m long, and Type D which is similar to Type A, again 33m long.

There are 24 blocks of Type A, 18 of Type B, 16 of Type C, and 3 of Type D.

Blocks "A" and "D" consist of 16 dwelling units of three and four rooms, with two entrances, each serving two apartments per floor.

Block "B" consists of 24 dwelling units with three entrances serving two, three and four room dwelling units.

Block "C" is the largest, having four entrances serving 32 dwellings of two, three and four rooms respectively.

Residential blocks are placed 15.26m apart, but in some cases the distance between them reaches 35.00m to 61.16m (See Figure 18). Dwelling units range from 48.38 m$^2$ to 86.59 m$^2$. The areas provided for kitchen, bathroom and balcony are similar in all the units (See Figure 18). Sizes of rooms in all the apartments range from 11.19 m$^2$ to 13.26 m$^2$. In sum: the

- Built-up area for the site = 17,084 m$^2$
  (i.e. 18.17 % of total site area)
- Open spaces and streets = 76,916 m$^2$
  (i.e. 81.8% of total site area)

2.3 Present Physical Conditions of the Case Study Area

Physical conditions

The exterior of most of the units in the project appear similar, except for a few alterations, such as the closing off of balconies. The open space initially designed to be a "green area" is now nothing but a common depository of trash and thus a potential breeding ground for disease. Poor or non-existent maintenance is very obvious. The present state of the buildings and of the overall site will certainly require more attention from official authorities as it may soon deteriorate to a degree which would necessitate demolition as the only solution.

Egyptian housing, especially in the informal and public sectors, is generally suffering from a
SITE PLAN OF THE
ZEINHOM HOUSING PROJECT
CAIRO

Total area of site = 9400m²
Total number of units = 1112
Initial population = 5560

Land use pattern
Built-up area = 18.17%
Open spaces and streets = 81.8%

Areas of different apartments:
Apart. A = 37.80m²
Apart. B = 40.90m²
Apart. C = 67.65m²

FIGURE 18 Typical floor plan

Block "A"
lack of systematic and regular maintenance. This eventually results in the average lifetime of most public housing of less than 25 years, which is half of the assumed norm for buildings of comparable type elsewhere.

The major problem facing this project, as well as most other public housing projects of similar nature, is sanitation. The sanitary system provided for these houses has caused considerable trouble for the occupants (See Fig. 19) and is a major source of their complaints. Severe problems caused by faulty sanitary piping may be observed on all rear facades, with walls adjacent to leaking pipes being severely deteriorated due to dampness and seepage (see Fig. 20). The real danger is the point at which deterioration will reach the foundation and thus cause serious structural damage and possible collapse of part or of the whole structure.

Clogging of the drainage system is also very common. For example, when a w.c. in the lower dwellings overflows as a result of clogging discharges from upper units, some residents will try to solve the problem by breaking the exterior drainage pipes, thus causing raw sewage to spill onto the common ground, which quite often is the

FIGURE 19 Sanitary problems appear very clearly on exterior wall of this dwelling.
FIGURE 20  Maintenance and sanitary problems
only open space provided where children can play. Clearly such lack of proper maintenance makes the spaces between the buildings highly dangerous and inhospitable, and they are therefore seldom used.

Another very common feature in most dwellings visible from the exterior are the various chicken coops and other additions to most balconies made by the inhabitants; similarly, residents of the ground floor dwellings occasionally build small additions made of cardboard or other light scavenged material for use as shops, or as a shelter behind which to breed animals such as goats and sheep, or to grow a small vegetable patch (See Figure 24).

Automobiles are another problem around most residential blocks, with owners using the sidewalks as parking spaces and thus obstructing pedestrian circulation and entrance access to the apartments. A newly-painted apartment may be seen every now and then in very bright and conspicuous colors, visible from the exterior, through the balcony. And, occasionally, while looking from below to the upper floors, a hole may be noticed which has been cut by the tenants through the ceiling of a balcony, providing access to the roof (See Fig. 22), with a wooden stairway
FIGURE 22: Hole cut by top floor apartment residents to provide access to the roof.
built by the inhabitants providing entry to the flat roof, which is often used as an additional storage space, or as a safe place on which to keep chickens and other small animals (See Figure 28).

A passer-by, in looking at these residential blocks will gain the general impression of a complete lack of maintenance and of obvious neglect, clearly developed over some time, and consequently having transformed such projects into potential or virtual slums.

FIGURE 23
In summary then, the existing poor state of these residential blocks and their surrounding site areas is the result of:

1. Poor design/standards (space-function/material);
2. Functional substitution of intended use to adapt environment to social customs (of both exterior and interior);
3. Lack of maintenance (of site and unit);
4. Social customs (not yet urbanized behavior).
Residents of ground floor dwellings occupy part of the open spaces to build shops or small vegetable patches. Growing of the grass is evidence of the continuing leakage of the drainage system.
FIGURE 27 Unused open spaces between residential blocks.
FIGURE 28

Roof tops used for storing purposes as well as for the breeding of chicken
2.4 Present Social Conditions of the Study Sample

The fact that time was very limited, and since the study depended on intensive observations, only thirty households were chosen as the sample size.

a) Eleven households lived in Unit A type apartments which consist of two rooms, a kitchen and a bathroom.

b) Fifteen households lived in Unit B type apartments which consist of three rooms, a kitchen and a bathroom.

c) Four households lived in Unit C type apartments which consist of four rooms, a kitchen and a bathroom.

The families chosen for the study sample belong to a fairly homogeneous socioeconomic level (i.e., lower income); there are few noticeable socioeconomic differences between families observed during the survey. Thus, they may be categorized as socially and economically belonging to the lower income (status) category of the overall population spectrum (see Graphs, Figure 29).
2.41 Education and Occupation

It was found that the educational level of most heads of household is relatively low and does not exceed the primary school level, except in one case (see Figure 29). Most of the more literate heads of household hold governmental jobs, while occupations of the illiterate heads of household vary from, e.g., butcher to grocer, to electrician to fried dough baker.
2.42 Family Formation

It has been stated on many occasions that the traditional Egyptian household, in its extended patterns, has disappeared with the shift towards urbanization. This could also be said with respect to middle and upper class urbanites; in fact one could say that among these two groups the nuclear family structure dominates and hence residence design has become adaptable to the accommodation needs of a nuclear family. But, how far this is true with respect to the chosen sample of the case study is still -- to some extent -- a matter of conjecture.
The extended family has a common origin in most households of the study sample in the past. In some cases three consecutive generations could be found living in one dwelling, starting from the father -- who is often the owner of the apartment -- his sons and even his grandsons. In such a situation, no preferential sex differentiation exists in terms of apartment allocation between sons and daughters, as evidenced in two cases, where the son married and stayed on in his father's apartment, and of three other cases of daughters marrying and also continuing to live with their parents.

Generally speaking, extended families lived together in the past as a result of traditional customs, but in our present case, the reasons for living together have changed. Extended family patterns exist nowadays more due to the economic inability of second generation married siblings to form separate and independent households, than as a result of custom or traditional values.

2.43 Densities per dwelling unit

It has been established that the average number of persons living in one unit consisting of two to three room (from the study sample) is seven, whereas in four room units the average number of occupants is only five. (See Figure 30).

Of the eleven two-room cases only three units had densities of less than five persons per dwelling unit, while the rest of the samples range from six to nine persons per dwelling. (This is consistent with other statistics covering density averages in the Cairo area)

As for the fifteen cases of the three-room units studies, ten cases had densities of a maximum of five persons per dwelling and three had six persons per dwelling, while only two cases had over nine persons per dwelling. Out of the 30 sample survey, only four samples were four room units and densities in three of these four room units was eight and nine persons per dwelling, and only one of this group had a density of four persons in the dwelling unit. In most of the study sample, size of family has changed greatly from what it was when families moved into these dwellings. Some families experienced a large increase in the number of family members, while others decreased as some members of the family moved out, (see Figure 30), possibly because jobs were located elsewhere.

Since the thrust of the thesis' argument is based on the recognition of change due to socio-economic development, standards of density will also change. The result will be:
Figure 30

DENSITY PER UNIT

UNIT A
1 2 3 4 5 6 7 8 9 10 11

UNIT B
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

UNIT C
1 2 3 4

POST-OCCUPANCY DENSITY PER UNIT

UNIT A
1 2 3 4 5 6 7 8

UNIT B
1 2 3 4 5 6 7 8 9 10 11 12 13

UNIT C
1 2 3 4
1. Move to larger apartments - which means that more housing should be built
2. Families should split - which also means more housing to be built, or crowding elsewhere.
3. Crowd even more into existing space
4. Merge or combine smaller apartments (rehabilitation)
5. Add to existing units - either vertically or horizontally (option chosen in this thesis).

2.44 Number of children, occupants' education and occupations

The number of children per household in this study sample ranged from three to fifteen with an average of seven children per unit. This indicates that the families in the sample are fairly large in number.

A general observation made was the relatively high level of education of the sons and daughters, as compared to parents, in most families. There was little illiteracy among sons, which indicates to some extent, the concern of parents and the government to improve the education of their children and eventually raise their social status.

Educated children will grow up with new norms and standards which will find their reflection in the way they relate to their living and dwelling environment. Better living standards will be expected as these children grow up, who may not accept
the existing designs based on a perception of inadequate past minimal living standards, These children presumably will support both politically and economically any attempt to improve their environment, first to improve the existing situation since moving out has become such a difficult task, and eventually by seeking improved new housing of higher design quality elsewhere.

Of the thirty cases studied, twenty families had children who had either finished high school or were still studying in institutes and universities. As for the occupations of those who had finished their education, 65% had governmental jobs, 25% worked in private enterprises, while the rest were drafted into the army, (if male?).

2.5 Description of the interior of the dwelling units

Generally speaking, conditions inside the apartments could be considered as poor; only in rare (exceptional) cases where a family member has been working for an oil-rich Arab State, can we observe a better quality of accommodation inside the dwelling. These differences are reflected most in the acquisition of goods, especially electric equipment, and/or fresh paint inside the unit and on ac-

FIGURE 31
cessible outside surfaces (e.g., balconies, around windows etc.).

The most characteristic feature of the interiors of most of the households is overcrowding of both people and furniture. People use rooms without restriction placed on the type of activity which may occur in a particular area of a given apartment—regardless of its originally "assigned" design function. Any part of the apartment may be used for sleeping, cooking and/or entertaining guests. In fact, due to severe overcrowding, people will sleep in all rooms. Only the kitchen space is used for cooking exclusively, but preparation of the food does or may take place again in any room. Thus, all rooms actually accommodate many different activities, and may thus for design purposes be considered as multi-functional.

It is interesting to note that twenty-seven households out of the thirty sampled had transformed the kitchen into another room, or moved the kitchen onto the very small balcony, $1.25m^2$ (see Figure 34).

This change of function and/or use pattern is no doubt the result of the needs of a large family, trying to make the best use of all available space. Besides being an outcome of limited space, multi-functional use of rooms is also a residual element of former extended family rural living patterns which traditionally relied heavily on open spaces for daily activities (i.e., washing, food preparation and entertainment) with interior spaces being generally reserved for more quiet activities (sleeping, rest, prayer).

Public housing neighborhoods are in many ways the very reverse situation found in rural villages. Village form and size are dictated by human contact and custom. In comparison, the neighborhoods created by the construction of public housing projects are formally rigid and functionally unyielding. Human contact is as a result of allocation or accident.

In the case of rural migrants who migrate to the city, greater adjustments are required with respect to both their new urban dwellings and the physical neighborhoods than with respect to other aspects of their new environment, such as kinship and traditional rules of village behavior. Still, housing occupied by many of the migrants is initially more "rural" than "urban" in style. To that extent, it may be said that many parts of Cairo are being ruralized. This transfer to another setting, i.e., to the city, combined with inadequate housing supply, results in functional overcrowding, much more severe than
that found in some villages. Being on open land, the village home minimizes the number of enclosed rooms in order to maximize private open space (ground level courtyards or a protected roofed-in courtyard).* This cherished open space is eliminated in multi-family vertically stacked residences of the city, which -- as previously mentioned -- results in overcrowded, cell-like, multi-functional rooms, without the corresponding relief of usable, accessible open private space.

2.6 Summary of Observations

After presenting a sociological view of the actual existing conditions for the occupants of public housing in the Zeinhom Housing Project and of the physical conditions in its existing structures, an important step is to start reviewing the results of this survey with regard to actual user requirements, and the determination of to what degree these real user requirements can be adequately transformed into technical solutions.

The observations can be summarized as follows:

- Closing of the balcony for extra space has led to a change in its initial design function;
- Overcrowding of used and unused furniture reduces and restricts usable floor space;
- Overcrowded rooms (persons per room) show lack of opportunity to move to a larger apartment or the need for sharing space by two, sometimes three, generations;
- Accommodation of an extended family lifestyle was not planned for, nor was doubling up foreseen;
- Vertical extension by means of roof use for additional space by the top floor apartments (for human activities or for animals);
- Horizontal extension by ground floor apartments (growing vegetables, drying laundry, children's play, etc.);
- Acquisition of automobiles necessitates provision of parking places;
- Misuse of public open spaces and the general deterioration of both site and buildings reveals the great need to minimize public open spaces and maximize private or semi-private open spaces.

2.7 Summary of User Requirements

The key problems associated with user requirements in the housing project are:

1. Due to still prevailing extended family life patterns of the sample group surveyed, the need for more or additional space is a major problem;

2. This problem is related to some extent to cultural characteristics, i.e., the need for central hall or livingroom, where the whole family could be together (also necessary with introduction of television);
Interior Conditions of Apartment
ACQUISITION OF ELECTRICAL APPLIANCES

FIGURE 33

<table>
<thead>
<tr>
<th>Study Sample Size</th>
<th>1</th>
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<td>Sewing machine</td>
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FIGURE 34

Kitchen transformed into a bedroom.
DISCLAIMER

Page has been omitted due to a pagination error by the author.

( Page 68 )
FIGURE 34

Kitchen transformed into dining room
FIGURE 35  Small kitchen balcony transformed by the users into cooking space.
These two pictures show how users have utilized the open spaces between the residential blocks, to achieve certain needs.
The need to provide parking spaces.
Arrow reveals cantilevered balcony which indicates the need of the user for more space.
Balcony ceiling lowered to provide storage space.

Kitchen sink moved out into closed balcony to give more kitchen space.
3. The most important technical requirement is improvement of the sanitary and drainage systems;
4. Another observed but unfulfilled need is appropriate and additional storage space. It is usual for this category of people to conserve everything possible for some future need, such as empty jars or boxes, bits of wood or metal containers, etc. This habit cannot be accommodated in the present available spaces without producing every more crowded living conditions. It also leads to the overloading and misuse of the physical structure (roof) by the top floor occupants (previously noted), since penetration of the balcony ceiling giving access to the roof in order to gain more storage space creates a structural hazard;
5. A very common feature in most public housing, and even in most of the low income family houses, is the breeding of birds, chickens and other animals. Even though they (the users) have never mentioned their need for space for this activity, there is an obvious implied requirement for more appropriate space to serve this need (vis. analysis of photographs and empirical evidence during site visits);
6. User requirements concerning the open spaces located between the residential blocks are very definitive. When questioned, the inhabitants almost unanimously agreed that they wanted to utilize these spaces in such a way as to provide the community with more common services such as shops, (super) markets, nurseries, community clubs, etc.
3. CONCEPTUAL DESIGN ALTERNATIVE

3.1 Approach to Remedy Existing Situation

3.2 Technical System
3. CONCEPTUAL DESIGN ALTERNATIVE

3.1. Approach to Remedy Existing Situation

From the previous chapters it should be clear that one of the major problems facing most public housing projects is the inability of the existing designs to respond more flexibly to the changing and differing needs of the users, (past, present and future).

Before going any further into the problem, it may be useful to clarify what is meant by flexibility in the context of this study:

"Flexibility may be defined as the ability to achieve a change of conditions without changing the basic system as such".

Thus, flexibility refers primarily to adaptations to change within a generic framework of structure, space and type of plan.

Without providing flexibility, designs for anonymous users tend to develop into closed systems that do not lend themselves to any change and which, while serving only a limited range of user groups, will lead to—as witnessed in the case study area—overcrowding and unplanned for functional substitution of intended use.

Given the relatively low per capita income of a country such as Egypt, the provision of new and larger housing for low-income families is economically difficult if not unattainable. This means that families who already have housing cannot move, no matter how crowded their apartments may have become (due to family increase or in migration).

Thus, the inclusion of some degree of flexibility/variability as a programmatic design element for any mass housing project must be considered as absolutely essential. In other words, the dwelling should be capable of accommodating—

1. new functions (in the technical sense)
2. new uses (in a behavioral sense)

and therefore it may be said that the dwelling is ADAPTABLE, and by extension any adaptable dwelling requires certain attributes of flexibility and variability.

These attributes of flexibility and variability and their interplay with user requirements and change are displayed in the following chart:
Similarly, in the context of this study, it may be useful to clarify what is meant by variability.

A definition of variability includes a temporal factor, in that adaptation of a dwelling to new needs without physical reconstruction or change of plan occurs over the short- and long-term:

**Means:**
- addition of "furniture", (including fixtures and appliances)
- change of doors, walls, and closets (or "built-in" elements)
- change of function (substitution, re-definition, adaptation, and subdivision)

**Needs:**
- generous spaces (by design and in terms of increased floor area or volume)
- larger spans (possibility of subdivision, addition of elements, partitioning, etc.)
- movable partitions (see above)

**Short-term:**
- mostly circulation, acoustic and climatic separation (i.e. kitchen, dining).
What are the basic classes of needs which may be linked to the concept of flexibility/variability?

1. **FAMILY CYCLE**
   a. **CHANGING NEEDS**
   1. Family formation
   2. Children grow up
   3. Children marry, move out or stay on
   4. Extended family of 2 or 3 generations
   5. Others

2. **BEHAVIORAL PATTERNS** (lifestyle)
   a. **SOCIAL MOBILITY**
   1. Increase in income
   2. Change of family status
   3. New job opportunities
   4. Others

3. **CHANGING WORLD VIEW**
   1. Generational: urbanization
   2. Aspirations and expectations from TV, newspapers, radio
   3. More education and women's emancipation
   4. Others

4. **DIFFERING NEEDS**
   a. **TYPE OF HOUSEHOLD** (activities)
   b. **INCOME DISTRIBUTION**

These changing needs which can be defined for almost all families at all income levels present more difficulties for the lower-income levels, since there is a need to make changing social and cultural patterns compatible with the economic and structural life-cycle of the dwelling itself (because these families are constrained by economic factors and thus do not have the freedom of moving out of their present dwelling).

This pattern can be theoretically resolved in the following ways:

1. provide for more internal F/V within the existing context of the housing project design
2. provide for "disposable housing" in the program, (i.e. temporary housing) and/or varying life-cycles for the various sub-systems or components (both in terms of function and use of the dwelling)
3. allow in the program for a method of exchange or moving either within the project or externally.
4. do nothing, and risk social disruption or unrest
PRINCIPLES OF FLEXIBILITY:
1. Interchangeability of room functions
2. Divisibility of apartment or layout
3. Divisibility of rooms
4. Circulation and access
5. Decentralization of layout

EXISTING SCHEMA:

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<tr>
<td>Laundry</td>
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Use Frequency

- conventional allocation
- possible allocation

This separation of functions ignores the complexity of family life in reality.

Alternative

Develop spaces with a potential for use-function change.

This implies changing
- Dimensioning to allow change of function
- Relationship of rooms to layout and each other.
Generally, the design of a house can be improved by observing actual family activity patterns and by familiarization with the real users' requirements.

From previously collected information on user requirements and from observation of an existing public housing project, the need for modification and improvement of the existing environment has become inevitable.

As already stated, one of the major problems facing most residents is limited available space as compared to density levels existing in almost all of the dwellings. In order to meet this requirement and ameliorate the density problem, additional space should be provided to existing structures wherever possible. This proposal is introduced as a 'transitional horizontal and vertical exterior extension' wherever space permits. This needed space has, in many cases, been annexed illegally already by some of the ground floor occupants (as depicted). The proposed additional space will provide residents of all levels with legitimately acquired and technically safe additional space. A study of the minimum and maximum spans for this proposal has been established with possible variations that could occur in plan distribution.

Flexibility and variability were achieved in plan variations to accommodate differing and changing present and future user needs. Styles I, II and III are steps taken to examine the different possibilities.

Technical systems utilized for this additional skeleton should be implemented without disruption of present usage of building, i.e., it should be in-use modification.

To arrive at this, three construction systems could be applied:
1. Conventional System: reinforced beams and columns (see Figure P.96)
2. Prefabricated columns, beams and slabs;
3. A combination of 1 and 2.

After reviewing structural working drawings of existing buildings it was found that new foundations were needed only for the exterior columns, while the interior columns will depend upon existing foundations, which were found capable of carrying the extra load.

A study for possible variations concerning open spaces between blocks is also presented. This is for typical blocks with minimum distances between them (see Figure P.101);
1. To provide spaces for car parking;
2. To provide space for possible shopping facilities;
3. To provide minimal public open spaces;
4. To provide private back yards.
In cases with maximum distance between blocks a study could be done to provide;
1. Shopping markets;
2. Nurseries;
3. Healthcare facilities;
4. Childrens' playground and recreation areas;
5. Parking places.

This proposal should make use of wasted areas and those that are currently not maintained well or are badly maintained and which exist between residential blocks. These uses should be developed keeping enough distance between blocks for privacy to be maintained and to permit sunlight and passage of air to freely enter every room.
STAGE I

STUDY OF POSSIBLE VARIATIONS IN INTERIOR ARRANGEMENT FOR DIFFERENT SPANS OF EXISTING PLAN.

1- In case of minimum extension
2- In case of maximum extension
STAGE 1
STAGE I

minimum extension is 1.5m
maximum extension is 3.00m
STAGE II

IMPLEMENTATION OF STAGE I ON EXISTING PLAN.

When minimum extension was provided:
* Apartment A increased by 17.04m²...41.6%
* Apartment B increased by 22.54m²...40.5%
* Apartment C increased by 16.95m²...25%
STAGE II

IMPLEMENTATION OF STAGE I ON EXISTING PLAN

When maximum extension was provided:
* Apartment A increased by 34.08m² ... 83.32%
* Apartment B increased by 45.08m² ... 81.13%
* Apartment C increased by 42.90m² ... 63.45%
STAGE III COMBINES STAGES I, II AND TESTS POSSIBLE VARIATIONS IN PLAN DISTRIBUTION FOR EACH APARTMENT SEPARATELY

1- in case of minimum extension  
2- in case of maximum extension

POSSIBLE VARIATIONS IN PLAN DISTRIBUTION FOR APARTMENT

IN CASE OF MINIMUM EXTENSION

In existing plan apartment A consisted of two rooms which were used as bedrooms by almost 90% of the study sample. The kitchen was also transformed into a sleeping space.

By introducing only the minimum extension, flexibility was provided which allowed for the possibility of obtaining the three above variations.

The design criteria followed in that stage was that each room must have proper ventilation and light.
STAGE III

POSSIBLE VARIATIONS IN PLAN DISTRIBUTION FOR APARTMENT B

IN CASE OF MINIMUM EXTENSION
STAGE III

POSSIBLE VARIATIONS IN PLAN DISTRIBUTION FOR APARTMENT C

IN CASE OF MINIMUM EXTENSION
STAGE III

POSSIBLE VARIATIONS IN PLAN DISTRIBUTION FOR APARTMENT

A

IN CASE OF MAXIMUM EXTENSION

Alternative (1)
Provides three bedrooms and a multi-functional room. Kitchen has been enlarged to provide a hobby room. Kitchen balcony is large enough to permit proper light and ventilation for bathroom.

Alternative (2)
Provides three bedrooms and a living-room, kitchen is divided into cooking and dinning. Kitchen balcony is narrow and deep, thus preventing adequate light and ventilation for bathroom.
STAGE III

POSSIBLE VARIATIONS IN PLAN DISTRIBUTION FOR APARTMENT A

IN CASE OF MAXIMUM EXTENSION
STAGE III

POSSIBLE VARIATIONS IN PLAN DISTRIBUTION FOR APARTMENT B

IN CASE OF MAXIMUM EXTENSION
New extension provides the ground floor units with a private back yard that could accommodate shops, rooms or to be left as a private garden.

POSSIBLE VARIATIONS IN PLAN DISTRIBUTION FOR GROUND FLOOR APARTMENTS A AND B
From the study of STAGES I, II, and III and considering the design criteria:

1- proper and adequate ventilation to all rooms.

2- density per room should not exceed three persons per room.

It was found that rooms with a facade width less than 3.60m should not be extended more than 1.5m, which is the minimum proposed.

The following diagram shows proposed extension for every span, in a typical A type Block in the case study site.
3.2 Technical System

TECHNICAL SYSTEM I

CONVENTIONAL CONSTRUCTION METHOD.

Reinforced concrete columns, beams and slabs

- column size: 25cm x 25cm
- beam size: 12cm x 60cm
- slab size: 10cm thickness.
TECHNICAL SYSTEM II

PREFABRICATED CONSTRUCTION METHOD.
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**TIE-beam**

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TECHNICAL SYSTEM II

AXONOMETRIC SHOWING METHOD OF ASSEMBLY
OF PREFABRICATED ELEMENTS
TECHNICAL SYSTEM I

BRICK INFILL COMBINED WITH PREFABRICATED COLUMN AND BEAM.
POSSIBLE VARIATIONS ON THE TISSUE LEVEL FOR TWO TYPICAL RESIDENTIAL BLOCKS

A

B
Advantages of proposed extension to existing building.

1- Increases area of existing units.
2- Increases flexibility in interior arrangements.
3- Minimizes wasted and neglected open spaces.
4- Cost of new additions per square meter is much less than the cost of the same area built separately. This is because it uses elements of existing building as support (foundation) and uses the rigidity of the building.
5- It can be performed in stages without disturbing the use of the building, and the occupants.
SECTIONAL PERSPECTIVE OF TWO RESIDENTIAL BLOCKS WITH NEW EXTENSION
CONCLUSIONS AND RECOMMENDATIONS
CONCLUSIONS AND RECOMMENDATIONS

The dwelling must continue to fulfill certain basic needs, some of which are culturally defined. It must give shelter from the elements as well as a sense of security and protection. It must provide for various activities, such as bathing, sleeping, eating, childrearing etc. It is a setting for an entire range of simple, repetitive domestic functions and as such, is a spatial framework for people's everyday lives.

Besides these functions the dwelling must certainly support and aid change rather than oblige users to restrict or give up desired activities.

The previous chapters provide sufficient evidence that provision of absolutely minimal space is the norm and standard for most of the public housing projects in Egypt. The "life cycle" of the buildings and their suitability for many generations of diverse occupants has been ignored. This thesis was initially presented in order to provide alternative design concepts and to influence future public housing design. Certain recommendations could be stated as a result of this research work and the information collected:

1. Regular and intensive post-occupancy and post-construction evaluation of existing public housing should be established to provide a feedback mechanism for future designs of similar projects.

2. Ownership of dwelling unit should be the basis for any future public housing projects to ensure maintenance.

3. Due to diverse users, provision for a design that could be adaptable to present and future requirements of users should be made.

4. Research into user characteristics and cultural background should be done prior to any design.

5. The need to research alternative construction materials that would require less maintenance over the life cycle of the building should be done.

6. The obvious shortage in present housing market necessitates preservation of existing stock to diminish the deficit due to demolition of deteriorating buildings. This is evident from the figures in the appendix and which represent a high percentage of the deficit in housing units.

7. From existing cases, it is quite evident that sanitary piping and drainage systems
should be improved, to avoid further damage to buildings and to maintain public health.

8. The need to increase the integration of communal service facilities (shops, market places, mosques etc.) with existing housing projects should initiate the re-design of the spaces in and around the building blocks.

In Summary

This thesis assists in indicating the importance of social aspects in any housing design. It also demonstrates the need to improve design standards for public housing in order to improve the environment of the users and at the same time help them to become more productive members of society.

The proposals suggested present the possibility of developing a method for in-use modification of existing public housing in Egypt as a means for upgrading and at the same time meeting the requirements and needs of the occupants.
APPENDIX

This appendix includes tables and census data of the main aspects that have and still are affecting the quality of housing in Egypt:

E.g., a) rates of migration;
   b) urban population growth;
   c) increases in costs of construction materials
   d) increases in wages for labor.
Appendix 1

An estimate of urban housing needs in Egypt to the year 2000

- Deficit in urban housing units 1980: 831,000
- To demolish unsound urban dwellings 1979 and relocation needs: 393,000
- To demolish unsound urban dwellings 2000 and relocation needs: 589,000

Housing needs: 3.6 million units

An estimate of urban housing needs in Cairo from 1980-1985: 134,000 units and till the year 2000: 618,000 units.
Table 2 Increase in cost of reinforced steel

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Cost of non-subsidized reaches approximately L.E. 350.00/ton.
Table 3 Increase in cost of brick

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Table 4 Increase in cost of cement
price/ton of portland cement

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</tbody>
</table>
Table 5
From preliminary results of size of population for the year 1976

Average family size and average no. of rooms/family and rate of crowding/room in 1976 census as compared with 1966 census

<table>
<thead>
<tr>
<th>Governorate</th>
<th>Average Family Size</th>
<th>Average No. of Rooms/Family</th>
<th>Rate of Crowding</th>
<th>1960</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairo</td>
<td>4.8</td>
<td>2.5</td>
<td>2.3</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Alexandria</td>
<td>5.0</td>
<td>2.5</td>
<td>2.0</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>Port Said</td>
<td>5.2</td>
<td>2.3</td>
<td>1.2</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Suez</td>
<td>5.0</td>
<td>2.7</td>
<td>1.2</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Total urban governorate</td>
<td>4.9</td>
<td>2.5</td>
<td>2.1</td>
<td>1.9</td>
<td></td>
</tr>
</tbody>
</table>

The reason behind the decrease in rate of crowding/room in the 1976 census is because in 1960 the hall was not considered as a room while in 1976 it was included as a room.
<table>
<thead>
<tr>
<th>Governorate</th>
<th>Sex</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cairo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2,606,999</td>
<td>2,477,464</td>
<td>5,084,463</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Giza</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>urban</td>
<td>708,947</td>
<td>670,330</td>
<td>1,379,277</td>
</tr>
<tr>
<td></td>
<td>rural</td>
<td>537,645</td>
<td>502,325</td>
<td>1,039,970</td>
</tr>
<tr>
<td></td>
<td>total</td>
<td>1,246,592</td>
<td>1,172,655</td>
<td>2,419,247</td>
</tr>
<tr>
<td></td>
<td>Kalyoubiya</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>urban</td>
<td>356,545</td>
<td>328,041</td>
<td>684,586</td>
</tr>
<tr>
<td></td>
<td>rural</td>
<td>513,334</td>
<td>476,086</td>
<td>989,420</td>
</tr>
<tr>
<td></td>
<td>total</td>
<td>869,879</td>
<td>804,127</td>
<td>1,640,006</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>urban</td>
<td>3,672,491</td>
<td>3,475,835</td>
<td>7,148,326</td>
</tr>
<tr>
<td></td>
<td>rural</td>
<td>1,050,979</td>
<td>978,411</td>
<td>2,029,390</td>
</tr>
<tr>
<td></td>
<td>total</td>
<td>4,723,470</td>
<td>4,454,246</td>
<td>9,177,716</td>
</tr>
</tbody>
</table>
### Table 7: Net immigration from/to major governorates from census 1966-1976

<table>
<thead>
<tr>
<th>Governorate</th>
<th>difference between census 1966-1976</th>
<th>natural increase in population 1966-1976</th>
<th>net immigration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairo</td>
<td>1,051,615</td>
<td>982,286</td>
<td>+69,329</td>
</tr>
<tr>
<td>Alexandria</td>
<td>586,472</td>
<td>441,305</td>
<td>+145,167</td>
</tr>
<tr>
<td>Port Said</td>
<td>-10,850</td>
<td>29,455</td>
<td>-40,304</td>
</tr>
<tr>
<td>Suez</td>
<td>-63,202</td>
<td>22,412</td>
<td>-85,614</td>
</tr>
<tr>
<td>Total urban governorate</td>
<td>1,564,035</td>
<td>1,475,475</td>
<td>+88,578</td>
</tr>
</tbody>
</table>

### Table 8: Net migration in the governorate of Cairo

<table>
<thead>
<tr>
<th>difference between census 1966-1976</th>
<th>natural increase in population</th>
<th>net immigration</th>
<th>rate of net immigration to total change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,051,615</td>
<td>982,286</td>
<td>+69,329</td>
<td>6.6%</td>
</tr>
</tbody>
</table>

### Table 9: Net migration in the Greater Cairo

<table>
<thead>
<tr>
<th>difference between census 1966-1976</th>
<th>natural increase in population</th>
<th>net immigration</th>
<th>rate of net immigration to total change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,171,764</td>
<td>1,529,093</td>
<td>+643,671</td>
<td>29.6%</td>
</tr>
<tr>
<td>Governerate</td>
<td>Rate of population with economic activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Total</td>
</tr>
<tr>
<td>Caico</td>
<td>50.1</td>
<td>11.0</td>
<td>31.1</td>
</tr>
<tr>
<td>Alexandria</td>
<td>51.8</td>
<td>10.7</td>
<td>11.8</td>
</tr>
<tr>
<td>Port Said</td>
<td>52.3</td>
<td>10.3</td>
<td>32.1</td>
</tr>
<tr>
<td>Suez</td>
<td>51.1</td>
<td>5.8</td>
<td>29.7</td>
</tr>
<tr>
<td>Total urban governrate</td>
<td>50.7</td>
<td>10.8</td>
<td>31.3</td>
</tr>
</tbody>
</table>
Table 11  An estimate of urban housing needs in Egypt in the four major urban governorates to the year 1985

<table>
<thead>
<tr>
<th>Governorate</th>
<th>1980-1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairo</td>
<td>134,000</td>
</tr>
<tr>
<td>Alexandria</td>
<td>77,000</td>
</tr>
<tr>
<td>Port Said</td>
<td>8,000</td>
</tr>
<tr>
<td>Suez</td>
<td>11,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>230,000</strong></td>
</tr>
</tbody>
</table>

Table 12  Number of families in the major governorates compared with available housing stock 1976 census

<table>
<thead>
<tr>
<th>Governorate</th>
<th>no. of families</th>
<th>existing of dwelling</th>
<th>needed no of dwelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairo</td>
<td>1,065,354</td>
<td>766,138</td>
<td>299,216</td>
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<tr>
<td>Alexandria</td>
<td>466,043</td>
<td>331,365</td>
<td>134,678</td>
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<tr>
<td>Port Said</td>
<td>52,156</td>
<td>45,004</td>
<td>7,152</td>
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<tr>
<td>Suez</td>
<td>40,113</td>
<td>38,630</td>
<td>1,483</td>
</tr>
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</table>
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10. Idem.

11. Tables in Index are from the report on National Policy to Confront the Housing Problem in Egypt, Cairo, Egypt, 1979.
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