URBANIZATION OF AGRICULTURAL LAND:
Informal Settlements in Cairo

by

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ABSTRACT

Informal settlements in Cairo today are the most important mode of urbanization supplying approximately 75% of the total housing units built yearly.

This thesis addressed two issues related to informal settlements: the loss of scarce agricultural land and the illegal, unplanned nature of these settlements. The first issue is discussed on the national and urban levels focusing on Cairo while the second is investigated by analysing a representative locality in terms of its growth and urbanization processes.

Recommendations, regarding both issues, are suggested for the popular efforts exerted by the informal sector, focusing on their improvement and incorporation into a legal framework.

Thesis Supervisor: Horacio Caminos
Title: Professor of Architecture, M.I.T.
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Rapid urbanization has become an urgent concern of many architects and planners in Egypt today. I have had the opportunity to deal with this problem as a member of the Housing Team of the Sadat City Development Group, which was involved with the planning of a new desert town. The key, however, to solving the housing problem of Cairo lies in harnessing the efforts exerted by the informal sector which have been ignored and have never been extensively studied. I became interested in investigating informal settlements; hence this work is an effort to contribute to the understanding of such settlements.

I gratefully acknowledge the guidance and support of Professor Horacio Caminos, from whom I have learnt much and with whom I have had some very enjoyable discussions concerning various issues during the two years of my study at M.I.T. I sincerely appreciate the friendship, suggestions and assistance of Reinhard Goethert who has generously made the much needed reference material and data for this work available to me, the comments and company of Happy, the friendship company and support of Hseuh-Jane Chen, Varin Kiatfuengfoo and Mayank Shah, and the classmates of 1979-80 and 1980-81.

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I gratefully acknowledge the financial support, extended to me as a Peace Fellow, by the Agency for International Development, as well as Amid-East for coordinating my program. Last but not least, to Laila my wife, whose patience, support and efforts helping me in producing this work; to my parents whose loving support and encouragement which are beyond the means of expression.
INTRODUCTION

Egypt is undergoing rapid urbanization. Urban dwellers increased from 30% of the total population in 1947 to 44% in 1976\(^{1}\). Consequently, the nation is facing a serious problem: the loss of scarce agricultural land which represents 4% of its total area\(^{2}\). The government, in an effort to conserve agricultural land, passed a law prohibiting all construction on such land. Inspite of that, settlements have continued to sprout and expand all around the cities, on agricultural land, as no other realistic alternative has been officially offered.

The focus of this study is on informal urbanization of agricultural land. The resulting settlements, though condemned as informal, have been supplying about 76% of all the housing produced in Cairo in the last 10 years\(^{3}\). The sturdy reinforced concrete dwellings built informally have become a fact the capital has to live with. Their role in housing a substantial percentage of the population, cannot be denied.

To understand the complexities of the process of urbanization of agricultural land, it is studied on three levels: The national, to give an overall insight of the problem; the urban, to monitor its impact on a specific city; and the locality, to understand the mechanics of the process which when repeated on a large scale affect the city as a whole.

On the national level the following factors affecting urbanization are reviewed: population growth, lack of sufficient employment in the agricultural sector, attraction of rural dwellers to Cairo, and migration to urban areas.

The implications of the national trend of urbanization are then investigated on the urban level, where the influx of migrants from rural areas is evident. In the case of Egypt, Cairo is most affected by rapid urbanization: 1000 new migrants enter Cairo every day\(^{4}\), about 60% of all migrants leaving rural areas are headed to the capital\(^{5}\). The expansion of Cairo takes place mainly on agricultural land. More loss of such precious land is threatened, this fact is raising controversial reactions.

In order to understand the process of informal urbanization on the city scale, a sample area, a locality, representing agricultural land being urbanized is selected as a case study. A field study was conducted. The locality is analyzed in two modes: the first, deals with the growth process, tracing the change from agricultural land to a built-up settlement; the second, investigates the urbanization process in terms of reasons for buying and selling lots, social structure of the inhabitants, physical characteristics of the layout and the dwellings.

Recommendations are given, addressing two basic issues related to informal settlements: location and quality. Their location of agricultural land is discussed and alternatives are suggested. Further expansion on agricultural land will continue until other alternatives are developed. Quality of existing settlements in terms of construction are quite high and comparable to the formal sector’s dwellings. The layouts of such settlements have several drawbacks as a result of their being unplanned. Upgrading is suggested to improve their situation. Further expansion of such settlements should be guided so as to avoid the problems that occurred in their existing counterparts parts. Land subdivision guidelines are recommended. No intervention in the process of construction is advised.

Making use of the popular effort exerted by the informal sector and channeling it to contribute further as a viable solution for the housing problem plaguing Egypt, in a legalized framework, is imperative at this stage.
EGYPT: URBANIZATION

The urban population of Egypt has nearly tripled from 1947 to 1977 (from 6.2 to 17 million). It is expected to increase to 45 million by the year 2000. This high rate of urbanization is attributed to the four following factors:

POPULATION GROWTH

Population doubled in the last 30 years from 18.9 million in 1947 to 39.9 million in 1978. The population density is estimated at 1114 persons/sq km. The annual rate of increase in recent years has been 2.6%. If such a rate persists, the population will grow to 80 million by the year 2000.

A family planning policy has been implemented since the 1960's. Satisfactory results were not achieved due to religious misinterpretation of the issue. Education and material incentives could be used to resolve this problem.

SCARCITY OF AGRICULTURAL LAND

The total area of Egypt is 1,001,449 km² of which only 4% is agricultural while the rest is desert. The per capita agricultural land decreased from 0.5 to 0.2 acres from 1900 to 1970. This is a result of the growth of urban centers (all of which are located on agricultural land in Egypt) coupled with the increase in population.

Employment per acre of agricultural land is the highest in the world and has reached saturation several decades ago. The increase in the rural population could not be employed in the agricultural sector. As a result, the excess in population has been migrating to urban areas.

Three new cities, Sadat, 10th of Ramadan and El-Ameria, have been planned to solve this problem. They are intended to house, in total, about 3 million people at a very high cost. This will have little effect on absorbing the expected population growth of Egypt. Further expansion of existing cities must also be planned for.
INTRODUCTION

CONCENTRATION IN CAIRO

In 1973 the governorate of Cairo housed 15% of the total population of the country. About 50% of all political, economic, financial, educational, cultural and administrative activities and services of Egypt were concentrated in it. Urban services in Cairo, by far, surpassed its share of the population (17) (see chart below(18)).

Although the government called for decentralization in the early 1960's, the actions of its different administrative bodies did not comply with this policy and more concentration occurred.

New satellites, El-Amal, El-Obour and 6th of October, are proposed to alleviate the pressure on Cairo. Unless they are truly self-sufficient, they will in effect increase its area. They might be used as dormitory suburbs reversing the initial intentions behind implementing them.

Financial and tax incentives should be used to attract entrepreneurs to new cities and smaller towns.

MIGRATION

Increase in population and scarcity of employment opportunities in rural areas as opposed to the amenity rich capital account for an influx of 1000 migrants daily to Cairo (19). (60% of all migration (20)). The result is reflected in the distorted population distribution in Egypt. Greater Cairo, today, houses more than 24% of the total population of the country and 53% of all the urban population (21). According to the censuses taken from 1927 to 1960, 34% of the population on Cairo were migrants (22). About 50% of them came from the delta governorates, 42% from Upper Egypt and 8% from the urban governorates.

The rank distribution of the Egyptian population in urban areas shows that Cairo claims absolute supremacy. Today Cairo's population is more than 8 million. It is followed by Alexandria which houses 2.3 million people. The two major cities are followed by a series of much smaller cities which accentuate the distortion of the population distribution.

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<tr>
<td>EMPLOYMENT</td>
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<td>EMPLOYEES: government</td>
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<tr>
<td>public</td>
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<tr>
<td>private</td>
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Percentage In Cairo

Percentage in the rest of Egypt
CAIRO: URBAN GROWTH

The repercussions of rapid urbanization in Egypt appear primarily in Cairo (23). The growth rate of Cairo is about 4%. This is a result of both natural growth 2.1% (24) and migration. The population increased from 0.67 to 3.3 million, (1907-1960), and nearly doubled by 1972 (25). In 1977 the population was estimated to surpass 8 million (26) and it is expected to reach 21 million by the year 2000 (27).

HOUSING SITUATION

This increase in population resulted in an increased demand for housing. The private sector supplied most of the housing until the early 1960's. This situation was reversed after that date, and a HOUSING SHORTAGE evolved because of rent control (which started in the late 1950's), laws prohibiting eviction (28) and scarcity of building materials (with resultant dependency on a black market) (29). Fear of investment in building was accentuated by the expropriation of assets for redistribution of wealth in the late 1950's.

As a result CONDOMINIUMS were introduced to cater to the demand of the higher income groups, and KEY MONEY, a compensation for discrepancies between real and estimated costs, were levied illegally by most of the landlords (30).

HOUSING SUPPLY was provided, after the 1960's by an increase in density, and by urban expansion. Proposed growth focuses on the creation of three new satellites.

INCREASE IN DENSITY: The overall density of Cairo in 1947 was 2 persons per room in 1972 it reached 3.1 persons per room (31). This increase in density resulted from the conversion of large houses into tenements and overcrowding, as newly married couples had to live with their parents, or new migrants moved in with their relatives for much longer periods than in the past. Adding one or more new stories to existing buildings was another way of increasing the overall density of the city.

CITY EXPANSION took place by means of three different sectors: public, private and informal sectors.

PUBLIC HOUSING projects were built by the government for the lower income groups. This approach failed (32) since it could never produce a sufficient number of dwellings to meet the demand. The units built were culturally unacceptable, in addition to their being uneconomic due to high subsidies involved.

FORMAL SETTLEMENTS, usually catering to the upper-middle and high income groups, were built either on desert land (Madinet Nasr and extensions of Heliopolis to the east) or on agricultural land (such as Madinet El Mohandesseen, to the west). By 1973 a law was issued prohibiting all building activities on agricultural land situated outside the administrative limits of the city (33).

INFORMAL SETTLEMENTS, on the other hand, were sprouting all over Cairo particularly on agricultural land. Between 1973 and 1978 about 76% of all construction around Cairo was built informally on agricultural land (34).

Official figures stated a housing shortage of 1.5 million units in Egypt in 1975, most of which lacked in Cairo (35). This figure reflects the shortage in the official formal housing stock. Because of the criteria for standard housing in Egypt, the shortage appears dramatic. In reality no one sleeps on the pavements and a large percentage of the population is housed in units provided in informal settlements. These were not accepted by the government. Lately, as a result of the enormous size of these settlements, they have been partially recognized and some are being upgraded.

SATELLITES for Cairo, in the desert, are being planned to alleviate pressure from the city and to divert growth from agricultural land. These satellites when completed will accommodate only 10% of the expected population increase.

Unless a more realistic alternative is given the remaining 90% of the population will continue to build in informal settlements.
INFORMAL SETTLEMENTS

DEFINITION: Informal settlements on agricultural land are illegal (not due to squatting, as the land is bought from its owners) because they are, invariably, in violation of one or more of the laws regulating land subdivision, sale of lots, construction and/or land use (see diagram below).

FACTORS RESPONSIBLE FOR THE FORMATION OF INFORMAL SETTLEMENTS:

Despite the laws regulating settlements, many are sprouting and expanding all around Cairo informally for reasons as follows:

HIGH STANDARDS, set by law, make formal housing inaccessible to lower income groups (see table to right).

LEGALIZATION of informal settlements, built before 1966, by a law passed that year perpetuated these settlements.

LENIENCY in dealing with violators, as a result of the unavailability of formal, feasible alternatives.

REASONS FOR SETTLING ON AGRICULTURAL VERSUS DESERT LAND:

LAND OWNERSHIP is a source of security, owning a dwelling is a cultural tradition in Egyptian villages.

LOCATION usually near employment opportunities, is more advantageous on agricultural land.

AVAILABILITY OF WATER is a key factor, it is obtained by hand pumps and is required for construction, washing and bathing. In early stages of the settlements subterranean water was used for drinking until it became polluted.

FORMAL VERSUS INFORMAL STANDARDS USED IN SETTLEMENTS:

ZONING REGULATIONS segregate different land uses. The informal sector depends upon economic activity incorporated in their dwellings, for additional income.

LAND SUBDIVISION LAWS allot a minimum of 33.3% of the land to public use. The informal sector minimizes such areas, improving land utilization in these settlements.

LOT COVERAGE LAWS limit the built-up area to 60% of the lot. The informal sector uses 100% of the lot (light wells are used) making maximum use of private land.

BUILDING CODES set high standards; minimum dimensions bring up costs. Informal builders disregard codes, bringing down standards and costs to suit their needs and means.

CHANGE OF LAND USE FROM AGRICULTURAL TO RESIDENTIAL

VIOLATION OF DECREES AS AMENDED

| LAND SUBDIVISION FOR CONSTRUCTING RESIDENCES WITHOUT PLANNING AUTHORITY APPROVAL | SALE OF NEW SUBDIVISIONS WITHOUT REGISTRATION OF TRANSACTION | CONSTRUCTION OF RESIDENCES WITHOUT BUILDING LICENSE |
| (Law # 52 of 1940 as amended by Law # 2 of 1952) | (Law # 18 of 1923) | (Law # 344 of 1956 as amended by decree # 169 of 1962) |
CASE STUDY

Informal settlements on agricultural land surround Cairo to the north, east and south (see map left). To understand these settlements, a specific locality, the El-Mounira sector in Embaba Kism was selected for analysis.

LOCALITY BACKGROUND: Embaba existed as a village before Islam came to Egypt. Bridges and the extension of a tramway line linking Embaba to the main portions of Cairo, to the east of the Nile, encouraged the development of this locality. In the early 1950's some industries and 2 housing projects: Al-Ommal and Al-Tahrir were erected to the east of the locality. The availability of employment and facilities laid the cornerstone for the formation of the informal settlement.

CRITERIA FOR CHOOSING THE LOCALITY:

TYPICALNESS: The informal settlements around Cairo are similar in terms of the illegal mode of their formation. Land values differ according to demand and location. As demand rises and prices escalate the type of settlers change. The chosen locality is a typical example of these settlements.

AVAILABILITY OF INFORMATION: such as air photographs tracing the stages of growth provide a concrete basis for analysis.

BOUNDARIES: The Upper Egypt railroad, south, and the public housing projects, east, determine the starting point of growth.

SIZE: El-Mounira is significantly large, the built-up area was 190.2 hectares in 1976 and it housed 150,000 people(44).

AGE: The locality as an informal settlement, about 30 years, helps monitor the stages of growth.

CASE STUDY ANALYSIS:

To understand the dynamics of the informal settlement, two types of analyses are used: the first measures growth using air photographs(45) and the second analyses the locality as a built environment using data collected from a field study(46).
URBANIZATION OF AGRICULTURAL LAND: CAIRO

LOCALITY PLAN (1947)
GROWTH PROCESS

The initiation and growth of the El-Mounira settlement could be followed from its original agricultural land subdivision map (1947, opposite page) through its progressive urbanization (locality air photographs: 1957, on this page, 1966 and 1976 on the two following pages).
STAGES OF GROWTH

The initiation and growth of the settlement took place in stages which occurred progressively and simultaneously. These stages could be identified as:

1- HORIZONTAL EXPANSION: When the settlement was initiated it first started in an area in which building took place, dispersedly, on agricultural land (on lots bought from farmers).
2- INFILL: While more horizontal expansion of the settlement takes place, more buildings are being built on vacant lots within the already built-up areas (in stage 1).

As the settlement became established, demand for apartments rose. Small contractor/developers started to construct apartment buildings, 5-7 story walk-ups, to cater to the new demand (these are built on lots, located in key positions along main streets, bought in early stages for speculation).

3- VERTICAL EXPANSION: New stories are added to the buildings according to demand, the needs of the owners, and/or availability of money.

The first two can be seen from the air photographs. The third could not be detected in all three photographs and therefore was not calculated.

HORIZONTAL EXPANSION (URBANIZATION OF NEW AREAS):

The initiation and expansion of the settlement is documented by means of an agricultural land subdivision map (1947) and three air photographs (1957, 1966 and 1976). The exact date of the initiation of the settlement is not available, but it took place in the early 1950's.

Three areas of growth were identified from the air photographs and were superimposed on one plan (opposite page). The area of each is as follows (47):

<table>
<thead>
<tr>
<th>AREA</th>
<th>DATES</th>
<th>AREA</th>
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<tbody>
<tr>
<td>AREA I</td>
<td>from early 1950's to 1957</td>
<td>29.1 Ha</td>
</tr>
<tr>
<td>AREA II</td>
<td>from 1957 to 1966</td>
<td>90.4 Ha</td>
</tr>
<tr>
<td>AREA III</td>
<td>from 1966 to 1976</td>
<td>70.8 Ha</td>
</tr>
<tr>
<td>TOTAL AREA</td>
<td>from early 1950's to 1976</td>
<td>190.3 Ha</td>
</tr>
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</table>

INFILL (INCREASE IN DENSITY):

Measuring the areas developed during different periods is not an accurate method for quantifying settlement growth. Areas when initially developed, are not totally built-up and as time passes additional lots are sold and more buildings constructed.

This is due to: speculation, farmers sell lots when in need of cash, and lots further away are cheaper and are therefore sold before the area is totally built-up.

GROWTH MATRIX:

To measure growth, the increase in density (infill) must be taken into consideration. To measure infill, a segment of 200x200m was selected for each area (see map at right). For every segment the built-up area was calculated for each ten year period, this was done by subtracting the previously built-up area from the total at a given year, thus the increment on the last 10 years could be calculated. The increment built-up area was then multiplied by the total area of the portion of the settlement it represents, thus the total increment of built-up area was calculated.

INFORMATION OBTAINED FROM THE GROWTH MATRIX:

HORIZONTAL ROWS: The amount of building that took place during each 10 year period, for each area, is recorded.

VERTICAL COLUMNS: The amount of building that took place during a 10 year period could be compared for different areas as well as added to give the total amount of building, which is recorded in the bottom row of the matrix.

PROJECTIONS: Areas that could be built in the future for each of the three areas are indicated in the last column. This was done by completing the pattern of built-up areas in the latest pattern diagram, streets were maintained and the rest of the area is assumed to be built-up. By the year 1986 it is assumed that the rest of the vacant lots will be developed, this is obvious from the amount of building that took place in the previous years.
CASE STUDY: EL-BORMA, EMBABA

LOCALITY GROWTH (1947-1976)

AREA I: EARLY 1950's
AREA II: 1957-1966
AREA III: 1966-1976

PUBLIC HOUSING PROJECTS
EARLY 1950's

SEGMENT I
SEGMENT II
SEGMENT III
GROWTH MATRIX

AREA I
SETTLEMENT INITIATED AFTER 1947
TOTAL AREA = 29.1 HA

AREA II
SETTLEMENT INITIATED AFTER 1957
TOTAL AREA = 90.4 HA

AREA III
SETTLEMENT INITIATED AFTER 1966
TOTAL AREA = 70.8 HA

* Total increment built-up area = percentage of built-up (dwellings/lots) increment per HA x total area in HA.
<table>
<thead>
<tr>
<th>Year</th>
<th>Patterns</th>
<th>Percentages/Areas</th>
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<tbody>
<tr>
<td><strong>1966</strong></td>
<td><img src="image" alt="Pattern Map" /></td>
<td>38.5% 20.4% 11.2% 35.1% 0%</td>
</tr>
<tr>
<td><strong>1976</strong></td>
<td><img src="image" alt="Pattern Map" /></td>
<td>37.7% 28.2% 10.6% 34.1% 0%</td>
</tr>
<tr>
<td><strong>1986</strong></td>
<td><img src="image" alt="Pattern Map" /></td>
<td>37.1% 28.7% 19.6% 44.5% 0%</td>
</tr>
</tbody>
</table>

*Total increment built-up area is the area that was built-up in the 10 year period prior to the year indicated at the head of the column.*
OBSERVATIONS ON GROWTH MATRIX

The areas of growth I, II and III indicate that the area built-up between 1957 and 1966 was the largest, as Area II is 90.4 hectares as opposed to 29.1 and 70.8 hectares for areas I and II respectively. This is disproved when the growth matrix is used as we have a total increment of built-up area for the total settlement during the years 1957 to 1966 equal to only 46.3 hectares as opposed to 81.7 hectares during the decade from 1966 to 1976. This is due to the fact that within the same segment representing Area II the amount of building during the period 1957 to 1966 was 35.1 hectares and from 1966 to 1976 it was 34.7 hectares. This coupled with the amount of building in Areas I and III, 3.1 and 44.8 respectively, clarifies how the intensity of building is affected by taking all areas into consideration.

The percentage of building per hectare in newly developed areas (first ten years) increased in recent years from 39% in Area II to 63% in Area III (Area I could not be compared as it was not constructed in the span of ten years as its two counterparts).

Another example demonstrating the importance of the matrix is seen in the case of the segment studied for Area II in its initial stage (1957-1966) and in its second stage (1966-1976) where the amount of built-up area per hectare was nearly the same: 38.8 and 37.7 respectively. The built-up area doubled although no physical area expansion occurred.

Projecting the final percentages of built-up areas per hectare is made possible since the 3 segments had a clear pattern by 1976 and by just completing the shapes of the blocks and assuming the vacant lots being built-up one can predict the quantity of further possible growth.

Area I could accommodate more built-up area, up to 5.3% per hectare which will total to about 4.9 hectares.

Area III will experience an increment of 19.6% built-up area a total of 13.9 hectares.

The total possible increment of built-up areas would be 20.3 hectares for the whole settlement. This is the potential for increased building within the locality.

If no horizontal expansion occurs and only infill takes place at the same rate of the 1966-1976 decade where 81.7 hectares were built-up, it would take only about 2.5 years to complete all infill (assuming no land speculation).

LOT SIZE MATRIX

Lot sizes have changed in the development of the settlement. The lot size matrix (right) was done to quantify the number of lots for the same three Areas I, II and III used in the growth matrix with the same three segments as a reference base.

Lots were categorized according to size:

- SMALL S: less than 60m$^2$
- MEDIUM M: 60-100m$^2$
- LARGE L: more than 100m$^2$

The number of lots, according to size were counted for each segment (200x200m) and the number of lots per hectare were calculated and multiplied by the area they represent to give right weightage to each, according to its size.

The total number of lots for each period, for all three areas, are given in the fourth row of the matrix. Percentages for lot sizes of each 10 year period are represented graphically in the bottom row.

The matrix shows that the sizes of lots decreased from the initial period to the last one.

SMALL LOTS: increased as a percentage of all the lots from 30% to 47% (in the 1957-66 period their percentage decreased to 28%).

MEDIUM LOTS: Decreased from 55% to 41%, the difference was transferred into smaller sized lots.

LARGE LOTS: decreased from 15% to 12%, although they
increased in the 1957-66 period.

In conclusion, the lots subdivided in the settlement have been decreasing in size in the current years. This is the result of the increase in prices of the square meter in this locality from L.E.4 in the early 1960's to about L.E.40-50 in the late 1970's.

**LOT SIZE MATRIX**

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOTS/HA</td>
<td>TOTAL**</td>
<td>LOTS/HA</td>
</tr>
<tr>
<td><strong>AREA I</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(29.1 HA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S less than 60</td>
<td>14</td>
<td>407</td>
<td>11</td>
</tr>
<tr>
<td>M 60 - 100</td>
<td>11</td>
<td>320</td>
<td>12</td>
</tr>
<tr>
<td>L more than 100</td>
<td>7</td>
<td>204</td>
<td>2</td>
</tr>
<tr>
<td><strong>AREA II</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(90.4 HA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S less than 60</td>
<td>13</td>
<td>1175</td>
<td>17</td>
</tr>
<tr>
<td>M 60 - 100</td>
<td>10</td>
<td>904</td>
<td>20</td>
</tr>
<tr>
<td>L more than 100</td>
<td>2</td>
<td>3158</td>
<td>7</td>
</tr>
<tr>
<td><strong>AREA III</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(70.8 HA)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S less than 60</td>
<td>3</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td>M 60 - 100</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>L more than 100</td>
<td>15</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AREA I, II, III</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(190.3 HA)</td>
<td></td>
<td></td>
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<tr>
<td>S less than 60</td>
<td>407</td>
<td>728</td>
<td>1495</td>
</tr>
<tr>
<td>M 60 - 100</td>
<td>204</td>
<td>204</td>
<td>991</td>
</tr>
<tr>
<td>L more than 100</td>
<td>30</td>
<td>4419</td>
<td>30</td>
</tr>
</tbody>
</table>

* 1950 is used to indicate the early 1950's  ** Total number of lots = no. of lots/hectare x area
URBANIZATION PROCESS

The process of informal urbanization is very dynamic. The main premises for its initiation and growth are: the desire of the agricultural landowners to subdivide their land into lots to be sold, and the increasing demand for such lots.

REASONS FOR SELLING AGRICULTURAL LAND

UNECONOMIC FARMING: as a result of the subdivision of inherited agricultural land (see page 26), plots become too small to be cultivated profitably.

INSUFFICIENT FARMERS: some of the landowners who own larger plots and are employed in sectors other than the agricultural one tend to rent their land to peasants. Landowners fearing to rent their land and/or not finding suitable renters, prefer to sell it, eliminating these problems.

UNFAVOURABLE FARMING CONDITIONS: in cases where the farmers pursue cultivating their plots, their propinquity to urbanizing areas raises problems: children and domestic animals from neighboring dwellings spoil their crops, shadows cast by adjacent dwellings on crops, etc.

MATERIAL INCENTIVES: land prices rose with the increased demand for lots in such areas tempting landowners to sell.

REASONS FOR BUYING LOTS:

The reasons for buying lots are identical to those motivating informal settlers all around Cairo (see page 11).

STAGES OF DEVELOPMENT:

The process of converting the agricultural land takes place in several stages, as follows:

INITIAL SETTLERS: The first settlers, of lower income groups, find security in possessing their own lot on which they could build their dwelling.

APARTMENT RENTERS: original settlers, having settled down, started to expand their structures and rent apartments, improving their economic situation.

SPECULATION: during the first few years, speculators buy large lots in key locations. When demand increases, they construct their 5-7 story walk-ups.

NEW CLIENTELE: as a result of increased building in the locality and speculation, land prices increase. Lower income groups can no longer afford the new high prices, and they have to look elsewhere for cheaper lots in younger settlements, at other farther locations. A new clientele for the lots replaces the first one. They are of lower income groups who have improved their economic status, by working for several years in the oil-rich neighboring arab nations. Their savings are usually channeled to: starting a business to ensure continued improved economic status, and securing a dwelling. Sometimes both are combined in the same structure.

CHARACTERISTICS OF SETTLERS:

INCOME LEVELS: settlers in informal developments are generally of the lower income groups.

Owners' monthly cash income averages L.E.50.

Renters' monthly cash income averages L.E.45.

ORIGINS: about 30% of the settlers come from the villages around the locality. The rest are out-migrants form the overcrowded areas in Cairo and in-migrants from rural areas.

FAMILY SIZE: these differ in the case of owner and renter. Owners' families average 6.4 persons. Renters' families are smaller and average 4.9 persons.

DENSITY: Room occupancy is about 2 persons per room, this applies to both owners and renters. This is the result of the larger sizes of dwelling units the owners build for themselves as opposed to the smaller units they rent out.

FINANCING:

To buy a lot and start building, cash is required, this is provided in different ways:

Family savings, in the form of cash or jewelry.

Cash obtained from selling land owned by the family in their village of origin or in the locality itself.

Key money from prospective renters are used for financing expansion.
LAYOUT

The CONFIGURATION of the layout was dictated by the original agricultural land subdivision. This is evident when the locality plan (1976) and the original subdivision (1947) are compared (portions of each are shown to the right, see also pages 14-17). Location of public streets follow the existing pattern of the agricultural public roads.

AGRICULTURAL LAND SUBDIVISION is a product of inheritance. According to Islamic law, all heirs get a share of the heritage, a son inherits a share of the land equal to double that of a daughter. This resulted in unequal subdivisions. The whole process of subdivision is dynamic and does not occur simultaneously all over the locality, another reason for the difference in sizes. Each new lot division had access to an irrigation canal and a public road, both of which are usually contiguous. This produces linear plots of land, up to 400 meters long. Generation after generation, they were further subdivided into narrower ones. Some became as narrow as 15 meters.

As the locality became urbanized, some canals dried up. This added to the width of the roads contiguous to them. The diagrams below show how subdivision could have developed. The end result is the 1947 land subdivision plan (page 14).

AGRICULTURAL LAND SUBDIVISION DIAGRAMS (4 Stages)
LAND USE

ZONING REGULATIONS do not exist for this locality; this is true for all other informal settlements. There is no segregation of different uses, contrary to formal development zoning regulations (see page 13).

ECONOMIC ACTIVITY sprouts spontaneously wherever there is potential for its success. Such activity lines both sides of main roads. RETAIL stores are located along the internal large ones. WHOLESALE (usually building materials) and WORKSHOPS (auto repairs, window and door carpenters etc.) are located on the periphery, in general, along the paved roads, for easy transportation of goods. The main MARKET is located in a wide street parallel to the eastern boundary near the housing projects. Daily transportation of fresh products from the nearby villages is made possible via the paved Sporting Club street.

MOSQUES are quite abundant. They act as COMMUNITY CENTERS in addition to their being religious establishments. Members of the community organize various MUTUAL HELP projects through them. They are either incorporated in the first floor of buildings or are built, through mutual help, on vacant public land or on a site bought communally.

SCHOOLS are limited to one in the locality. At least 20 more are needed to serve the population of the locality. The schools in the nearby housing projects are used, though they are far beyond walking distances for a majority of the people.

Other COMMUNITY FACILITIES such as health centers, police and fire departments, post offices, banks etc., are not provided. Nearby facilities are used. These were acceptable in the early stages when the settlement was small, but local community facilities are required as the area grows further.
CIRCULATION

STREET FORMATION: Owners of agricultural land, when subdividing it for sale, have to provide access to each building lot. Streets are placed within the strip of agricultural land according to its width (see diagrams below).

MAIN STREETS vary in width from 10 to 30 meters. The wider ones result from the drying up of canals, the widths of which are added to the original roads.

SECONDARY STREETS formed by the land owners, are usually 4 or 5 meters wide. No encroachment occurs on such streets due to the high degree of social control in such a community.

TRANSPORTATION ROUTES are restricted to the paved streets on the periphery of the locality. No public transportation is provided, except for the bus stop located south of the housing projects. Micro-buses, run by individuals, have a regular route around the site, connecting it to the rest of the city. They are the only mode of transportation for most of the inhabitants, especially the ones far from the public housing projects. These vehicles charge 5 times as much as the subsidized public transportation in the rest of Cairo.

(Top) Main street: Vehicular circulation, to the left a micro-bus, the main mode of transportation is seen. (Bottom) Secondary street: Pedestrian circulation, used by the women for socializing and children for playing.

STREET FORMATION DIAGRAMS (4 Examples)

KEY

- STREET
- BUILT-UP AREA
- AGRICULTURAL PROPERTY LINES
UTILITIES

Utilities in the locality are substandard and provided by the inhabitants either individually or, sometimes, by communal efforts as follows:

WATER SUPPLY

Some of the dwellings on the eastern periphery of the site have been able to tap into the public water supply system serving the two public housing projects.

The remaining majority of the dwellings get their water either from HAND PUMPS, in central locations, or in the entrances of dwellings when possible. Seepage from sewage storage tanks pollutes such water since pipes connected to pumps are not dug deep enough. PUBLIC FOUNTAINS are provided by the government around the periphery of the site along the canal.

Water is carried by female members of the family, it usually takes 2-3 hours a day for this task to be fulfilled, by carrying it in metal containers called "bastilla", or it is bought from water vendors, called "saqqa" (if a man) or "mallaya" (if a woman), or from neighbors that have piped water.

SEWAGE DISPOSAL

Dwellings to the east of the site, as in the case of water supply, have been able to tap into the public water-borne sewage system.

For the remainder underground sewage holding TANKS called "khazzan" are dug by the owners in the street in front of their lot. These are placed parallel to the facade of the dwelling and are 4-5m long, 1.5-2m wide and 2m deep. They are lined with red brick and then plastered. Their cover is
CASE STUDY: EL-HOUNIRA, EMBABA

LOCALITY SEGMENT PLAN

LOCALITY CONSTRUCTION TYPES

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHACK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOOD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MASONRY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONCRETE</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Accurate

LOCALITY UTILITIES AND SERVICES

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<thead>
<tr>
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<tbody>
<tr>
<td>WATER SUPPLY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SANITARY SEWERAGE</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>STORM DRAINAGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRICITY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REFUSE COLLECTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUBLIC TRANSPORTATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAVED ROADS, WALKWAYS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELEPHONE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STREET LIGHTING</td>
<td></td>
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</tr>
</tbody>
</table>

LOCALITY COMMUNITY FACILITIES

<p>| | | | |</p>
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<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>POLICE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIRE PROTECTION</td>
<td></td>
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<tr>
<td>HEALTH</td>
<td></td>
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</tr>
<tr>
<td>SCHOOLS, PLAYGROUNDS</td>
<td></td>
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<td></td>
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<tr>
<td>RECREATION, OPEN SPACES</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: None, Limited, Adequate.

Quality of information: Accurate
either vaulted brick or reinforced concrete. They are sometimes higher than the street level to prevent vehicles from destroying them, but this prevents vehicular circulation in the streets. They cost about L.E.200.

When these tanks are filled the sewage—limited to toilet waste—is removed through a 60cm opening with a metal cover, by means of buckets or a mechanical suction car for a fee of L.E.30, this is done every 6 months (average) according to the number of units per building. All residents share this fee. Insufficient servicing, due to the high cost or the low number of cars servicing the area, causes overflowing in the streets, an unhealthy condition.

The sewage is then dumped in the canal located on the periphery of the site, another cause for unsanitary conditions.

Washing water (grey water) is disposed of in empty lots, nearby, or in the streets, especially in summer.

ELECTRICITY AND STREET LIGHTING.

ELECTRICITY is provided to most of the dwellings, either illegally and then accepted by the electric company or legally by the company initially.

STREET LIGHTING is not provided by the company, but this is taken care of by the inhabitants and shop-owners who leave a light on all night infront of their entrances for safety reasons.

GARBAGE COLLECTION

This is non-existent and garbage is dumped in vacant lots or near the canal. When traditional open air ovens are used to bake bread, the garbage is used as fuel, otherwise it is left and becomes a source of unhealthy conditions, insects plague the area.
BLOCK

BLOCK FORMATION: The influence of the original agricultural land subdivision is again evident in the formation of blocks in terms of shape and size. After creating streets to provide access to the lots (see page 30) the remaining land on either side is subdivided and sold as lots.

The block is generally formed by two rows of lots, from two contiguous agricultural plots, located back to back. Other configurations occur depending upon width of the agricultural plots (typical situations are shown in the diagrams below).

BLOCK CHARACTERISTICS: Blocks are generally long like the secondary streets that run parallel to them and quite narrow, varying from 12 to 20m in width. This has its effects on the circulation pattern as streets are too closely spaced without perpendicular streets to facilitate communication within the neighborhood.

(Top) A row of dwellings form a single loaded block
(Bottom) An agricultural plot subdivided into two rows of dwellings with a street in the center.

BLOCK FORMATION DIAGRAMS (4 Examples)
CASE STUDY: EL-MOUNIRA, EMBASSA

LAND UTILIZATION DIAGRAMS

PERCENTAGES
- Streets/Walkways: 18%
- Playgrounds: --%
- Cluster Courts: --%
- Dwellings/Lots: 88%

DENSITY
- 20 Persons/Hectare
- 1716 People/Hectare

LOCALITY BLOCK LAND UTILIZATION DATA

<table>
<thead>
<tr>
<th>AREAS</th>
<th>Hectares</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public (streets, walkways)</td>
<td>0.04</td>
<td>18%</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces, schools, community centers)</td>
<td>0.27</td>
<td>88%</td>
</tr>
<tr>
<td>PRIVATE (dwellings, shops, factories, lots)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0.31</td>
<td>100%</td>
</tr>
</tbody>
</table>

CIRCULATION EFFICIENCY
- 500 Meters/Hectare

LOCALITY BLOCK
- Network length (streets, walkways) = 500 m/ha
- Areas served (total area) = 100

DENSITIES
- Lots: 32
- Dwelling Units: 88
- People: 532

NET WORK EFFICIENCY
- Average area, dimensions = 82 m²
LOTS/DWELLINGS

LOTS differ according to the size desired by the buyer, about 80m in average (see lot size matrix page 23). The depth is fixed according to the width of the agricultural plot. The width of the facade is flexible and determined by the required lot area. Many of the larger lots have a facade longer than the depth of the lot, an uneconomic proportion. Prices in the 1960's were about L.E.4 and this escalated to about L.E.40-50 per m² in 1980.

DWELLINGS: About 80% of the owners live in their buildings. There are two types of dwellings according to the type of construction:

PROGRESSIVE (SMALLER STRUCTURES):

These are built in stages and are generally 2-3 stories high. The structure is of load bearing red brick walls with reinforced concrete floors. Sometimes the structure is built using a reinforced concrete skeleton with brick walls, columns are extended with each increase in height. Stages of construction are as follows:

1- Foundations are of ordinary concrete, from cement and old brick pieces. Then 2-3 rooms are built in red brick and covered by a temporary roof of palms, straw mats or corrugated tin. These are used as living and cooking quarters and a bathroom is also provided. The temporary roof is suitable for the initial stage as the weather conditions are favourable most of the year. The investment was about L.E.100-200 for this stage in 1977 according to the number of rooms built. A local mason usually builds this stage, sometimes with the help of the owners.
CASE STUDY: EL-MOUNIRA, EMBABA

PHYSICAL DATA

DWELLING UNIT
- Type: WALK-UP APARTMENTS
- Area (sq m): 96
- Tenure: RENTAL/OWNERSHIP

LAND/LOT
- Utilization: PRIVATE
- Area (sq m): 96
- Tenure: LEGAL OWNERSHIP

DWELLING DEVELOPMENT
- Location: PERIPHERY
- Type: WALK-UP
- Number of floors: 4
- Utilization: SINGLE/EXTENDED FAMILY
- Physical state: GOOD

MATERIALS
- Foundation: CONCRETE/BRICK
- Floors: TILES ON CONCRETE SLABS
- Walls: BRICK
- Roof: CONCRETE

DWELLING FACILITIES
- WC: 1
- Shower: 3
- Kitchen: 1
- Rooms: 4
- Other: BALCONY

SOCIO-ECONOMIC DATA

GENERAL: SOCIAL
- User's ethnic origin: SUNNI MUSLIM
- Place of birth: ASSIUT (UPPER EGYPT)
- Education level: LITERATE

NUMBER OF USERS
- Married: 2
- Single: 3
- Children: 4
- Total: 7

MIGRATION PATTERN
- Number of moves: 2
- Rural - Urban: 1954
- Urban - Rural: 1965
- Why came to urban area: EMPLOYMENT

GENERAL: ECONOMIC
- User's income group: LOW
- Employment: FACTORY EMPLOYEE
- Distance to work: 4 KM
- Mode of travel: BUS

COSTS
- Dwelling unit: N/A
- Land - Market value: US $165/m²

DWELLING UNIT PAYMENTS
- Financing: INITIAL KEY MONEY
- Rent/Mortgage: $65/MONTH
- % income for rent/mortgage: 15%
2- When enough money is saved a concrete roof is erected to replace the temporary one. This is done by a contractor at the cost of L.E. 400-500 (1977 prices) for a 60-80 m² dwelling, this is cheaper than the prices of formal construction. A second floor is then erected with a temporary roof as in stage one.

3- The second stage is repeated whenever more stories are required.

FINANCING additional stories are made possible by means of savings coupled with key money obtained in advance from prospective renters.

INSTANT (LARGER STRUCTURES):

At early stages of the settlement entrepreneurs, usually contractors, buy lots for speculation at key locations usually along main streets. When the area becomes inhabited and demand for apartments rises, the contractors erect their buildings, 4-6 stories high to cater to this demand. The construction is not staged as in the case of the progressive dwellings.

FINANCING is usually through profits earned from building dwellings for local dwellers, most of their investment is usually returned as soon as tenants move into their apartments in the form of key money.

RENT: Although rent control committees come to newly built walk-ups to make rent estimates, no one abides by their decision. Owners set rents based on the real costs and the tenants acknowledging that, pay accordingly. Rent is usually L.E. 2-3 per room per month, while the rent committees set rents at a low L.E. 3-4 per apartment.
CASE STUDY OBSERVATIONS

Informal settlements seem to quench the demand for housing more effectively than the public housing projects. This is because of the nature of the process of informal urbanization.

URBANIZATION PROCESS:

The positive factors related to informal settlements are summarized as follows:
- No subsidies are required by informal settlements. Even if services were provided and subsidized by the government, they would be minimal compared to the costs of providing completely finished 4-5 story walk-ups in the public housing developments.
- The quality of construction and maintenance are high because the users are totally involved with solving their own housing problem.
- Building costs, rents, etc., are all set according to supply and demand. This has functioned well as opposed to the formal housing market where controls have caused problems.

The physical aspects of a settlement could be discussed as two related components: land subdivision and construction.

LAND SUBDIVISION:

The key factor influencing the layout of an informal settlement is the original agricultural land subdivision.

Informal settlements are formed when several farmers start selling their plots after subdividing them, each individually, to prospective settlers. The resulting final layout is formed by many individual decisions taken at low levels confined to the agricultural plot scale.

As a result, these settlements suffer from several drawbacks that occur in different scales, these are summarized as follows:

LAND USE: Facilities: such as schools are lacking in such settlements since farmers sell all the land in the form of lots except for the access streets.

STREETS: Narrow: (4-5m) due to maximizing lot sizes.
Unpaved: with high, obstructive sewage tanks.
Long: (300-400m sometimes) without streets to shorten the walking distances in the perpendicular direction, providing them implies eliminating 2 lots.
Frequent: in one direction due to the narrowness of original plots. (circulation efficiency is a high 500m/ha).

BLOCKS: Narrow: affecting lot depths.
Long: (300-4-5m) affecting circulation.

LOTS: Squarish: proportions are squarish or the facade is sometimes longer than the depth of the lot, an uneconomic proportion.

CONSTRUCTION:

The process of construction which is a combination of two different types: the incremental and the instant meet the different needs of the prospective dwellers of these settlements.

TYPES OF CONSTRUCTION: The reinforced concrete structures and the load bearing wall construction dwellings are comparable to formal construction systems, they only lack elaborate finishings, which do not affect sturdiness.

STANDARDS: These are suitable for the lower income groups' needs. Official standards are far too high for them.

FINANCING: Since the process of building is self-financed by the settlers no government funding is needed. High initial financing and subsidies, needed in public housing projects are totally eliminated.
The high percentage (76%) of informal construction in Cairo for the past several years has imposed itself as a reality, and has proved itself capable of housing large numbers of the lower income groups.

These settlements were officially ignored, at first, but have been recognized recently. Official reaction to informal developments remains unclear, because such settlements involve the following three conflicting issues:
1- Potential solution for housing lower income groups.
2- Loss of scarce agricultural land.
3- Unplanned settlements.

Acknowledging the fact that the informal settlements should be viewed as a potential solution for housing lower income groups, sets the premises for investigating the possibilities and potentialities of making maximum use of this popular effort. Channeling such effort in a legal framework and gearing it to contribute to solving the housing problem is recommended.

The inevitable further expansion of Cairo raises two main questions related to: location and mode of expansion.

**POTENTIAL GROWTH LOCATIONS:** Different alternatives should be pondered. These could be categorized as follows: satellites, suburbs on desert and agricultural land.

**MODE OF EXPANSION:** A set of recommendations based on maintaining the positive aspects of informal settlements and overcoming their drawbacks are suggested.

The positive aspects of these settlements are summarized as follows: Sturdy construction free of any government subsidies. At the scale of a dwelling its users are best suited for decision making and implementation.

The negative aspects are related to LAND SUBDIVISION. This is because it takes place on a small scale and the overall result has many drawbacks that appear in land use, circulation, land utilization, circulation, blocks and lots.
POTENTIAL GROWTH LOCATIONS

Informal urbanization is primarily responsible for the loss of scarce agricultural land. In the case of Cairo the alternatives considered for growth are summarized as follows:

SATELLITES:

Three satellites around Cairo on desert land are being planned to absorb excess population growth and to divert the expansion of the capital away from the agricultural land around it in the north and west.

The proposed satellites, El-Amal, El-Obour, and the 6th of October, are proposed to house less than 3 million in total by the time they reach their designated full size in 50 years. Population of Cairo is expected to exceed 21 million by the year 2000, an increase of 13 million over the 1978 population. This implies that 10 million are not covered by the satellite program.

SUBURBS ON DESERT LAND:

Suburbs around Cairo on desert sites, expanding formally such as Madinet Nasr or Heliopolis, are aimed for higher income groups as codes and regulations set high standards (see page 13).

Helwan to the south, is an isolated case of a settlement for industrial workers, but again this is confined to a specific category of people. This settlement implies high subsidies burdening the government.

SUBURBS ON AGRICULTURAL LAND:

Loss of agricultural land has been a controversial issue for the past several years. A law was issued prohibiting the conversion of agricultural land, within the city limits to urbanized areas. The overpowering pressure resulting from demand for housing by the increasing population resulted in the violation of this law, all around Cairo. Large informal settlements are the living evidence of this violation.

A fundamental question should be raised at this point in time, to tackle this problem: should all building on agricultural land be banned?

To answer this question, the reasons for conserving agricultural land should be reviewed.

Conserving agricultural land has been called for as a result of its scarcity in Egypt, coupled with its perpetual decrease as a result of loss to urbanization. The nation has become a net importer of foodstuffs as opposed to its having been a net exporter, this is a result of the increase in population as well.

It has been demonstrated that the motivation to convert agricultural land into informal settlements is bifold: the farmers and prospective settlers are equally eager to sell and buy agricultural land (see page 25).

Firstly the farmers cannot cultivate the small plots they inherit as a result of the small subdivisions resulting from larger original plots. Consequently they are motivated to sell their land.

Secondly the prospective builders pressed by their urgent demand for a lot to build their dwellings offer attractive sums of money to the farmers.

To preserve the agricultural land, the government could buy it and consolidate all the small plots into larger areas which could be cultivated more efficiently. This would also ensure that no more land will be urbanized.

Wheaton (48) argues that it is even more profitable to urbanize the fringe of agricultural land around Cairo. Newly reclaimed desert land could replace agricultural land lost to urbanization.

LOCATION RECOMMENDATIONS

In view of the three alternatives discussed above the following is recommended:

SATELLITES:

The satellite program could help curbing a small percentage of Cairo's growth. In case of their success, they could be expanded to accommodate a larger portion of the expected
population growth and more such satellites could be implemented.

**SUBURBS ON DESERT LAND:**

These should be planned to accommodate lower income groups. These should be made comparable to agricultural land to ensure their success in attracting settlers. This could be achieved as follows by providing:

- **SERVICES** as a substitution for the availability of subterranean water in agricultural land
- **TRANSPORTATION** (which could be subsidized) as a compensation for the far location of desert sites from employment locations.

**SUBURBS ON AGRICULTURAL LAND:**

It has been demonstrated that new satellites will not, in isolation, solve the problem of housing the increase in population. Satellites coupled with the subordinating alternative of serviced suburbs on desert land will not be effective in the immediate future, since this involves several years of initial work, and time is needed for them to grow and effectively act as magnets for the increasing population.

This means that if no action would be taken immediately, to be implemented parallel to the preparation of the two above-mentioned alternatives, Cairo will suffer additional loss of agricultural land to informal settlements.

To counteract this, all informal settlements should be surveyed and a new boundary for the city limits should be drawn incorporating areas that could not be cultivated successfully because of their small size, propinquity to built-up areas, low fertility and productivity. These areas could be added to the city, therefore providing more land for development. Such areas should be planned and provided with services to house potential informal settlers.

These new areas together with increasing the density in the already built-up areas (see growth matrix pages 20-21) should suffice to cover the demand until the time the other alternative solutions are implemented and effective.

**MODE OF EXPANSION**

The mode of expansion implies the quality and mechanics of urbanization inherent in informal settlements. These will be discussed with respect to the existing settlements for which **UPGRADING** is recommended, and future expansion for which **GUIDELINES** are proposed.

**UPGRADING**

Existing settlements should be accepted, legalized and upgraded as it would be impractical to continue ignoring them or contemplate removing them, which is an uneconomic task. The government has already taken steps in that direction and water and sewage networks are being designed for some of these settlements.

Efforts should be made to achieve upgrading in a more comprehensive way as community facilities should be provided to improve the overall environment of the settlements.

Recommendation for upgrading are given on page 46-47.

**GUIDELINES FOR FURTHER DEVELOPMENTS**

Guidelines should be set for further developments to make the best use of the informal sector's popular effort. These guidelines are aimed at eliminating the drawbacks and to further the positive aspects related to such settlements.

Ideally, land consolidation and planning the new settlements would be recommended. This, in practical terms, is not a viable solution as it involves increased intervention by centralized administrations, the fact that defeats the very purpose, as it increases costs and that would make such settlements beyond the reach of the lower income groups.

Agricultural land subdivision is the key factor affecting all the aspects of the layout (as shown in the case study). It is therefore imperative to realize this and to proceed taking this into consideration.

Minimum consolidation, however, is required to provide
community facilities, especially schools. Their location should be decided upon and chosen with respect to each locality as a whole.

RECOMMENDATION TABLES

Recommendations guiding further growth are given in the table of the next two pages.

The table consists of 6 columns as follows:

1- ISSUES/ELEMENTS: related to informal settlements.
2- OBSERVATIONS ON CASE STUDY: related to each of the issues/elements in (1) are categorized as positive and negative aspects.
3- UPGRADING GUIDELINES: for the existing settlements are recommended wherever possible.
4- RECOMMENDED GUIDELINES FOR FURTHER GROWTH: are suggested related to each issue/element.
5- EXISTING SITUATION: is depicted in a diagram of part of the settlement, used from the case study, illustrating the observations mentioned in column (2).
6- IMPROVED LAYOUT: is shown in a diagram of the same portion of the segment in column (5).

The use of the same portion of the segment to illustrate the improved layout is just for comparative reasons, as such changes could not be implemented on existing settlements, they could only be applied to new developments that have similar conditions. Minimal changes are recommended retaining the agricultural subdivisions as they are.

It could be seen that all the major drawbacks illustrated in column (2) are eliminated by using the few guidelines recommended in column (4).

This table is followed by two pages showing the overall effect of using these guidelines on a larger scale (page 49) and these are contrasted with the existing situation (page 48). Land utilization, lot density and circulation efficiency are compared in chart form for each. These show how the improved layout supersedes the existing one.

UTILITIES:

A table for recommendations guiding utilities is shown on pages 50-51. This table has the same columns as the previous one, explained above and it is also followed by two pages demonstrating how utilities are provided more efficiently and economically in the case of the improved layout.

Only water supply is illustrated as an upgrading project has been designed for the case study locality (49). A segment is chosen and contrasted with the improved layout. The upgrading could not be done otherwise as the layout sets many constraints. These could only be eliminated in areas that will be developed in the future.

Savings are reflected in the sizes and lengths of pipes used in the improved layout scheme. Upgrading is penalized because of the length of the streets (pipes have to be increased in diameter to minimize head loss).

Other infrastructure networks could be, likewise, more efficient as a result of having a more efficient layout.

The proposed improvements done in the layout give the possibility of providing all infrastructure in stages: this could be done by providing such services in the streets only, which have been minimized, while the inhabitants could provide them in condominium by means of mutual help in their shared courts. The existing layout does not facilitate this and all the infrastructure network has to be provided in one stage.

The SHARES COURTS "HARAH" (50) recommended as a replacement for public streets provide the possibility of segregating responsibilities, as the public sector is responsible of the public areas only, while the users have maximized control and responsibility in maintaining their environment. This implies also the provision of infrastructure in these courts since the provision of waterborne-sewage for example costs nearly the same as providing a sewage storage tank.
# LAND SUBDIVISION RECOMMENDATION TABLE

<table>
<thead>
<tr>
<th>ISSUES/ELEMENTS</th>
<th>POSITIVE ASPECTS</th>
<th>NEGATIVE ASPECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development</td>
<td>Centralized administration costs are eliminated.</td>
<td>No planning is done on the locality level.</td>
</tr>
<tr>
<td>Land Use</td>
<td>Mixed uses help families increase their incomes and employment is created. Mosques are abundant and used as community centers.</td>
<td>No community facilities are provided such as schools, health centers, police, fire stations, etc.</td>
</tr>
<tr>
<td>Land Utilization</td>
<td>Public land is minimized. Private land is maximized.</td>
<td>Semi-public land is non-existent (community facilities). Semi-private land is nearly non-existent.</td>
</tr>
<tr>
<td>Circulation</td>
<td>Gridiron layout: no segregation of lines of circulation and lines of access as all the streets are public. Narrow streets, 4m, are not easily used by vehicles in emergencies. Sewage tank covers obstruct vehicular circulation. Long streets, up to 400m some times are not subordinated by perpendicular streets to shorten circulation lengths.</td>
<td>Narrow affecting lot sizes. Long affecting circulation. Proportions are uneconomic: depth is less than frontage.</td>
</tr>
</tbody>
</table>

## UPGRADED GUIDELINES

- Physical change is nearly impossible after the settlement is established.
- No land use regulations needed.
- Vacant areas in central locations should be identified and bought from farmers for community facilities, which should be assigned to each area according to needs.
- Changing land utilization is very difficult when the settlement is developed. Semi-public land should be provided, as mentioned above.
- No physical change can be implemented to improve the circulation layout.
- Paving streets could be possible after infrastructure is provided and obstructing sewage tanks are removed.
- No change possible.
- No change possible, infrastructure lengths are increased because of lot proportions.
- No intervention is required with the dwellings, no change is needed.
Guidelines for the development of settlements are recommended. 
Agricultural land subdivision should be taken in consideration.
Mixed land use should be encouraged.
Areas should be allotted to community facilities such as schools etc. These should be bought from their owners, the farmers. This would ensure the appropriate location of facilities with respect to the rest of the community.
The layout could be improved if semi-private and semi-public areas are provided.
The use of a grid layout as opposed to a gridiron one would achieve this more effectively.

Grid layout: segregation of lines of circulation and lines of access should be aimed for. Access is provided via dead end streets (shared courts "harah") which have a limited number of users (their inhabitants). These should not exceed 100m in length for safety (fire fighting).
Street widths could be increased if every two landowners of contiguous agricultural plots placed their streets on one shared side providing lots on the other. Streets would be 8m wide instead of 4m. The same area of streets is maintained within each plot not penalizing landowners.
Street lengths should not exceed 200m. In cases where the agricultural land plots are longer than 200m a secondary street, perpendicular to the plot should be provided to achieve an efficient layout in terms of circulation.

Using a grid layout creates larger blocks resulting in a more efficient layout.

Depth of lots are increased by placing the streets on one side of the agricultural plot.

Building regulations should be altered and standards should be reduced to meet the needs and means of the users.
**Utilization Diagrams**

- 1 Hectare

**Percentages**

- Streets/Walkways: 23%
- Playgrounds: -%
- Cluster Courts: 4%
- Dwellings/Lots: 73%

**Density**

- Lots/Hectare: 88.8

**Circulation Efficiency**

- Unit Length: m/ha 500

**Segment Land Utilization Data**

<table>
<thead>
<tr>
<th>Densities</th>
<th>Total Number</th>
<th>Area Hectares</th>
<th>Density Lots/Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOTS</td>
<td>1288</td>
<td>14.5</td>
<td>88.8</td>
</tr>
</tbody>
</table>

**Areas**

| Public (streets, walkways, open spaces) | 3.3 | 23%
| SEMI-PUBLIC (open spaces, schools, community centers) | - | -
| PRIVATE (dwellings, shops, factories, lots) | 10.6 | 73%
| SEMI-PRIVATE (cluster courts) | 0.6 | 4%
| TOTAL | 14.5 | 100%

**Network Efficiency**

- Network Length (streets, walkways) = 500 m/ha
- Areas served (total area)

**Lots**

- Average area, dimensions = 82 m²

**Existing Layout**

- Public: streets/walkways
- Semi-Private: cluster courts
- Private: lots

1:2500
SEGMENT LAND UTILIZATION DATA

DENSITIES

<table>
<thead>
<tr>
<th>Lots</th>
<th>Total Number</th>
<th>Area Hectares</th>
<th>Density H/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>1260</td>
<td>14.5</td>
<td>86.8</td>
<td></td>
</tr>
</tbody>
</table>

AREAS

<table>
<thead>
<tr>
<th>Areas Description</th>
<th>Hectares</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways, open spaces)</td>
<td>2.5</td>
<td>17.3</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open space, schools, community centers)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PRIVATE (dwellings, shops, factories, lots)</td>
<td>9.8</td>
<td>67.5</td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>2.2</td>
<td>15.2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>14.5</td>
<td>100%</td>
</tr>
</tbody>
</table>

NETWORK EFFICIENCY

<table>
<thead>
<tr>
<th>Network length (streets, walkways)</th>
<th>147 m/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas served (total area)</td>
<td></td>
</tr>
<tr>
<td>LOTS</td>
<td></td>
</tr>
<tr>
<td>Average area, dimensions</td>
<td>~ 78 m²</td>
</tr>
</tbody>
</table>
## SERVICES RECOMMENDATION TABLE

<table>
<thead>
<tr>
<th>UTILITY</th>
<th>OBSERVATIONS ON CASE STUDY</th>
<th>NEGATIVE ASPECTS</th>
<th>UPGRADE GUIDELINES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water supply</strong></td>
<td>Piped water supply is provided to the dwellings on the periphery only.</td>
<td>Water fountains are supplied on the periphery of the site only. Walking distances are very long for some areas of the site. Pump water is polluted by the seepage from sewage storage tanks.</td>
<td>Piped water should be supplied to the dwellings that lack it (a project has been designed for providing such a service). Pipes used for providing such a service should be large in diameter as a result of the long street lengths (to reduce head-loss). All the pipelines should be provided by the government in one stage.</td>
</tr>
<tr>
<td><strong>Sewage disposal</strong></td>
<td>Sewage storage tanks are independent of the city sewer system (an on site sewage disposal system). No centralized system is involved. This is adequate until piped water is supplied to the whole site.</td>
<td>Sewage removal from tanks is not as frequent as needed, resulting in unhygienic conditions.</td>
<td>Water-borne sewage should be provided. Sewage pipes have to be large in diameter since long streets are dictated by the layout. Water-borne sewage would solve overflowing problems.</td>
</tr>
<tr>
<td><strong>Electricity &amp; street lighting</strong></td>
<td>Electricity is provided to most of the dwellings. Street lighting is provided by the dwelling/shop owners.</td>
<td>Cables providing electricity run on street surfaces, this is a source of danger especially when sewage overflows.</td>
<td>Proper placement of cables is important to eliminate hazards. Street lighting should be provided where needed.</td>
</tr>
<tr>
<td><strong>Garbage collection</strong></td>
<td>Garbage collection is non-existent. Garbage is dumped in vacant lots and near the canals around the site. This creates serious health hazards.</td>
<td>Garbage collection should be provided. This will be a tedious and expensive task, as it has to be collected from each dwelling individually.</td>
<td></td>
</tr>
</tbody>
</table>
RECOMMENDED GUIDELINES FOR FURTHER GROWTH

Improved layout provides the chance to create smaller loops from which water supply pipes could be extended in the dead-end shared courts, these could be reduced in diameter as opposed to the pipes used in upgrading the existing areas. The overall street lengths in the improved layout are much less than those in the existing one, infrastructure lengths are a function of these street lengths.

Sewage disposal should be taken care of using the water-borne system. This will be implemented more economically in the improved layout compared to the existing one, as in the case of the water supply network.

The gridiron layout used in the improved layout identifies the streets in which street lighting should be provided by the government. These streets have been minimized which will bring down overall costs. Street lighting in the shared court should be provided by its residents in condominium.

Each condominium could have a point for placing garbage at its entrance on the street. This will facilitate garbage collection, and bring down maintenance costs.
WATER SUPPLY

KEY
- 10" PIPE
- 6" PIPE
- 4" PIPE
- 2" PIPE
- VALVE

EXISTING LAYOUT
<table>
<thead>
<tr>
<th>Pipes</th>
<th>Existing Length</th>
<th>Improved Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>355</td>
<td>2955</td>
</tr>
<tr>
<td>4&quot;</td>
<td>4350</td>
<td>3585</td>
</tr>
<tr>
<td>6&quot;</td>
<td>2310</td>
<td>1105</td>
</tr>
<tr>
<td>10&quot;</td>
<td>255</td>
<td>255</td>
</tr>
<tr>
<td>Total</td>
<td>7265m</td>
<td>5900m</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valves</th>
<th>Existing Number</th>
<th>Improved Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot;</td>
<td>--</td>
<td>20</td>
</tr>
<tr>
<td>4&quot;</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>6&quot;</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>10&quot;</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>37</td>
</tr>
</tbody>
</table>
CONCLUSIONS

Informal settlements constitute an undeniably high percentage of the housing produced in Cairo today.

The escalating demand for shelter, high standards dictated by zoning, land subdivision, and building codes combined; have contributed to the inaccessibility of housing to the lower income groups in Cairo.

In response, the informal sector started to solve their problem independent of the official housing framework. Agricultural landowners, eager to sell their land for high profits, started subdividing their plots into small lots which became available to lower income groups. The development of such areas takes place informally, as settlers evade all regulations that require high standards and tailor their environments and dwellings to suit their needs and means.

The investigation of a representative informal settlement revealed its positive and negative aspects.

CONSTRUCTION is sturdy and the owners considering their dwelling an investment and a means of providing housing for their families, are proud of their structures and do their best to improve and maintain them as more funds become available to them. Flexibility, the possibility of expansion and the total independence of subsidies are some of the positive aspects related to such settlements.

LAND SUBDIVISION on the other hand, is the main problem related to informal housing. Since the development takes place, based on decisions taken individually by agricultural landowners, the final layout lacks elements that should be provided based on a comprehensive overall framework. Community facilities such as schools are lacking as a result of the mode by which the layout is formed. Circulation network is inefficient and cannot cope with situations of emergency when they arise. Blocks are uneconomic in proportion.

It is recommended to accept and upgrade the existing informal settlements.

Guidelines for further settlements are suggested in terms of location (agricultural or desert land) and in terms of improving their layouts and preventing them from falling into the same pitfalls their existing counterparts are suffering from.

Agricultural areas that are either uneconomically cultivated, or have become less productive, should be identified in the areas with potential for the inevitable growth of Cairo. A new boundary could then be conceived for the capital city. Growth in these areas should be guided with the minimum possible intervention from centralized administrative bodies.

Alternatives for Cairo's growth on desert sites, such as suburbs or satellites, should be seriously considered. Lower income groups should be taken into consideration in such extensions of the city.

STANDARDS regulating urbanization should be revised to meet the needs of lower income groups.

The informal sector could thus be incorporated in this revised, realistic, legal framework so that their efforts could contribute formally to the housing supply of Cairo.
APPENDIX

NOTES

1. From table by the A.I.D. Office, Cairo, August 1978.
3. Goethert and Shafei, 1979, LANDSAT Analysis for 1973 & 1978. During these 5 years the increase of 58.92 sq. km of built-up area was analysed according to the type of land it took place on: 76% of the urban growth took place on agricultural land.
5. Abd El Dayem, Characteristics of internal migrants.
10. Ibid., p.98.
11. Area Handbook for Egypt, p.73.
12. Ibid.
17. El Foully, How to Control the Growth of Cairo, (paper, MIT).
19. Abd El Dayem, Characteristics of Internal Migrants.
20. Ibid.
21. Ibid.
22. Ibid.
23. For background information of Cairo see Appendix, Urban Form for background of Cairo see Appendix, Urban Context.
28. TAP Report 78-3, p.3.
29. Ibid., p.3.
33. See case study introduction.
34. Barrada, International Youth Congress, 1979, (address).
35. TAP Report 78-3, p.2.
36. The term "informal housing" was first given to such housing by Dr. M. Serageldin in the "Housing and Community Upgrading for low Income Egyptians" report, 1977.
37. See note No.3.
38. Law No.29 of 1966.
39. The majority of lower income groups originate from rural areas.
40. Zoning regulations regarding industrial areas, Law No.28 of 1949, requires segregating industrial areas from residential ones. Although there are no regulations regarding retail activities, in some areas it is impossible to have shops due to setback requirements by building codes.
41. Subdivision of lands for construction, Law No.52 of 1940.
42. Law No.106 of 1976.
43. Area measured by author from 1976 air photograph, using a planimeter, population obtained from 1976 unpublished census.
44. Made available by Goethert, MIT.
45. Field study by author, summer 1980.
46. Field study sources: (quality of information is mentioned between brackets)
   Air photographs: Goethert, Cairo Univ./M.I.T. Joint Research Team.
   Locality Growth Plan: (Accurate) based on air photographs.
   Land Use Plan: (Approximate) Field Survey by author.
   Circulation Plan: (Approximate) Ibid.
   Segment Plan: (Accurate) Enlarged Air Photograph.
   Block Plan: (Accurate) Ibid.
   Typical Dwelling: (Accurate) Measure drawings by author.
   Physical Data: (Approximate) Field Survey.
   Other Information: Field Survey by author, summer 1980.
49. Metered Water Service Connections Program ES-Parsons, ECG-Cairo prepared for the General Organization for Greater Cairo water supply A.R.E.
50. A harah is a traditional form of dead end streets found in abundance in Fatimid Cairo, and in most of the villages. This physical form reflects the social relationships between the lower income groups of Egypt, it should be incorporated in any land subdivision for such groups.
Large scale industrialisation in the 1920's. Large scale industrialisation started after the 1952 revolution. In addition to the production of iron and steel, consumer goods, such as cars, refrigerators, etc. are made. Especially since 1952 the output of a variety of smaller consumer goods has been increased.

GOVERNMENT: In 1960 law established a ministerial council for Cairo presided over by the governor. The governorate (Mukhabat) of Cairo is one of 25 major districts into which Egypt is administratively divided. It is the seat of a highly centralized national government which maintains financial control over local programmes and budgets.

DEMOGRAPHY: Cairo houses 23 percent (29 in 1976) of the entire population of Egypt. Annual rate of increase is about 4 percent. The percentage of dependent population (below 12 years and above 65 years) is 19.6 percent. Most of the migrants to Cairo are in their productive years.

SOCIO-CULTURAL: Previously diverse, ethnically and religiously, Cairo's population is now becoming increasingly homogeneous, about 92% are Sunni Muslims, the remainder being chiefly Coptic Christians. Only a small portion are Catholic or Protestant from European origin and a tiny fragment of an ancient Jewish community remains. Today, differences of status within the Egyptian population depend largely on place of origin (one third of Cairo's residents were born in rural Egyptian class) and degree of modernity.

SOCIO-ECONOMIC: The lowest income sector is concentrated in the Fatimid traditional sectors of Cairo as well as in the informal settlements around the capital; they constitute about 60% of the total population. Upper income sectors are concentrated in the central areas and in some suburbs such as Maadi, Helopolis and Maadi New.

U R B A N C O N T E X T

PRIMARY INFORMATION: Cairo (Al-Qahira), with built-up area 264 sq.km., stands on the banks of the Nile, on Latitude 37° North and Longitude 25.2° East.

The climate is characterized by a two season year, long hours of blazing sunshine and rare rainfall (2.5 cm a year). Winter between November and April is cool (9-20.4 degree Centigrade). Summer, April to October, is hot (21-38.2 degree Centigrade). Typical of desert climate, there is a wide daily variation of temperature, nights are distinctively cooler than the day time, which is true for summer as well as winter.

During March-April or May a hot driving south-east dust storm known as the Khamsaen blows through the country. It is known to cause the temperature by 15°C in two hours.

HISTORY: The seed from which Contemporary Cairo sprang was the town of Fustat, founded by Abu 'Ubada ibn Al-Ashur, commander of the Arab who brought Islam to Egypt. Successor dynasties added royal suburbs to the increasingly prosperous commercial and industrial port city of El-Fustat. Today little remains of these early developments in the southern part of the city. In 969 adherents of a dissident Islamic sect, the Fatimids, invaded Egypt. The conquering general Jawhar, established a new rectangular walled city northeast of existing settlements in El-Fustat. Initially named Al-Mansuriyah, the city was renamed 'Al Qahira' in 973-974 when the Fatimid Caliph Al-Ma'mun made it the capital of a dynasty that lasted for 100 years.

In 1260 Bybars I became first Mamluk Sultan and served as the capital of the Mamluk empire which governed Egypt and the fertile crescent until 1517. In 1837, Cairo lost its political autonomy to the conquering Turks, who reduced Cairo to a provincial capital. Between 1798 and 1801, Napoleon invaded Egypt, and the Turks returned after Napoleon's defeat. In 1865, Muhammad Ali, commander of an Albanian contingent, was appointed Viceroy, thus founding the dynasty that ruled Egypt until his great-grandson, Farouk I abdicated in 1952.

ECONOMY: From its inception the economy of Cairo has been based on governmental functions, commerce, trade and industrial production. The modern production sector expanded dramatically in the 1920's. Large scale industrialisation started after the 1952 revolution. In addition to the production of iron and steel, consumer goods, such as cars, refrigerators, etc. are made. Especially since 1952 the output of a variety of smaller consumer goods has been increased.

GOVERNMENT: In 1960 law established a ministerial council for Cairo presided over by the governor. The governorate (Mukhabat) of Cairo is one of 25 major districts into which Egypt is administratively divided. It is the seat of a highly centralized national government which maintains financial control over local programmes and budgets.

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U R B A N D E V E L O P M E N T: Cairo is fan-shaped, narrowest in the south, where the river valley is wedged between desert escarpments, widest in the north where the valley blends into the Delta. Expansion into the desert is blocked by terrain and by the expense of irrigation. Over the centuries the city grew toward the river channel. Recently, however under the stimulus of industrial development, the city has been elongating north and south.
GLOSSARY

The criteria for the preparation of the definitions have been as follows: 
- Second Preference: definitions from technical dic-
tionaries. 
- Third Preference: definitions from the Urban Design Project (U.S.D.P.) Files. They are used when existing sources were not quite appropriate or satisfactory. 

Terms included for specificity and to focus on a particular context are indicated in parenthesis. Sources of definitions are indicated in paren-
thesis. (See also: REFERENCES).

ACCESS. The pedestrian/vehicular linkages from to the site to/from existing or planned approaches (urban streets, limited access highways, public transportation systems, and other systems such as: waterways, airways, etc.) (U.S.D.P.)

ACTUAL LAND COST. "The cost of land is..., set solely by the level of demand. The price of land is not a function of any cost conditions; it is set by the users themselves in competition." (Sharon, 1971)

AIR VALUATION (TAX). A tax based on a property's value; the value taxed by local governments is not always or even usually the value of the property, but only a valuation for tax purposes. (U.S.D.P.)

AIRPORT DISTURBANCE. The set or process of destroying the rest, tranquillity, or settled state of (the site by the annoyance of airport noise, vibration, hazards, etc.) (Merriam-Webster, 1971)

AIRPORT ZONING RESTRICTIONS. The regulation of the height or type of structures in the path of moving aircraft. (Morris, 1971)

ALTERNATING CURRENT (A.C.). An electric current that reverses its direction of flow at regular intervals. (N.O.C. ST 45-7, 1953)

AMENITY. Something that conduces to physical or ma-
terial comfort or convenience, or which contributes satisfaction rather than monetary income to its owner. (Merriam-Webster, 1971)

AMPERE (amp). A measure of the rate of flow of electricity. It is somewhat comparable to the rate of flow of water (quantity/time). A steady current of one ampere will produce one calorie of heat per square centimeter of water in one hour. (N.O.C. ST 45-7, 1953)

APPRAISAL. An estimate and opinion of value, espe-
cially by one fitted to judge. (Merriam-Webster, 1971)

APPROACHES. The main routes external to the site (pedestrian/vehicular) by which the site can be reached from other parts of the urban context. (U.S.D.P.)

ASSESS VALUE. A valuation placed upon property by a public officer or board as a basis for taxation. (Kaye, 1971)

ASSESSMENT. The valuation of property for the pur-
pose of levying a tax or the amount of the tax levied. (Kaye, 1971)

BACKFILL. Earth or other material used to replace material removed during construction, such as in culvert, sanitary sewer, and other trenches and behind bridge abutments and retaining walls or between an old structure and a new lining. (Deffen, 1972)

BARRIER. A (boundary) as a topographic feature or a physical obstacle impeding the movement or travel of persons or vehicles from one side or area to another. (Scribner, 1971)

BETTERMENT (TAX). A tax on the increment in value accruing to an owner because of development and im-
provement work carried out by local authorities. (U.S.D.P.)

BINDER COURSE. A transitional layer of bituminous paving between the base and stone base and the sur-
face course (to increase equality between base and sur-
face course). (Deffen, 1972)

BITUMINOUS. A coating of or containing bitumen; as asphalt pavement. (Merriam-Webster, 1971)

BLICK. A block is a portion of land bounded and served by lines of public streets. (U.S.D.P.)

BOUNDSOM. Something (a line or area) that fixes or indicates a limit or extent of the site. (Merriam-
Webster, 1971)

BUILDING CODE. A body of legislative regulations or by-laws that provide minimum standards to safeguard life or limb, health, property, and public welfare by regulating and controlling the design, construction, quality of building materials, location and maintenance of all buildings and structures within the city, and any development specifically regulated therein. (ROTC ST 1967)

BUILDING DRAIN. lowest horizontal piping of the building drainage system exempting discharge from such as raw, waste, and sewage water, from pipes. It is con-
ected to the building sewer. (N.O.C. ST 45-7, 1953)

BUILDING MAIN. Water-supply pipe and fittings from the water main or other source of supply to the first branch of the water-distribution system of a building. (N.O.C. ST 45-7, 1953)

CESS POOL. An underground catch basin that is used where there is no sewer and into which household wastes and some liquid wastes is drained to permit leaching of the liquid into the surrounding soil. (Merriam-Webster, 1971)

CIRCULATION. System(s) of movement/passage of people, goods from point to place, streets, walkways, parking areas. (U.S.D.P.)

CLAY. A latticeless colloidal substance, plastic when moist (crystalline grains less than 0.002mm in diam-
eter). (U.S.D.P.)

CLEANOUT. A plug or similar fitting to permit access to traps or new lines. Cleanouts are usually used at turns and other points of collection. (N.O.C. ST 45-7, 1953)

CLIMATE. The average condition of the weather at a particular place for a long period of years as exhibited by temperature, wind, precipitation, sun energy, humidity, etc. (Merriam-Webster, 1971)

COLLECTION SYSTEM. The system of pipes in a sewage network, comprised of house service, collection lines, manholes, laterals, mains. (U.S.D.P.)

COMBINED SEWER. A sewer that carries both storm water and sanitary or industrial wastes. (Deffen, 1972)

COMMUNITY. The people living in a particular place or region and usually linked by common interests; the region itself; any population cluster. (U.S.D.P.)

COMMUNITY FACILITIES/SERVICES. Facilities/services used in common by a number of people. It includes: schools, health, hospital, police, fire, public transportation, community center, etc. (U.S.D.P.)

COMMUNITY RECREATION FACILITIES. Facilities for ac-
tivities voluntarily undertaken for pleasure, fun, relaxation, exercise, which are carried out in order to avoid boredom, worry, or tension. (U.S.D.P.)

COMPONENT. A constituent part of the utility network. (U.S.D.P.)

CONDOMINIUM. A form of ownership wherein the owner of each dwelling unit has complete ownership of his unit and shares in the ownership and can use its supporting utilities, ser-
vice, and community facilities. (U.S.D.P.)

DIRECT CURRENT (D.C.). An electric current that flows in one direction. (N.O.C. ST 45-7, 1953)

DISCHARGE (Q). Flow from a culvert, sewer, channel, etc. (N.O.P.)

DISTANCE. The degree or amount of separation between two points (the site and each other element of the urban context) measured along the shortest path or joining them (paths of travel). (Merriam-Webster, 1971)

DISTRIBUTION SYSTEMS. The part of an electric sup-
ply system between bulk power stations (generating stations or transformation station tapped from trans-
mission lines) and the consumers' service switches. (Merriam-Webster, 1971)

DISTURBED SOIL. Soils that have been disturbed by artificial process, such as excavation, transporta-
tion, and compaction in fill. (U.S.D.P.)

DRAINAGE. Interception and removal of ground water or surface water, by artificial or natural means. (DeFina, 1971)

DUTY DIST. Dusty fine powdered particles of earth, grit, refuse, waste, litter, etc. (Merriam-Webster, 1971)

DWELLING. The general, global designation of a build-
ing/cluster in which people live. A dwelling contains one or more dwelling units. (U.S.D.P.)

DWELLING BUILDERS. Four groups are considered: SELF-HELP BUILD: where the dwelling unit is directly built by the user or occupant; ARTIFICAL BUILD: where the dwelling unit is totally or partially constructed by skilled craftsmen hired by the user or occupant; pay-
ment can be monetary or in part of an offer of the dwelling or for services to the user or occupant or developer; SMALL CONTRACTOR BUILD: where the dwelling unit is totally or partially constructed by a developer, "small" contractor is defined by the scale of operations, financially and materially; the scale of the operation is comparative and large size of oper-
ings encompassing the building of large quantities of similar units, or a singularly large complex; LARGE CONTRACTOR BUILD: where the dwelling unit is totally built by a large organization hired by the developer, "large" contractor is defined by the scale of operations, financially and materially; the scale of the operation is comparative and large size of oper-
ings encompassing the building of large quantities of similar units, or a singularly large complex (U.S.D.P.)

DWELLING DENSITY. The number of dwellings, dwelling units or families per square mile. Dwelling density is the density of an overall area (ex. in-
cluding lots, streets). Net density is the density of selected, discrete portions of an area (ex. in-
cluding only lots). (U.S.D.P.)

DWELLING DEVELOPERS. Three sectors are considered in the process of dwelling development: dwelling building sector with limited or no access to the formal finan-
cial, managerial, technical, etc. Dwelling building sector involved in the provision of dwellings. The housing process (promotion, financing, construction, opera-
tions) is carried out by the Popular sector generally for "self use" and sometimes for profit. PUBLIC SEC-
limits the circuit with the voltage dropping to zero twice in each cycle. The amount of energy flowing through the circuit with the voltage dropping to zero twice in each cycle.

**APPENDIX**

**TOR.**

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<th>Example, a living room, bedroom, but are contained in a building/shelter (U.S.D.P.)</th>
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<td>A TANK TOILET. Toilet with storage tank of water (Merriam-Webster, 1971)</td>
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gas network; telephone network, public transportation; police and fire protection; refuse collection, health, schools, playgrounds, parks, open spaces. (U.S.D.P.)

INSULATIONS. A material or body that is a poor conductor of electricity, heat, or sound. (Merriam-Webster, 1971)

INTERIOR CIRCULATION NETWORK (SITE PLANNING). The pedestrian/wheelchair circulation system inside the site or the area designed based upon the exterior circulation/accesses and land development requirements. (U.S.D.P.)

INTERVAL. A space of time (or distance) between the occurrence of similar conditions or states. (Merriam-Webster, 1971)

KILOWATT (kw). A convenient measure of energy. Kilowatt hour (kwh) measures the total quantity of energy consumed in a given time. One kilowatt represents the use of one horsepower of electrical energy for a period of one hour. (NUT 45-7, 1953)

LAVATORY. A vertical pipe or shaft leading from the floor of the ground to a sewer, for admitting light for purposes of inspection. (U.S.D.P.)

LAND COST: Price of the amount of money given as an allowance for the sale of a specific thing (the site). (Merriam-Webster, 1971)

LAND DEVELOPMENT COSTS: The costs of making raw land ready for development through the provision of utilities, services, access, etc. (U.S.D.P.)

LAND LEASE. The renting of land for a term of years for the purpose of using land, which may run as long as 99 years. (U.S.D.P.)

LAND-MARKET VALUE. Refers to 1) the present monetary value of a parcel of land, expressed in terms of tax value based on the land; or 2) the present commercial market value of the land. (U.S.D.P.)

LAND OWNERSHIP. The exclusive right of control and possession of the land. (U.S.D.P.)

LAND SUBDIVISION. The division of the land into blocks, lots and laying out streets. (U.S.D.P.)

LAND TENANCY. The temporary holding or mode of holding a parcel of land of another. (U.S.D.P.)

LAND UTILIZATION. A qualification of the land around a dwelling in relation to user, physical controls and responsibilities, sidewalks, streets, open spaces; user-agent-unlimited; physical controls — minimum; responsibility — public sector. (U.S.D.P.)

LIMIPUBLIC. A medium or low density of land users within a group of people; physical controls — partial or complete; responsibility public sector and user. (U.S.D.P.)

LITERATE. Able to read and write. (U.S.D.P.)

LONDON PLANNING. The ratio of building area to the total lot area. (U.S.D.P.)

LPP. The point or area in space actually occupied by a parcel of land. (U.S.D.P.)

MET DENSITY: The ratio or the amount of energy consumed in a given time. (U.S.D.P.)

MEDIAN BARRIER. A double-faced guard rail in the median of an island dividing two adjacent roadways. (DePina, 1972)

MEASURING BOUNDARIES. Characterized by continuous, homogeneous land uses or topography, expressed as: idiosyncratic, residential, commercial, open spaces, main streets, etc.; LAND: similar residential uses, comparable uses (as parks with residential). (U.S.D.P.)

MICROCLIMATE. The local climate of a given site or habitat varying in size from a tiny cove to a large land area, but being usually characterized by considerable uniformity of climate. (Merriam-Webster, 1971)

MODE OF TRAVEL. Manner of moving from one place (the site) to another (other parts of the urban context). (U.S.D.P.)

MODEL (OF URBAN LAYOUT). A representation of an urban residential area, used to study artificial utilization of land, subdivision and utilization of a specific network for public circulation. (U.S.D.P.)

MUTUAL OWNERSHIP. Private land ownership shared by two or more persons and their heirs under mutual agreement. (U.S.D.P.)

NATURAL FEATURES. Prominent objects in or produced by nature. (U.S.D.P.)

NATURAL UNDISTURBED SOIL. Soils that have not been disturbed by artificial process. Although natural, they depend greatly on local conditions, environment, and past geological history of the formations. (U.S.D.P.)

NEIGHBORHOOD. A section lived in by neighbors and having distinguishing characteristics. (U.S.D.P.)

NETWORK EFFICIENCY (LAYOUT EFFICIENCY). The ratio of the length of the network to the area(s) contained within or among to it. (U.S.D.P.)

MUTUAL WIRE. Wire carrying no voltage between itself and a ground. (NUT 45-7, 1953)

NOISE. Any sound (affecting the site) that is undesirable (such as that produced by traffic, airports, industry, etc.). (Merriam-Webster, 1971)

ODOR. A quality of something that affects the senses of smell. (Merriam-Webster, 1971)

OMH (electrical). The unit of resistance to the flow of current, having the property of increasing the greatest the resistance. When resistance is constant, ohms are used to determine the current drawn by any given load (U.S.D.P.)

ORGANIC SOILS. Soils composed mostly of plant material. (U.S.D.P.)

ORGANIC WASTE: Human waste, i.e. garbage, sewage, etc. (U.S.D.P.)


PERCENT RENT/MORTGAGE. The fraction of income allocated for dwelling rental or dwelling mortgage payments; expressed as a percentage of total family income. (U.S.D.P.)

PIT PRIVY/LATRINE. A simple hole in the ground, usually back dug, covered with slab and protective superstructure for disposal of human excreta. (U.S.D.P.)

PRIVATE CIRCULATION. The service for collection and disposal of all the solid wastes from a community. (U.S.D.P.)

PRIVATE UTILITIES. Includes: water supply, sanitary sewerage, storm drainage, electricity, street lighting, telephone, circulation networks. (U.S.D.P.)

RESERVE COLLECTION. The service for collection and disposal of all the solid wastes from a community. (U.S.D.P.)

RESERVOIR. Large-scale storage of water; also function to control fluctuations in supply and pressure. (U.S.D.P.)

RESIDENTIAL AREA. An area containing the basic needs/requirements for daily life activities: housing, local employment, shopping, schools, recreation. (U.S.D.P.)

RESISTANCE. The opposition to electrical flow. (Resistance increases as the length of wires is increased or decreases as the cross-sectional area of wires is increased). (NUT 45-7, 1953)

RIGHT-OF-WAY. A legal right of passage over another person’s ground (land), the area or way over which a right-of-way exists such as: a path or thoroughfare through which one may lawfully use the strip of land devoted to or over which is built a public road, the land
APPENDIX

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The subdivision of urban land and the provision of services for residential use and complementary commercial use. Site and services projects are aimed to assist the new housing for the lower income groups of the population by providing site and services projects. The subdivision of land will enable the residents to build their own dwellings; also services: the opportunities for services and community facilities, financing and communications. (U.S.D.P.)

SLOPE. Degree or extent of deviation of the land surface. (Merriam-Webster, 1971)

SIZE. Physical magnitude or extent (of the site), relative or proportional dimensions (of the site). (Merriam-Webster, 1971)

SITE EXEMPTION. A grant by a government of immunity from taxation; (a ten-year tax exemption on new housing in New York stimulated new construction in the 1920's; to be increased by a 10-year tax exemption on new buildings). (Abrams, 1966)

SITE INCENTIVE. Favorable tax treatment to induce the development of the urban area. He would not otherwise be likely to do so. (U.S.D.P.)

SITE STRUCTURE - TAXATION. The method by which a nation (state, municipality) implements decisions to transfer resources from the private sector to the public sector. (U.S.D.P.)

TOILET. A fixture for defecation and urination, esp. water closet. (7th Collegiate Webster, 1953)

TREATMENT. (a) a process or procedure for purifying, clarifying, or refining; (b) any corrective or remedial action in connection with a process. (U.S.D.P.)

TRAP. A fitting that provides a water seal to prevent sewer gases and air from discharging through fixtures. (Merriam-Webster, 1971)

TRANSPORTATION. Means of conveyance of passengers or goods from one place to another along routes, ways, or highways in connection with metropolitan activity. (U.S.D.P.)

TRANSPORTATION. Means of conveyance of passengers or goods from one place to another along routes, ways, or highways in connection with metropolitan activity. (U.S.D.P.)

TVA. That which is revealed to the vision or can be seen (from the site). (Merriam-Webster, 1971)

USE GROUPS. Based upon the substance (minimum income per family unit) low income families are distinguished: very low (below subsistence level); the income group with no household income available for housing, services, or transportation; low (1 x subsistence level); the income group with no very limited available benefits; moderate (2 x subsistence level); the income group that can afford limited housing among the lowest assistance; very low (5 x subsistence level); the income group that can afford housing without subsidy, but with mortgage payments, or by rent; very high (10 x subsistence level); the income group that can afford to pay for housing, but is not able to pay. (U.S.D.P.)

USEMINT. The right to profit from a parcel of land or control of a parcel of land without becoming the owner or formal lessee; legal possession by decree without charge. (U.S.D.P.)

USE: Includes: water supply, sanitary sewerage, storm drainage, electricity, street lighting, gas, telephone. (U.S.D.P.)

UTILITIES/INFRASTRUCTURE. The organization and/or infrastructure for meeting the general need (as for water supply, wastewater, pumping, electricity, etc.) in the public interest. (U.S.D.P.)

VALUE. A water supply distribution component which intercepts the supply for maintenance purposes (U.S.D.P.)

VEST. A pipe opening to the atmosphere, which provides ventilation for a drainage system and prevents trap siphonage or back pressure. (Merriam-Webster, 1971)

WATER. A pipe in a dwelling which carries water for domestic purposes. (HOTC ST 45-7, 1953)

WATER PIPE. A pipe (in a dwelling) which carries water from water basins, sinks, and similar fixtures. (Merriam-Webster, 1971)

WATER SUPPLY. Source, means, or process of supplying water, (as for a community), (U.S.D.P.)

WATER SEWER. Storm sewer: the layer of natural soil or fill (compact soil) upon which the pavement structure including curbs is constructed. (DePina, 1972)

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EXPLANATORY NOTES

QUALITY OF INFORMATION
The quality of information given in drawings, charts and descriptions has been qualified in the following manner:

Approximate: when deduced from different and/or not completely reliable sources.

Accurate: when taken from reliable or actual sources.

Tentative: when based upon rough estimates of limited sources.

QUALITY OF SERVICES, FACILITIES AND UTILITIES
None: when the existence of services, facilities and utilities are unavailable to a locality.

Limited: when the existence of services, facilities and utilities are available to a locality in a limited manner due to proximity.

Adequate: when the existence of services, facilities and utilities are available to a locality.

METRIC SYSTEM EQUIVALENTS

Linear Measures
1 centimeter = 100 centimeters
1 meter = 1,000 meters
1 kilometer = 1,000 kilometers
1 inch = 2.54 centimeters
1 foot = 0.3048 meters
1 mile = 1.60934 kilometers

Square Measures
1 square meter = 1,550 square inches or 10.7639 square feet
1 hectare = 10,000 square meters
1 acre = 0.4047 hectares

CURRENCY EQUIVALENTS
1 Egyptian Pound (L.E.) = 1.5 US Dollars.