

DWELLINGS AND LAND MODELS: Nairobi, Kenya

by

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Signature of Author.....<sup>a</sup>

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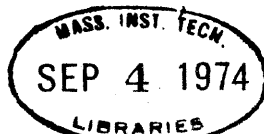
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Rotch



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by Tara Singh Chana

Submitted to the Department of Architecture  
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Master of Architecture in Advance Studies.

#### ABSTRACT

This is a study on dwellings and land models for urban dwelling environments in Nairobi, Kenya.

The study is based upon the survey-evaluations of twenty existing dwellings and land case studies in Nairobi, Kenya. These survey-evaluations have served as references for understanding the different dwelling environments in the Nairobi urban context. They have been used as a tool for the formulation of the dwellings and land models developed in this study.

This study presents two proposed dwellings and land models, tenements and expandable row houses, within an urban community on a selected site. The models are described in the context of the site, the community and the dwellings. The study also includes brief introductory sections on Nairobi Urban Context, a contextual reference; on Case Studies, an overview of existing dwellings and land models in Nairobi; on Wanjala, an urban dweller in tenements; and on the Time/Process Perspective of significant existing models to illustrate the actual dwellings and land situations in the past, the present and the future.

A glossary is included to define terms that are used in the text and that are essential to the presentation and understanding of the subject.

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## PREFACE

This study is a continuation of a study on "DWELLINGS AND LAND; Urbanization in Developing Countries; Case Studies in Nairobi, Kenya", carried out in the program: Urban Settlement Design in Developing Countries, at the Massachusetts Institute of Technology, in the School of Architecture and Planning. Survey-evaluations of twenty existing dwellings / land situations in Nairobi, Kenya were made in order to identify and evaluate the different case studies in relation to social, economic and physical factors. These survey-evaluations have served as a tool for the formulation of the dwellings and land models in this study. Similar survey-evaluations have been extensively used by the Urban Settlement Design Program for developing urbanization projects in San Juan, Nairobi and Beirut.

The author gratefully acknowledges the guidance and advice of Professor Horacio Caminos, whose experience has been invaluable

in the preparation of this study. The author is also indebted to Reinhard Goethert for his personal assistance, participants in the Urban Settlement Design Program (1972-74) for their comments and to Sureta Chana for her moral support.

The funding for the study was partially provided by a grant from the Rotch Fund.

Photographs of the URBAN GROWTH PATTERN have been reproduced from the Nairobi City Council Exhibition at the Organization for African Unity Trade Fair, which was held in Nairobi in 1972. Photographs of the panoramas of Nairobi are from Praful Patel and the aerial photographs of Eastlands and Kawangware (cover photograph) are from the Survey of Kenya, Ministry of Lands and Settlements, Republic of Kenya.

T.S.C.  
Urban Settlement Design Program, M.I.T.  
Cambridge, Massachusetts. Spring 1974.

## INTRODUCTION

*The following sections are contained in the introduction:*

*BACKGROUND AND ISSUES: a discussion of the basic problems of urbanization in Nairobi, Kenya.*

*NAIROBI URBAN CONTEXT: a brief outline of the geography, history, economy, administration, income, groups, settlement pattern, housing and graphs on climatic data, population growth, population distribution, income distribution.*

### BACKGROUND AND ISSUES

Unchecked urban growth in the rapidly urbanizing parts of the economically underdeveloped countries is creating serious physical, social, economic and political pressures on the majority of the population. Basic human needs of this population are not being met with. Nairobi, the capital city in Kenya, is experiencing such urban growth.

The present population of about 600,000 is growing at an annual rate of 7.5%. It is likely to increase to 3,000,000 (five times) by the end of the century. It is projected that 0.25 million potential wage earners

will be unemployed and that 0.55 million families will require shelter within the next 25 years. There will be more cars as the number of cars owned in the city is projected to increase tenfold over the next 25 years if no measures of restraint are adopted.

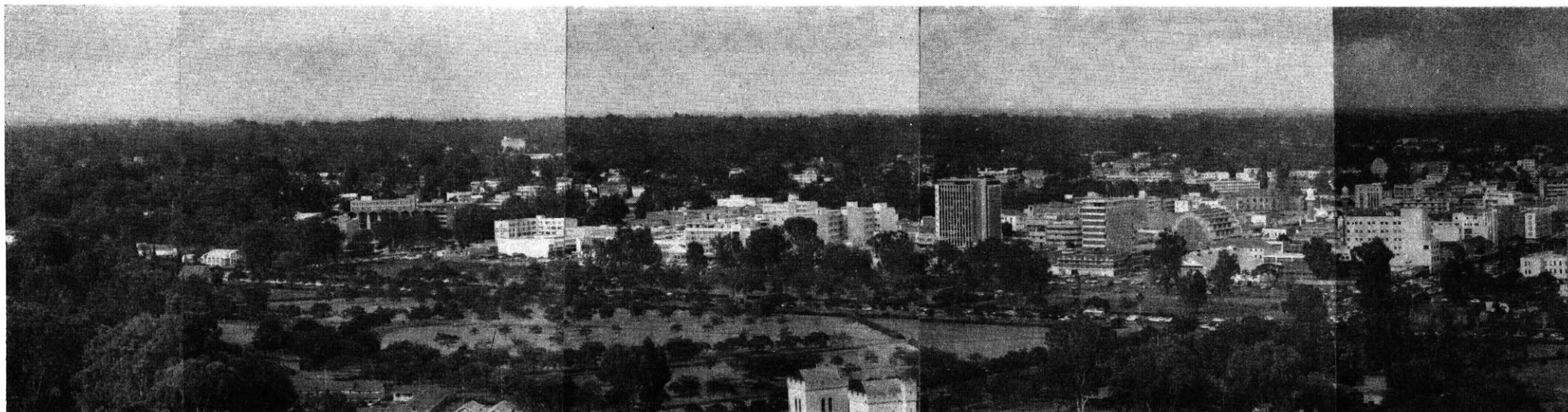
Economic growth, on the other hand, has continued largely on the lines set by the earlier colonial structure, resulting in a small rich elite, while the majority of the population remains poor.

It is this poor majority of the population that needs to be the concern of the decision-

makers. Basic problems need to be identified and understood by politicians, planners, administrators and other individuals in power. Urgent changes are needed if any serious efforts are to be made to meet the needs of this low income majority. In order to effectively introduce change, some basic questions need to be considered at both the national and local level.

Housing policy in Kenya is one such area. The present housing policy in Kenya has not managed to provide for the mass of urban dwellers: the public housing programs are beyond the income range of the majority of

**PANORAMIC VIEW OF THE CITY CENTER FROM THE UHURU PARK, NAIROBI:** The photograph shows the growing skyline of the city with the government/administrative center on the right and the commercial center in the middle and the University of Nairobi campus on the extreme left of the photograph.



the population in Nairobi.

Dwellings and land are two major physical components of urban settlements. Any recommendations / approaches to the housing problem should focus on these physical components as being major physical constraints.

The physical development of urban settlements in the Nairobi Metropolitan Area is based upon the former colonial British model of the garden city plan. The plan has promoted the stratification of residential developments on a racial basis. Each of these developments are characterized by their unique types of dwelling land situations (see

CASE STUDIES). Almost 80% of the city of Nairobi's residential land has less than 20% of the city's population, which is mainly the high income groups in suburban planned residential developments. Urban sprawl (a problem inherited from the western countries) is rapidly deteriorating the quality of life with particular impact on the majority of the population which is poor and has less access to land and public subsidized housing. It also has other impacts on the quality of the settlements:

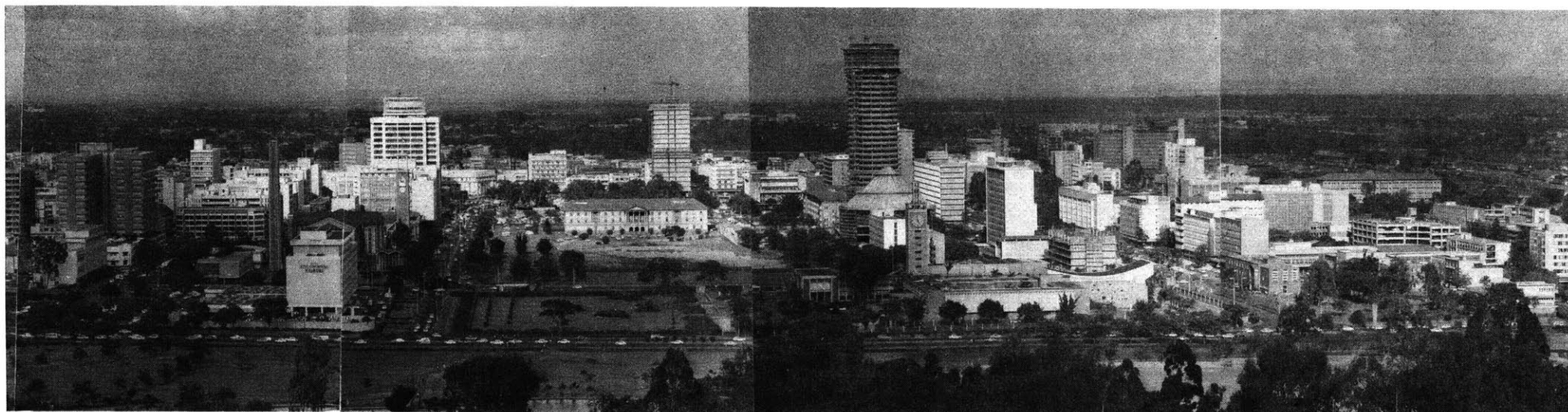
a) community life is destroyed and social relations are weakened, b) Transportation

becomes a burden to the private and the public sector, c) Land speculation increases d) Utilities, services become a burden to the public sector since the overextended networks increase the cost of installation and maintenance. It is essential that these basic problems of urban sprawl be understood by decision makers in order to formulate and implement any effective policies and guidelines for future urban settlements. New models should provide alternatives to the current practices. This issue is critical and urgent.

Changes are needed to shift the focus from

dwellings and land models based upon imported western models to dwellings and land models based upon local existing models; and from an individual detached houses to land and infrastructure.

These changes would only be effective if they are carried out by all the individuals in power, particularly by those involved in decision making processes at both national and local levels.



**NAIROBI URBAN CONTEXT**

The following section contains brief statements of basic information. The statements are included to familiarize the reader with Nairobi while at the same time, focusing on specific aspects.



1. KENYA, LOCATED ON THE EQUATOR, IS THE SECOND LARGEST NATION OF THE THREE EAST AFRICAN COUNTRIES: TANZANIA, KENYA, UGANDA.

Kenya became independent in 1963, and a republic in 1964 with a parliamentary type of government. The strong centralized system includes a president who is popularly elected every 4 years. The country has an area of 224,960 square miles with a population of 11 million (1972).

2. NAIROBI, THE CAPITAL OF KENYA, IS LOCATED AT A PROMINENT GRADIENT CHANGE BETWEEN THE ATHI FLAINS AND THE NGONG HILLS, ON A HIGH PLATEAU 5,500 FEET ABOVE SEA LEVEL AND WITH A RESULTANT TEMPERATE CLIMATE.

Situated thirty miles south of the equator (latitude 1° 15' south and longitude 36° 45' east), the days are frequently warm and sunny and the nights cool, with temperatures varying from 3°C during the cool season (June, July, August) to 43°C in the hot season (December, January, February). The average annual rainfall is 43mm.

3. NAIROBI HAS DEVELOPED FROM A SMALL RAILWAY STATION AND COLONIAL ADMINISTRATION CENTER TO BECOME ONE OF EAST AFRICA'S LARGEST CITIES.

The establishment of the headquarters for the railways and the colonial administration in 1899 brought a corresponding economic and physical growth and development to the Nairobi area which led to the exploitation of the country's natural and physical resources. Nairobi is the primary center for social, political and economic activities and the hub for transportation and communication networks, not only in Kenya, but for all of East Africa. Over 21% of the labor force in Kenya is in Nairobi. The productive resources and the proximity of services offered in the Nairobi area have greatly stimulated further industrial activities and, consequently, the development of the neighboring towns Thika and Athi River.

4. THE STEADY ECONOMIC GROWTH AND PHYSICAL DEVELOPMENT OF NAIROBI HAS LED TO AN APPROXIMATE DOUBLING OF THE POPULATION WITH EACH SUCCEEDING DECADE.

The present population is approximately 600,000 people, with an annual growth rate of ± 7.5%, compared to a national average of ± 3%. The projected population in thirty years will rise to

3.0 million people. Two-thirds of the projected increase is considered to be due to in-migration from the rural areas. Nairobi accounts for 10% of the urban population and 21% of the employment force in Kenya. At present, approximately 75% of the Nairobi population is under the age of thirty years, of which 40% are males. The ethnic composition of the Nairobi population is 86% African, 11% Asian, and 3% European in 1969. The distribution of income and employment among these three ethnic groups reflect highly the socio-economic differentiation of the colonial period, which has continued into post-Independence.

5. THE NAIROBI CITY AND REGION ARE ADMINISTERED BY THE NAIROBI CITY COUNCIL UNDER THE DIRECTION OF A PUBLICLY ELECTED MAYOR.

The City Council is divided into various Departments, each under a director, which is responsible for Nairobi's social, economic, political and physical planning and general administrative functions.

6. SIXTY-FIVE TO SEVENTY-FIVE PERCENT OF THE NAIROBI POPULATION IS IN THE LOW INCOME SECTOR EARNING LESS THAN \$1,300 PER YEAR.

This sector is predominantly African with the remaining 25% Asians and Europeans in the middle to high income sectors. African, Asian and European per capita incomes stand in a ratio of 1 to 23 to 100; with the annual per capita income for Nairobi approximately \$325. The incomes do not reflect the fact that many in the low income sector own land, livestock and carry on intensive cultivation in the rural area.

7. THE INITIAL PATTERN OF SETTLEMENT IN NAIROBI WAS STRICTLY ALONG RACIAL LINES.

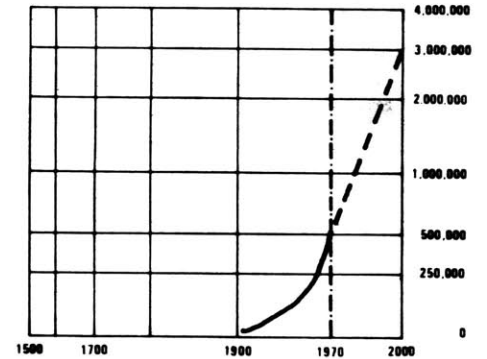
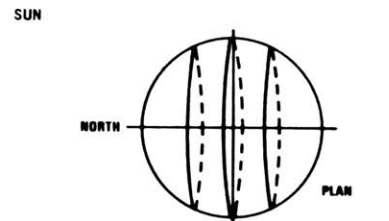
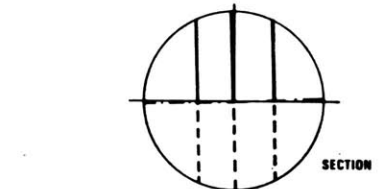
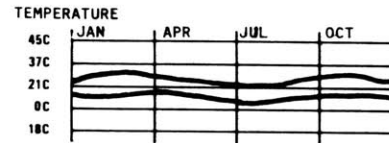
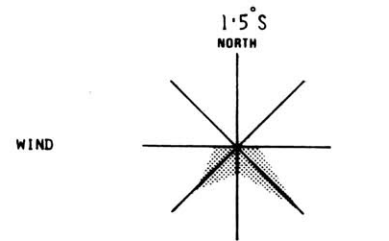
The European residential areas were limited approximately to the western, northwestern, and northern parts of the City (known as Upper Nairobi). The Asian residential areas extended from Eastleigh to parts of Westlands, into portions of the city center and into a southern section of the city. The African residential areas sprawled eastward from the railway residential properties close to the city center into Eastlands and into the southwest section of the city. Squatters comprise 25% of the low income sector and make up 20% of the Nairobi population.

8. SIXTY-FIVE TO SEVENTY-FIVE PERCENT OF THE POPULATION OF NAIROBI IS OUTSIDE OF THE FORMAL HOUSING MARKET.

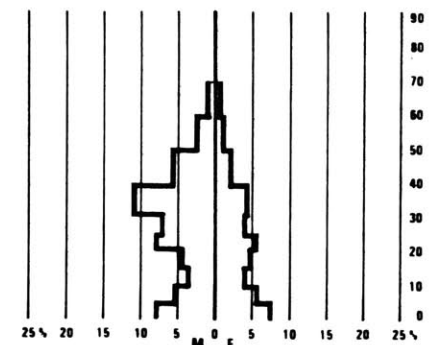
The initial housing in Nairobi was constructed by the government for upper income European administrators and Asian laborers. Africans were excluded from Nairobi except for government-built single room row housing for single male workers ("labor lines"). At present, the housing increase of ± 2% per year does not match the population growth of 7.5% per year. Ninety percent of the land is occupied by 14% of the population.

9. KENYA IS IN AN INCIPIENT STAGE OF RAPID URBANIZATION WHEN COMPARED TO OTHER LESS DEVELOPED COUNTRIES.

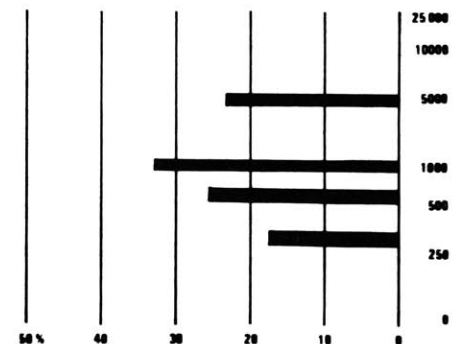
Nairobi has an influential upper income group and a small but rising middle class. The low income sector, however, is at a take-off point before a rapid explosion. At this point in time, the low income people still dream of returning to their rural past. Housing tenure, investment patterns, house construction types, all still indicate the temporary status of the rural immigrant. If the pattern of other less developed countries emerges, the low income sector in Kenya will become a permanent exploding mass fed by both a rapid rural immigration and an exponential natural growth.



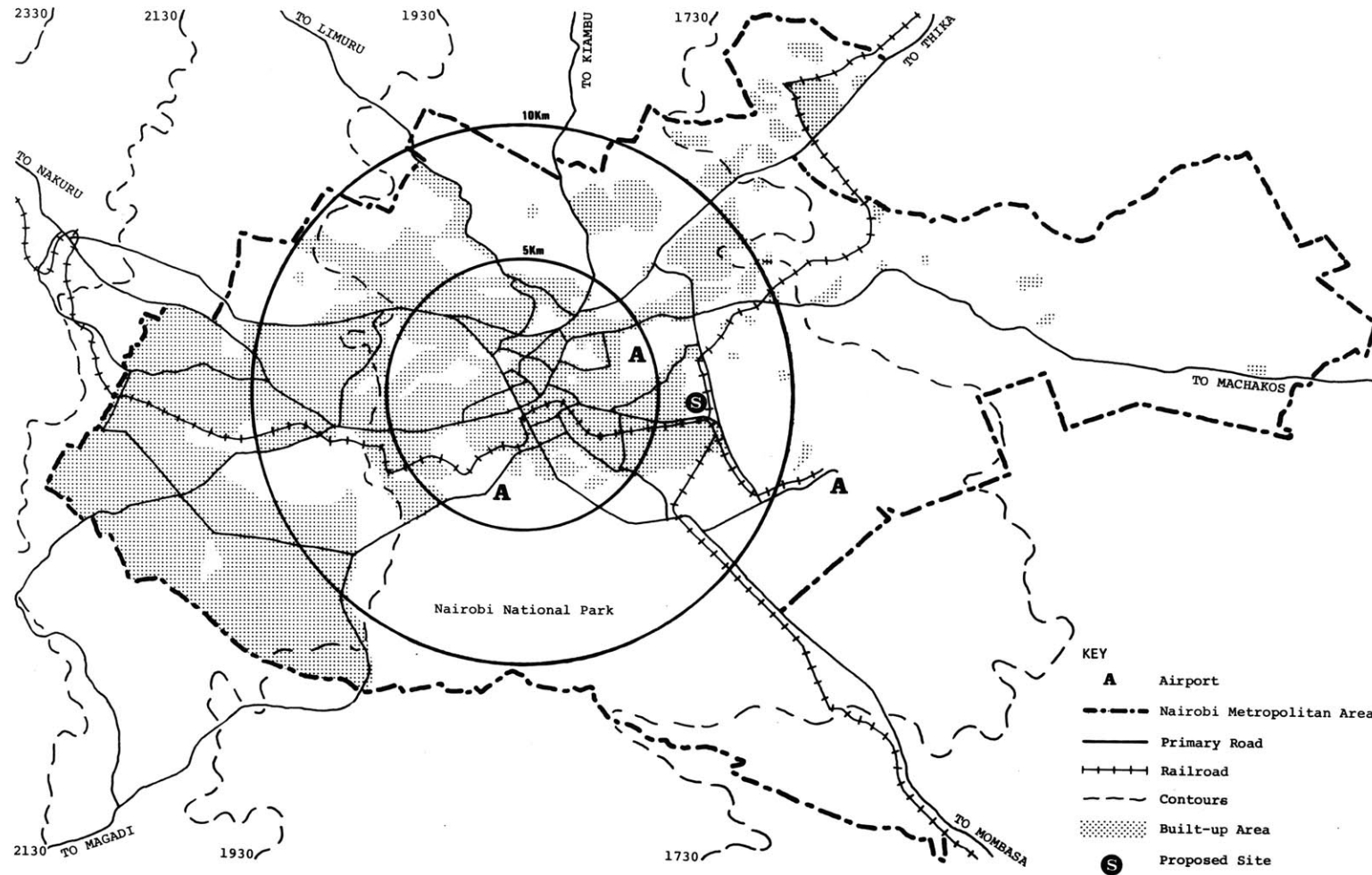
URBAN POPULATION GROWTH  
horizontal: dates vertical: population  
Source: Nairobi City Council (1972)



URBAN POPULATION DISTRIBUTION  
horizontal: percentages vertical: ages  
males: M 303,200 females: F 206,100  
Source: Kenya Population Census, 1969.  
Total Population 509,300

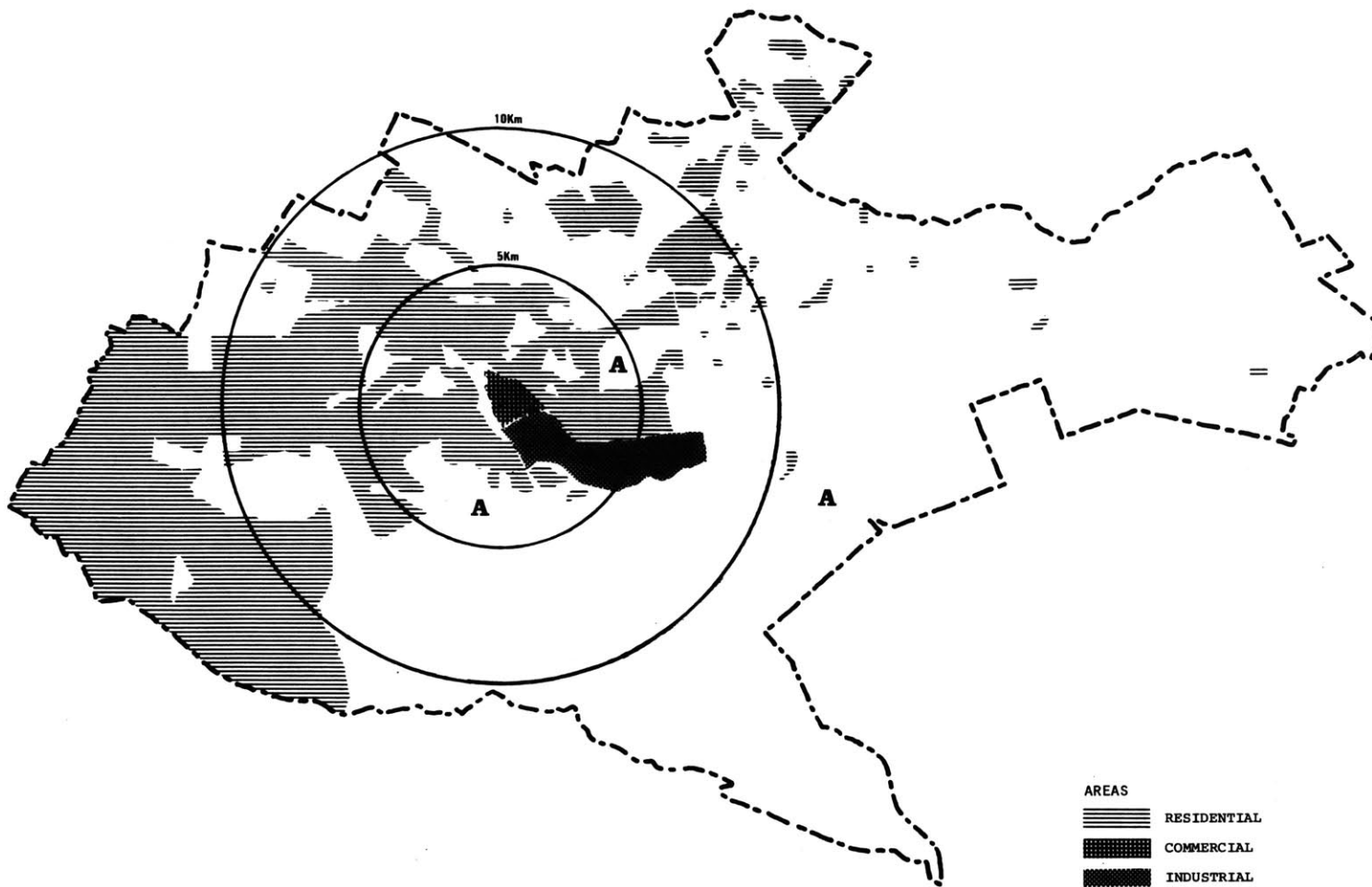


URBAN ANNUAL INCOME DISTRIBUTION  
horizontal: percentages vertical: dollars  
Source: Approximate.



- KEY
- A Airport
  - Nairobi Metropolitan Area
  - Primary Road
  - + + + Railroad
  - - - Contours
  - Built-up Area
  - Ⓢ Proposed Site



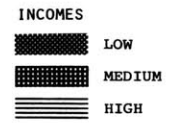
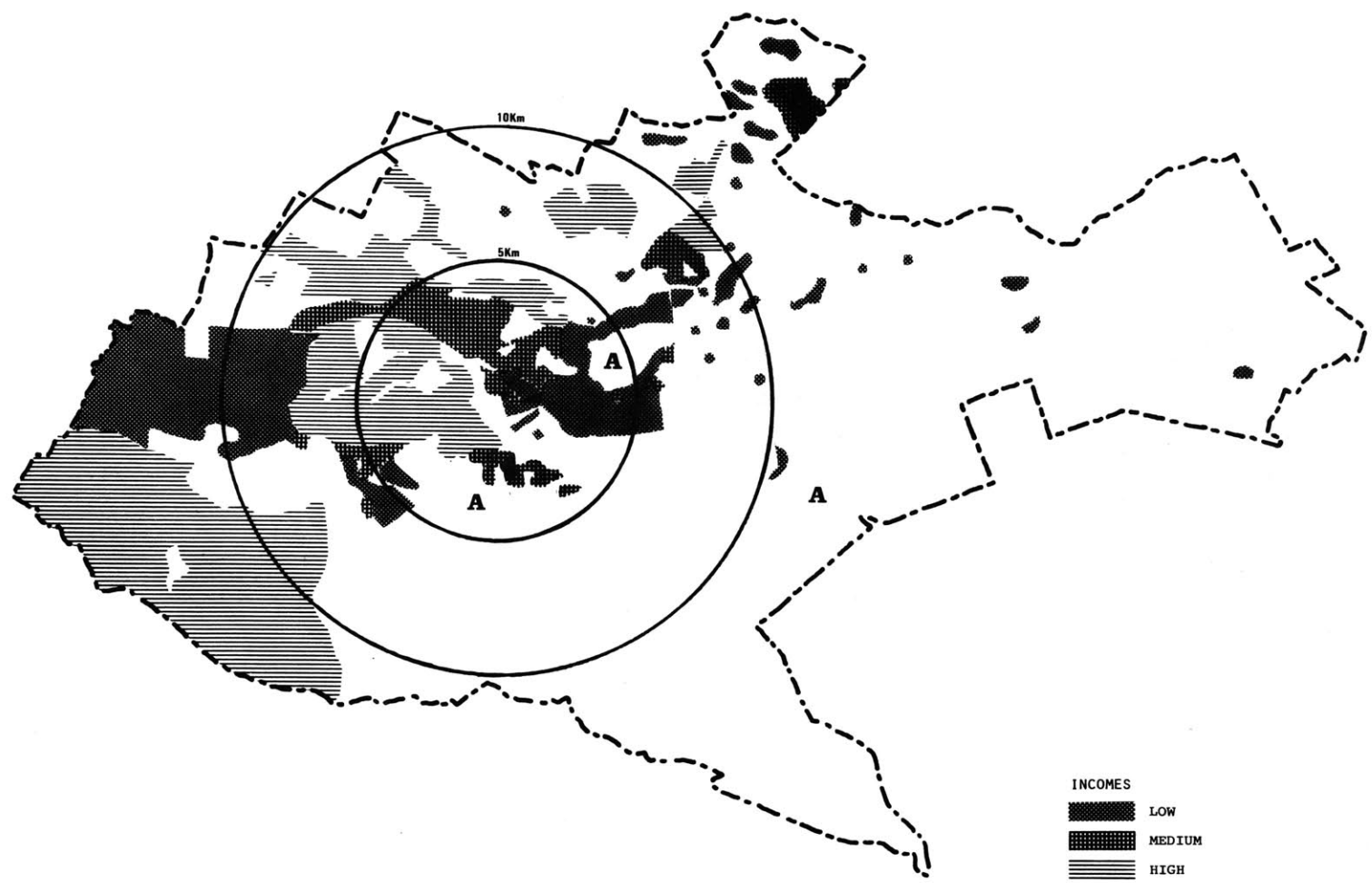


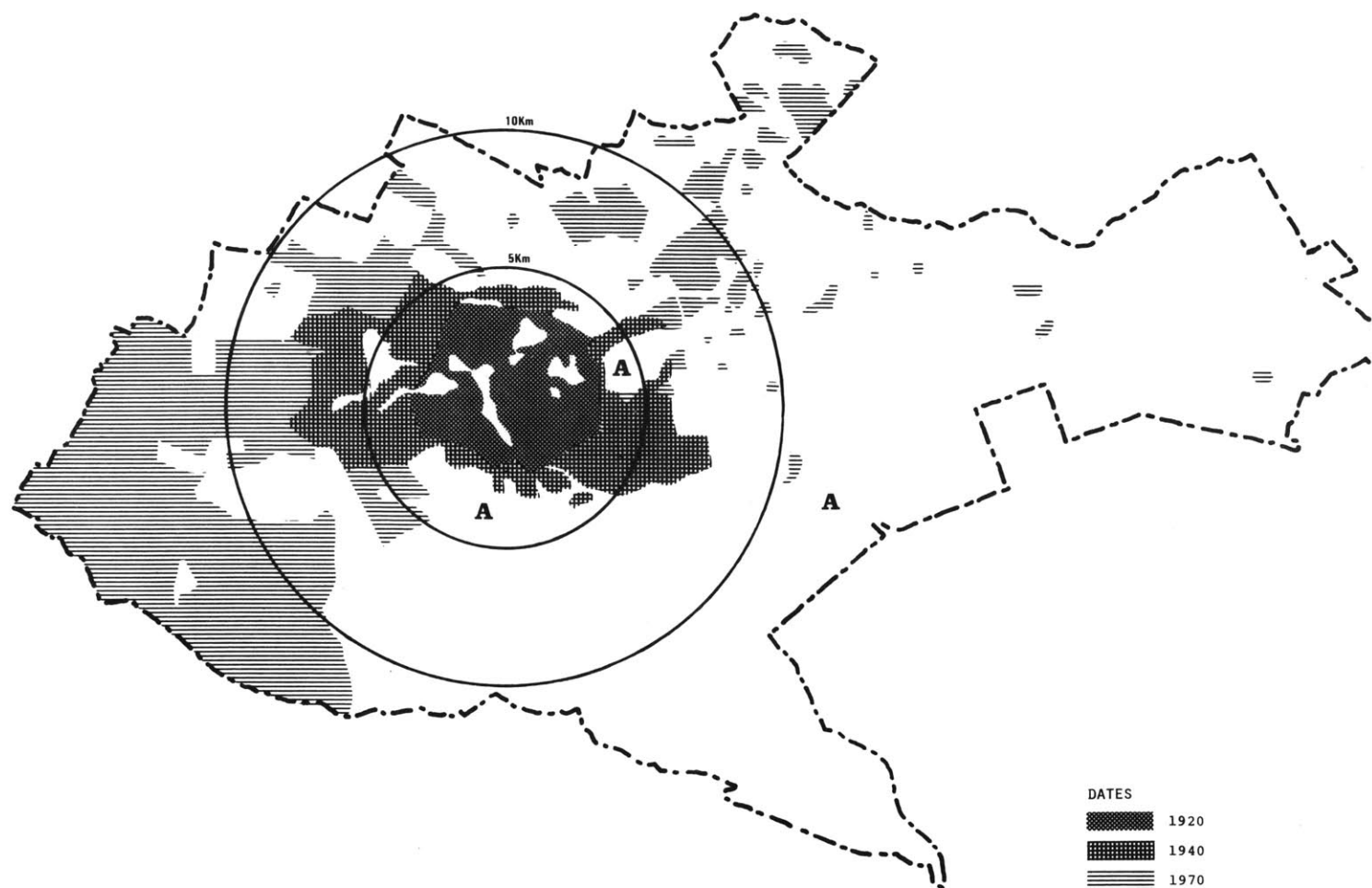
AREAS  
RESIDENTIAL  
COMMERCIAL  
INDUSTRIAL



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1:250000



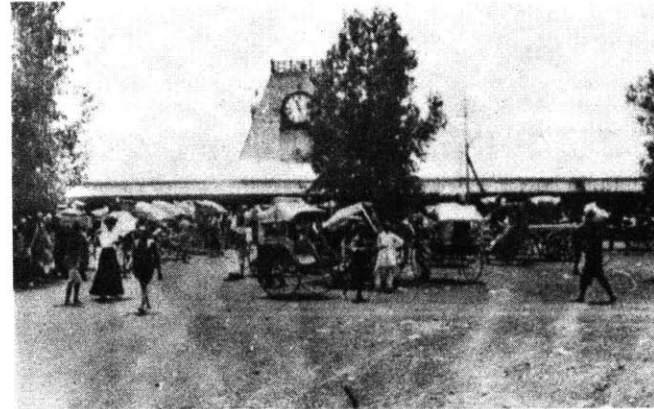




DATES  
1920  
1940  
1970



1:250000



NAIROBI, KENYA: (top left) The construction of the railway line from Mombasa on the coast to the hinterland in the 1890's. Most of the labour was imported from India by the former Colonial Government.

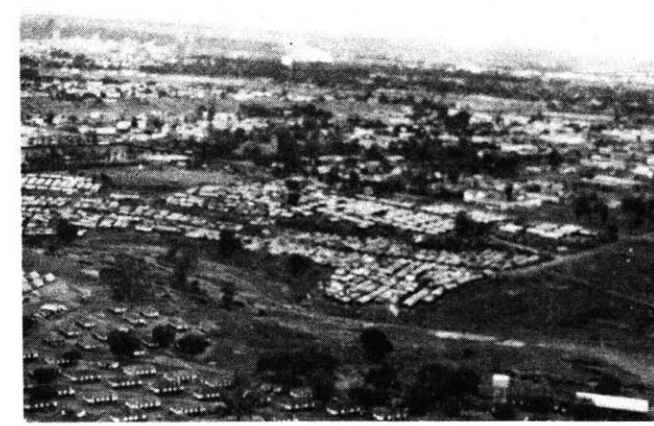
(top right) The Nairobi Railway Station became the nucleus of Nairobi in 1899, with an arbitrary boundary of 1 1/2 mile radius. In 1919 Nairobi became a municipality with a population of 29,860 inhabitants and an area of 2,508 hectares. Note the use of "rickshaws" and handcarts for transportation.

(center left) One of the major commercial streets of Nairobi in 1930. Automobiles were introduced as a means of transport. Traffic controls, such as the policeman, had to be introduced to insure the safety of the pedestrians.

(center right) Another major commercial street in the 1940's, shows the increasing use of the automobile. In 1947 a Master Plan for a "Colonial Capital in Africa" was prepared by a team of South African planners, on the lines of a "Garden City" plan to introduce land use controls. By 1944 the city had been extended to an area of 8,216 hectares with a population of 108,900.

(bottom left) An air view of the city center in 1970. In 1963 the new independent administration of the city expanded the city boundaries to include adequate land for future residential and commercial use. The Nairobi Metropolitan Area at present has an area of 68,144 hectares with a population of 600,000 (in 1972).

(bottom right) An air view of the Mathare Valley, one of the largest uncontrolled urban settlements in the eastern part of the city in 1970. Since the independence in 1963, the city has grown at an annual rate of about 7.5%. Unchecked urban growth and urban sprawl are some of the problems facing the city today.



## CASE STUDIES

*This section of the study shows a brief overview of the changing dwellings and land situations studied in " DWELLINGS AND LAND: Case Studies in Nairobi, Kenya." (Caminos, Goethert, Chana) - Urban Settlement Design Program, M.I.T. The full housing spectrum from very low income to high income situations was studied , but because this study was for utilization in public housing the first ten cases focused on the low income groups. The cases have provided first hand material with which to identify basic patterns in different physical, and socio-economic aspects of the housing process.*

Dwellings and land are the two major physical components of human settlements. A "dwelling" has been defined in the general global designation of a building/shelter in which people live. A dwelling contains one or more dwelling units. "Land" has been defined in terms of land utilization - aqualification of land around a dwelling in relation to the user, physical controls, and responsibility ( see GLOSSARY ).  
The combinations of different dwelling unit

types and land utilization patterns form distinct dwellings and land models. Eight existing models have been evaluated with a time/process overview of the actual dwellings and land situations (see TIME/PROCESS PERSPECTIVE). They have been retraced to the past to identify their originating models in terms of culture, physical characteristics and users. They have also been identified in similar terms at the present. Finally, they have been projected into the future.

Existing dwellings and land models are the most valuable source of information of reference in formulation of urban land policies and future models. The existing models provide a guide to general yet basic questions of land (for what?) Land distribution (how to?) The models also provide a guide to more specific questions; How do the models relate to the different cultures and values? What range of population densities do they permit? To what

PANORAMIC VIEW OF EASTLANDS FROM JOGOO ROAD, NAIROBI:  
The photograph shows the city center in the background. On either sides of Jogoo Road are the former "labour lines", like the residential developments of Makongeni and Bahati.



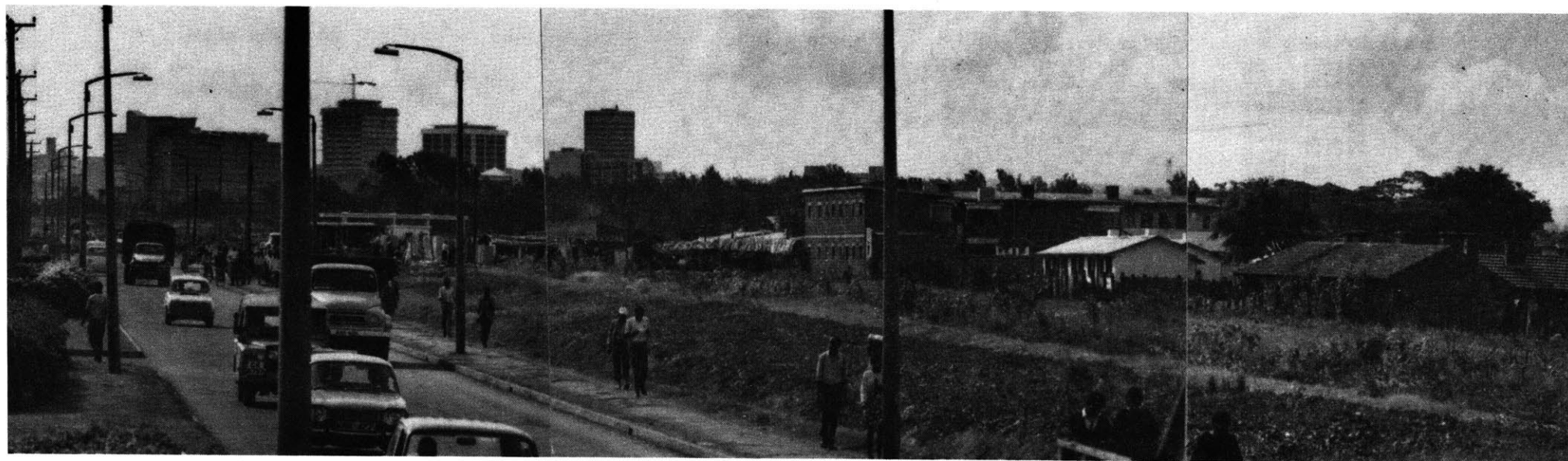
income groups are they accessible? How efficient is the land utilization which they provide?

By examining and evaluating each model, the recommendations /comments have been made whether to promote the model, recommend changes to eliminate short comings, or whether to discourage the use of the existing dwellings and land model entirely. Evaluations of these models point out the following:

1. The universal / traditional model of the tenement court houses permits high population densities and has efficient land utilization. It is accessible to low/moderately low income groups. This model is popularly accepted but not officially promoted; it has become a practical solution to housing demand. The existing model as built can be easily up-graded in terms of safety, ventilation, privacy, cooking facilities, toilets, showers, washing facilities, etc.

2. The universal / traditional model of row houses / apartments also permits medium and high high densities. This model can become a practical solution to the housing demand if the land layout is redesigned to eliminate wasteful land utilization: service alleys, redundant circulation and unused open spaces and green areas. The existing model as built has become a symbol of independence supported by politicians but only accessible to middle and high income

groups due to inefficient land subdivision, instant / complete mode of dwelling development, low densities, and loans / subsidies only available to the rich, etc. These survey-evaluations have emphasized the need to develop models based upon the semi-private communal use of land at two scales: within a group of rooms (tenement courts) and within a group of lots (clusters courts).



## CASE STUDIES

The following section contains case studies depicting selected dwelling environments/situations in the Nairobi Urban Area at the present time.

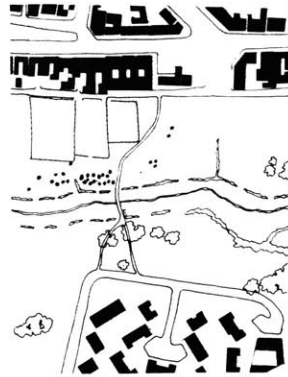
The ten cases summarized on this page are in the very low and low income groups; those on the next page are in the middle and high income groups.

### 1 DAGORETTI



Rooms: private traditional, 1959  
Income group: very low  
Density: 36 people/hectare  
DAGORETTI is a rural settlement that is being engulfed by the expansion of the city. Land is still plentiful in this area.

### 2 KIRINYAGA VILLAGE



Shanties: popular temporary, 1970  
Income group: very low  
Density: 450 people/hectare  
KIRINYAGA VILLAGE is a squatter settlement in the city center. It is a survival situation: plastic covered shanties crowded in junk yards.

### 3 KARURA VILLAGE



Shanties: popular temporary, 1970  
Income group: very low  
Density: 720 people/hectare  
KARURA is a 'temporary resettlement', 3 years old, on the urban periphery. It is a survival situation: cardboard covered shanties crowded in a forest.

### 4 MATHARE VALLEY



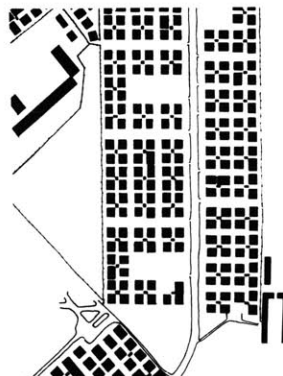
Rooms: private tenements, 1969  
Income group: low  
Density: 1600 people/hectare  
MATHARE VALLEY does not provide private or semi-private land for dwellings; therefore, this layout is substandard.

### 5 KAWANGWARE



Rooms: private tenements, 1964  
Income group: low  
Density: 552 people/hectare  
KAWANGWARE does not provide private or semi-private land for dwellings; therefore, this layout is substandard.

### 6 KARIOBANGI



Rooms: public site/services, 1963  
Income group: low, moderately low  
Density: 532 people/hectare  
KARIOBANGI exhibits bad land utilization. The layout does not provide private or semi-private land for the users.

### 7 BAHATI



Rooms: public subsidized, 1953  
Income group: low  
Density: 320 people/hectare  
BAHATI does not provide private or semi-private land for dwellings; therefore, this layout is substandard.

### 8 UPPER HILL



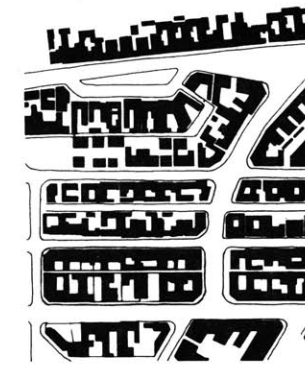
Rooms: employer-provided, 1955  
Income group: low  
Density: 17 people/hectare  
UPPER HILL has wasteful land utilization and demands large areas of land. This model is obsolete in urban areas, but it still proliferates in automobile dominated suburbia. (U.S.A., Latin America).

### 9 EASTLEIGH



Rooms, private tenements, 1945  
Income group: low  
Density: 480 people/hectare  
EASTLEIGH exhibits very good land utilization. The dwelling may easily be up-graded in terms of safety, ventilation, privacy, cooking facilities, toilets, showers, washing facilities, etc.

### 10 RIVER ROAD



Rooms: private tenements, 1938  
Income group: low  
Density: 768 people/hectare  
RIVER ROAD exhibits very good land utilization. The dwellings may easily be up-graded in terms of safety, ventilation, privacy, cooking facilities, toilets, showers, washing facilities, etc.

**11 QUARRY ROAD (det.)**



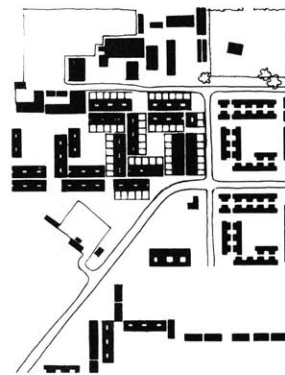
Houses: public subsidized, 1945  
Income group: middle  
Density: 114 people/hectare  
*QUARRY ROAD has wasteful land utilization and demands large areas of land. This model is obsolete in urban areas, but it still proliferates in automobile dominated suburbia (U.S.A., Latin America).*

**12 QUARRY ROAD**



Houses: public subsidized, 1955  
Income group: middle  
Density: 72 people/hectare  
*QUARRY ROAD has wasteful land utilization and demands large areas of land. This model is obsolete in urban areas, but it still proliferates in automobile dominated suburbia (U.S.A., Latin America).*

**13 KARIOBANGI SOUTH**



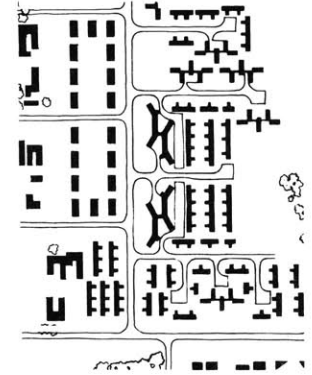
Houses: public subsidized  
Income group: middle  
Density: 258 people/hectare  
*KARIOBANGI SOUTH has a very inefficient Garden City layout. These layouts require redesign to eliminate wasteful land utilization, green areas of no use, redundant circulation, and service alleys.*

**14 UHURU - PHASE 4**



Houses: public subsidized  
Income group: middle  
Density: 312 people/hectare  
*UHURU has a very inefficient Garden City layout. These layouts require redesign to eliminate wasteful land utilization, green areas of no use, redundant circulation, and service alleys.*

**15 PUMWANI**



Apartments: public subsidized  
Income group: middle  
Density: 384 people/hectare  
*PUMWANI has bad land utilization. The area should be greatly improved by using land more efficiently and by allowing user control and responsibility over semi-public space.*

**16 WESTLANDS**



Apartments: private rental  
Income group: high  
Density: 150 people/hectare  
*WESTLANDS has bad land utilization. The area should be greatly improved by using land more efficiently and by allowing user control and responsibility over semi-public space.*

**17 WOODLEY - KIBERA**



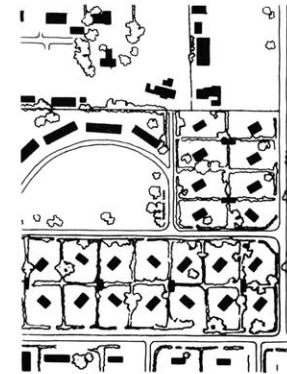
Houses: public subsidized  
Income group: high  
Density: 264 people/hectare  
*WOODLEY-KIBERA has a very inefficient Garden City layout. These layouts require redesign to eliminate wasteful land utilization, green areas of no use, redundant circulation, and service alleys.*

**18 PARKLANDS**



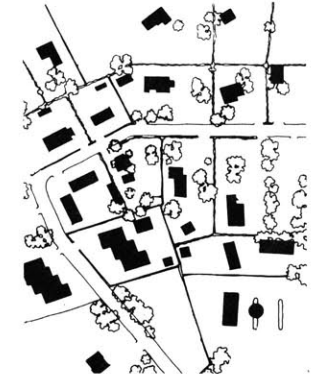
Houses: private rental  
Income group: high  
Density: 120 people/hectare  
*PARKLANDS has a very inefficient Garden City layout. These layouts require redesign to eliminate wasteful land utilization, green areas of no use, redundant circulation, and service alleys.*

**19 WOODLEY 1**



Houses: private subsidized  
Income group: middle and high  
Density: 35 people/hectare  
*WOODLEY 1 has wasteful land utilization and demands large areas of land. This model is obsolete in urban areas, but it still proliferates in automobile dominated suburbia (U.S.A., Latin America).*

**20 PARKLANDS (det.)**

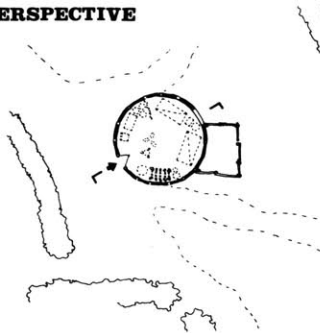


Houses: private ownership  
Income group: high  
Density: 25 people/hectare  
*PARKLANDS has wasteful land utilization and demands large areas of land. This model is obsolete in urban areas, but it still proliferates in automobile dominated suburbia (U.S.A., Latin America).*

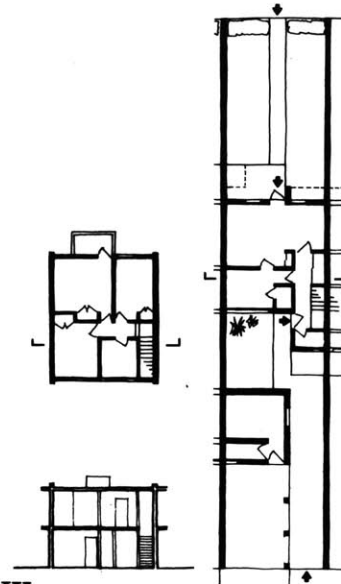
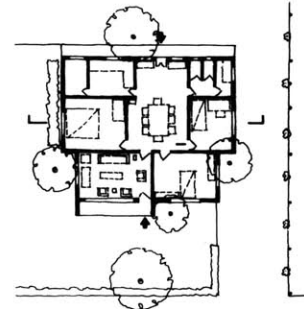
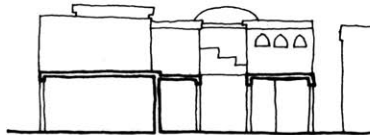
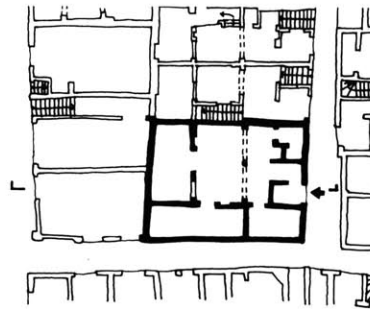
**TIME/PROCESS PERSPECTIVE**

EXAMPLES

Plan



Section



**I**

**TRADITIONAL RURAL/VILLAGE HOUSES**

Grouped in compounds, 1 story.

*Physical Characteristics*

*Population Density* LOW/MEDIUM density.

*Land/Layout* Social structure/organization is major constraint.

*Users*

AFRICAN traditional model used by TRIBAL groups.

**II**

**URBAN COURT/ROW HOUSES (Moslem, on coast)**

Clustered in lots, interior courts, 2-3 stories in compact configuration.

*MEDIUM/HIGH density.*

*Social structure/configuration, people's activities/movements is major constraint.*

MOSLEM traditional model used by ALL INCOME groups.

**III**

**VICTORIAN SUBURBAN COTTAGE (HOUSE)**

Isolated in one or more acres of land, 1-2 stories.

*VERY LOW density.*

*Economic use of land is not constraint.*

XIX Century ENGLISH model used by UPPER MIDDLE income groups. A small scale version of model (estate) used originally by high income groups in England.

**IV**

**TOWN/GARDEN CITY ROW HOUSES/APARTMENTS**

Aligned in narrow lots in towns or garden cities, 2-4 stories.

*MEDIUM/HIGH density.*

*Economic use of land is a relative constraint.*

UNIVERSAL/TRADITIONAL model used originally by MIDDLE/HIGH income groups.

THE PAST

**AFRICAN MODEL**

Model was developed in Africa.

*Users Before Independence*

AFRICAN TRIBAL groups.

*Users After Independence*

AFRICAN VERY LOW INCOME groups. Three situations are recognized in Nairobi: 1) Engulfed in urban periphery: land is not scarce yet. 2) Squatting in city center: plastic shanties crowded in junk yards. 3) "Temporary resettlements" (3 years old) on urban periphery: cardboard shanties crowded in forest.

*Case Studies*

1. DAGORETTI (example above); 2. KIRINYAGA VILLAGE; 3. KARURA.

Model was developed in Africa.

AFRICAN, ASIAN, ARAB MIDDLE INCOME groups.

AFRICAN, ASIAN, ARAB LOW/MIDDLE INCOME groups. Found in the East African Coast in old city sections (Mombasa, etc.).

No cases in Nairobi. (example above from other source)

Model was imported to Africa in XIX Century by English.

EUROPEAN MIDDLE/HIGH income groups.

Predominately EUROPEAN, ASIAN MIDDLE/HIGH income groups (few Africans). Became a symbol of SUPREMACY supported by African political leaders.

8. UPPER HILL; 11. QUARRY ROAD (detached); 12. QUARRY ROAD; 19. WOODLEY I; 20. PARKLANDS (detached) (example above).

Model was imported to Africa in XX Century by English.

Did not exist.

Predominately ASIAN, AFRICAN MIDDLE/HIGH income groups. Became a symbol of SUPREMACY supported by African political leaders.

13. KARIOBANGI SOUTH; 14. UHURU-PHASE 4; 17. WOODLEY-KIBERA (example above); 18. PARKLANDS.

THE PRESENT

**LAND ISSUES**

AFRICAN culture.

Permits MEDIUM/HIGH population density. Accessible to VERY LOW/LOW income groups. VERY GOOD land utilization (See case studies 2,3).

MOSLEM CULTURE.

Permits MEDIUM/HIGH population. Accessible from LOW to MIDDLE income groups. VERY GOOD land utilization.

WESTERN culture.

Permits LOW population densities. Accessible to MIDDLE/HIGH income groups. WASTEFUL land utilization in urban areas, demands large areas of land (See case studies 8,11,12,19,20).

UNIVERSAL.

Permits MEDIUM/HIGH population densities. Accessible to MIDDLE/HIGH income groups. Town Row House layouts are EFFICIENT (no cases found); Garden City layouts are not (See case studies 13,14,17,18).

THE FUTURE

*Comments*

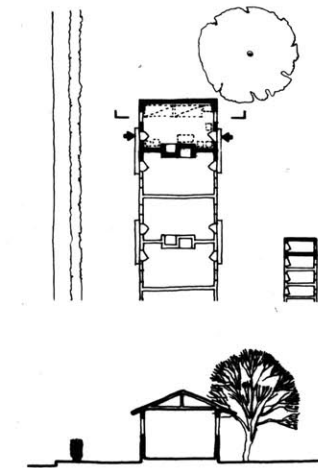
KIRINYAGA and KARURA VILLAGES are survival situations that exhibit GOOD land utilization, maximization of small group/private responsibility. Model has potential for economic provision of communal utilities and services.

Model provides GOOD land utilization, maximization of private responsibility, minimization of lines of utilities and services, public responsibility.

Model is becoming OBSOLETE in urban areas, but still proliferates in automobile dominated suburbia (U.S.A., Latin America).

Garden City layouts require REDESIGN to eliminate wasteful land utilization, green areas of not use, redundant circulation and service alleys, etc.





**V**  
**INDUSTRIAL ROW HOUSES**

Aligned in narrow lots, 1-2 stories.  
  
HIGH density.  
Economic use of land is major constraint.

XIX Century European Model used by LOW INCOME industrial labor. A small scale version of universal, traditional models (See IV TOWN ROW HOUSES) used originally by upper/middle income groups.

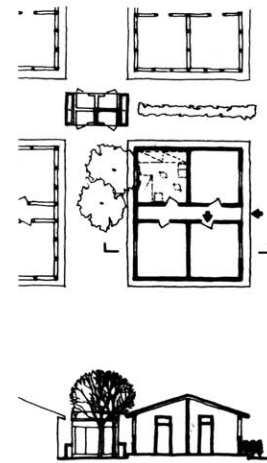
Model was imported to Africa in XIX Century by English, as a degraded model-'labor lines' (Dwelling became only one room).

AFRICAN LOW INCOME groups.  
AFRICAN LOW INCOME groups. Became a symbol of colonialism rejected by African political leaders.

4. MATHARE VALLEY; 5. KAWANGWARE;  
7. BAHATI (example above).

WESTERN culture.  
Permits MEDIUM/HIGH population densities. Accessible to LOW income groups. Model does not provide private or semi-private land for dwellings (See case studies 4,5,7).

Model is SUBSTANDARD for above reason. (See Land Utilization, pages 19-25)



**VI**  
**'LABOR CAMP' ROW/GROUP HOUSES**

Uniformly distributed groups in common land of camp, 1 story.  
  
MEDIUM/HIGH density.  
Layout which provides minimum collective utilities, services, and facilitates supervision is major constraint.

XIX Century Colonial Model used by LOW income African labor. Camp layout is European Creation (military) for colonies. Dwelling unit is generally a local type, i.e., Swahili house.

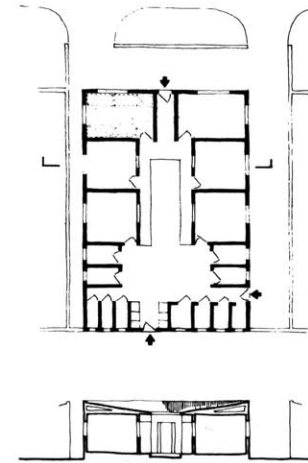
Model was developed in Africa by English.

AFRICAN LOW INCOME groups.  
AFRICAN LOW INCOME groups. Became a symbol of colonialism rejected by African political leaders.

6. KARIOBANGI (example above).

WESTERN COLONIAL culture.  
Permits MEDIUM/HIGH population densities. Accessible to MODERATELY LOW income groups. Model does not provide private or semi-private land for dwellings (See case study 6).

Model is SUBSTANDARD for above reason. (See Land Utilization, pages 19-25).



**VII**  
**TENEMENT COURT HOUSES**

Aligned in lots, rooms around central courtyard, 1-4 stories.  
  
HIGH density.  
Economic use of land is major constraint.

UNIVERSAL/TRADITIONAL model used originally by ALL INCOME GROUPS as dwelling unit or as tenement.

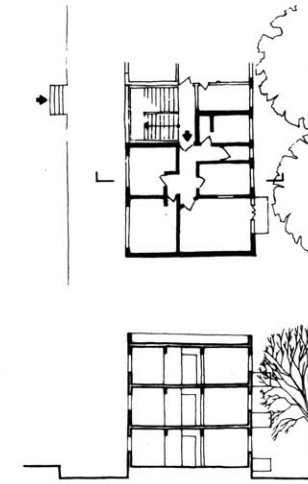
Model was imported to Africa in the XIX Century by Asians as an extended family dwelling unit.

ASIAN MIDDLE income groups.  
Predominately AFRICAN LOW income groups. Became a practical solution to housing demand as a tenement. Popularly accepted but not officially promoted.

9. EASTLEIGH (example above);  
10. RIVER ROAD

UNIVERSAL.  
Permits HIGH population densities. Accessible to LOW/MODERATELY LOW income groups; VERY GOOD land utilization (See case studies 9,10).

Models as built can be EASILY UP-GRADED in terms of safety, ventilation, privacy, cooking facilities, toilets, showers, washing facilities, etc.



**VIII**  
**WALK-UP APARTMENTS**

Varied group configurations in commonly shared public/semi-public land, 3-4 stories.  
  
MEDIUM/HIGH density.  
Higher densities, not economic use of land, is major constraint.

EUROPEAN, U.S.A., XIX Century model used originally by LOW/MIDDLE income groups, often as Public Housing.

Model was imported to Africa in the XX Century by Europeans.

Did not exist.  
AFRICAN, ASIAN MIDDLE/HIGH income groups. Developed by public sector (See case study 15) and private sector (See case study 16).

15. PUMWANI; 16. WESTLANDS.

WESTERN culture.  
Permits MEDIUM/HIGH population densities. Accessible to MIDDLE/HIGH income groups. BAD land utilization (See case studies 15,16)

Model SHOULD BE GREATLY IMPROVED to use land more efficiently, to allow user control and responsibility over semi-public space, to determine optimum population ranges. The model, as Public Housing, becomes unlivable when certain population ranges are exceeded.

Plan

Section

ORIGINAL MODEL  
Physical Characteristics  
Population Density  
Land/Layout

Users

AFRICAN MODEL

Users Before Independence

Users After Independence

Case Studies

LAND ISSUES

Comments

EXAMPLES

THE PAST

THE PRESENT

THE FUTURE

### WANJALA, AN URBAN DWELLER IN TENEMENTS

Tenements, old and new, provide dwellings for about 35-40% of Nairobi's total population primarily in the low income sector. These tenements first developed during the 1910's as extended family dwellings and are at present occupied by African low income groups. Even after independence in 1963, the tenements have become a practical solution to the housing demand. They are privately accepted, however, they are not publicly promoted. Private tenements have been developed in Kawangware and Mathare Valley after independence (see CASE STUDIES). The universal/traditional model of tenements was originally used by all income groups as a dwelling unit or as single room tenements with shared facilities. This model of dwelling/land situation is basically a configuration of rooms around a central courtyard and is aligned in narrow lots. The tenements permit high residential population densities of 300-600 persons per hectare and are accessible to low/moderately low income groups. Land utilization evaluations have shown that the model permits a very good land utilization allowing about 28% of land for streets, walkways and 72% of land for dwellings/lots. (See "DWELLINGS AND LAND"-Camino, Goethert, Chana).

Wanjala is a typical urban dweller in one of the private tenements in Eastleigh, Nairobi, and represents a typical rural immigrant, who has been living in traditional rural huts. The following notes are about the life of Wanjala. These notes are taken from open-ended interviews / conversations with Wanjala carried out with him during field surveys in Nairobi in 1971 and 1972.

#### WANJALA'S RURAL BACKGROUND:

Wanjala, who is around 35 years old, was born on September 1939 in a village in Bukoma Sub-location, 40 miles north of Busia, a town about 200 miles from Nairobi in the Western Province of Kenya. His father is a fisherman, earning his living by fishing on Lake Victoria and by looking after cattle herds of other villagers. His monthly income varies from \$15 to \$90, depending upon the season, the highest catches coming during the months of March-May.

Wanjala has two brothers and one sister. His elder brother is married with two sons and a daughter. He is also a fisherman and lives in traditional rural huts in the village like the rest of the family. Wanjala's younger brother left the village after leaving school due to continuous illness. He is presently living in Nairobi and is looking for a job. Wanjala's sister is married and also lives in the village. Except for Wanjala and his younger brother, no one in his family had any formal education.

Wanjala went to a primary school for 7 years in a nearby village and could not go onto a secondary school due to poor grades. He spend another year to improve his grades and was offered admission to a teacher training college in 1957. After one year of study he dropped out due to poor grades but later joined another teacher training college in the neighbouring Bukoma District, after having taught in the village primary school for one year. He graduated from this college in 1959 and got his first appointment as a teacher at Mudembe Primary School, near the village. In 1962 he was appointed headmaster of Bukoma Primary School in Busia. Having worked for 4 years in the rural areas Wanjala decided to visit his cousin in Nairobi and investigate possibilities for a teaching job.

#### WANJALA / MIGRATION TO THE CITY:

In 1963, just before Independence of Kenya,

Wanjala made his first visit to the city of Nairobi.

"I found out that the place was extremely different from my experience at home; the people put on smart clothes; cinemas and bars were definitely more decent than the ones at home; so I happened to fall in love with town life. I asked my cousin whether he could help me to get a place in a Nairobi school."

With these impressions in mind he went back to his job in Busia and resigned when he got a teaching job at St. Peter Clavers Primary School in Nairobi. He migrated to Nairobi in early 1964. He taught for about 1 1/2 years and resigned from teaching to take up a job as a freight clerk with the Kenya Maize and Produce Board, a semi-public organization. He has been working with this organization for the past 9 years. He also took courses in elementary book-keeping and was promoted to the position of a clerk.

#### WANJALA / HIS URBAN FAMILY STRUCTURE:

After having migrated to the city, Wanjala has still maintained rural ties.

"I regretted [coming to Nairobi] because when my family was growing and the cost of living was rising I found things very tough... if I save enough money I would rush home [to his village] immediately and put up a permanent house on my land, because even if I had a house here in Nairobi I would still be going home."

Wanjala was single when he migrated to the city in 1964. He first lived in Ziwani in a public subsidized dwelling in Eastlands, which is a predominantly African residential area, 1.5 km from the city center.

"The first house I got it right on the day I got my employment; the parish priest of the school I was teaching in gave it to me." Wanjala was single and paid a rent of \$1.5 per month for a single room unit with shared facilities. The rent was about 3% of his monthly income of \$50. After 10 months of his stay in Ziwani he got married and 2 months later moved to a similar residential area in Jericho, 5 km from the city center. His first child was born during their stay in Jericho. The family now shared the 2-room dwelling unit with his younger brother and brother-in-law. Here he paid a rent of \$3 per month, which was about 6% of his monthly income of \$50.

When he left his teaching job to join the

Kenya Maize and Produce Board, it became difficult for him to get a dwelling. He looked for housing and a friend took him to Eastleigh in search of a room in one of the tenements, but did not succeed.

"Of course, again a friend who was a relative gave me accommodations at his place [in the city center]. Then I began to face the hardship of obtaining a house; my friend made contact with landlords, but did not succeed in finding me a room. Fortunately, my office-mate had got some workmans compensation with which he had bought a house [a tenement] in Eastleigh, in which he had a room for me to live in."

After having temporarily shared one room with his friend in the city center he moved to his present dwelling in the Eastleigh private tenements, 4 km from the city center. His family has now grown to three children, his elder brother's son, and one of his cousins. They all share a single room with a kitchen, and communal / shared wc and shower. He pays a rent of about \$24 per month, which is about 17% of his monthly income of \$142.

#### WANJALA / HIS FUTURE PROJECTIONS.

His attitude towards land ownership in the future is two-folded.

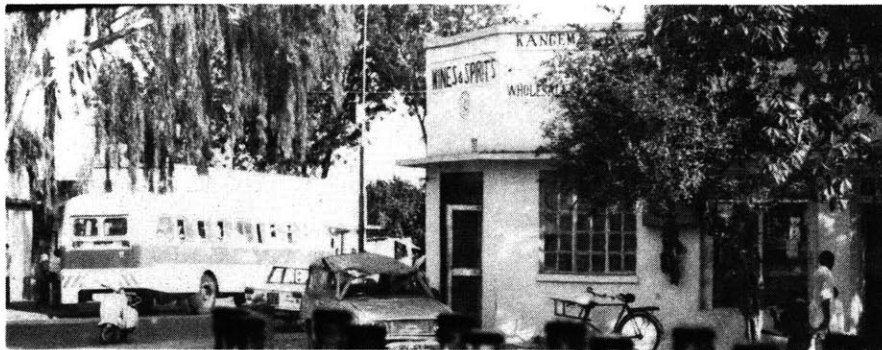
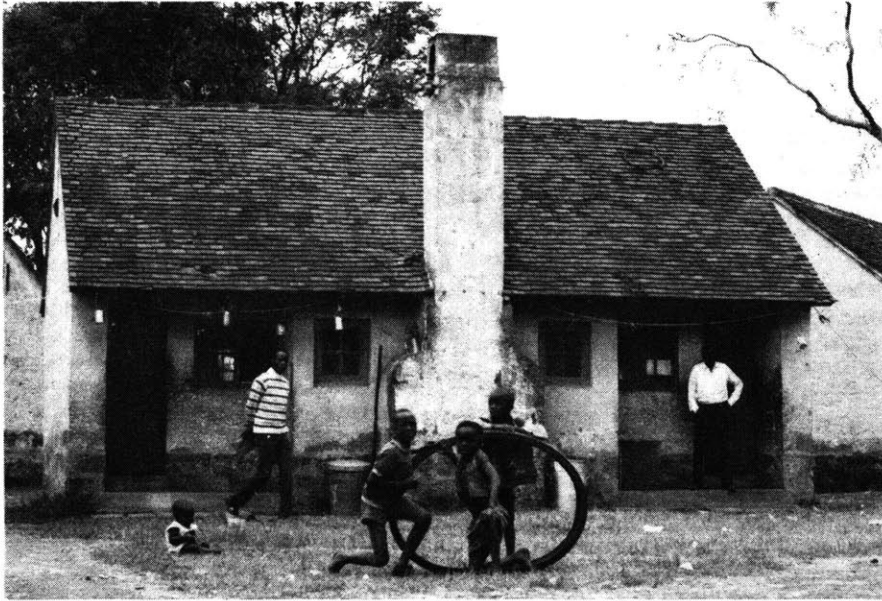
"I am thinking of building a home there [in his village]. I would build it on my own small piece of land I have there [0.3 hectare] in my location.... Another ambition is to get a house in Nairobi. I would not necessarily live in it, I would sublet it. I have seen very many being bought and turned into bars and doing very good business [old tenements as boarding and lodging restaurants]. If I could get a house on tenant purchase it means you keep on staying in the house until it is yours."

As regards financial support to own a house in the city he commented:

"I would be prepared to spend up to 25% of my income on rent for a tenant purchase house. In fact to get a loan is difficult; you have to show some form of security; a house or business, not your income."

As regards his children, he plans to send them to primary schools, without first attending nursery schools:

"I find it [a nursery school] a mere waste of time." He further anticipates that his children will get university education and his daughter will go to the rural areas to teach in their village.



WANJALA: (top left) Wanjala, on the left, is in front of his first dwelling in Ziwani, a public housing estate in Eastlands. Based upon the "Garden City" type of layout, the open spaces around the rows of single room dwelling units are used for various activities.

(center left) State House Road; the detached house where Wanjala stayed with his friend after leaving his teaching job in 1965.

(bottom left) One of the old tenements being used as a liquor store near Wanjala's present house in Eastleigh. The Kenya Bus Service serves the area. Note the different modes of transportation.

(top right) Eastleigh tenements on the Seventh Street, where Wanjala presently lives. Eastleigh has adequate utilities and services.

(bottom right) The layout of the tenements is the universal/traditional type with rooms around a courtyard that is used for different activities. Kitchens, showers, toilets and washing areas are located at the rear of the court and used communally.

## DWELLINGS AND LAND MODELS

The following section outlines alternative guidelines for the development of urban settlements in Nairobi, Kenya. They are intended as a reference source for design determinants for those involved in the development of dwellings and land models for the very low, low, and moderately low income groups in the rapidly urbanizing areas of developing countries. The models are presented in the same comparative format used in the survey-evaluations of existing urban dwelling environments, developed at the Urban Settlement Design Program, M.I.T.

They are described in the following sections:

1. SITE CONTEXT.
2. COMMUNITY CONTEXT.
3. DWELLINGS CONTEXT.

### PLANNING POLICIES AND GOALS:

The policies/goals proposed provide a framework / set of alternative guidelines for approaching the basic problems related to the community. (See GLOSSARY for definitions of the terms used in this section).

### LAND USE: RESIDENTIAL COMMUNITY.

Land use to be defined in the following terms:

- Primary: residential.
- Secondary: commercial, including main commercial zone, markets and light industries.
- Supporting: Community facilities, including schools, parks, clinics, fire and police stations.

### TARGET INCOME GROUPS: LOW INCOME GROUPS.

The target low income groups of the community reached:

- Very low: less than \$325/year, 30% of the population.
- Low: \$325/year, 30% of the population.
- Moderately low: \$1,300/year, 40% of the population.

### LAND TENURE: CONDOMINIUM LEASE, RENTAL.

Tenure options with emphasis on the following land tenure types, to be offered:

- condominium lease: lots for row houses.
- rental: lots for tenements.

### DWELLING UNIT TENURE: LEASE, RENTAL.

Tenure options with emphasis on the following dwelling unit tenure types to be offered:

- lease: row houses.
- Rental: rooms in tenements and row houses.

### INTENSITIES OF LAND USE: MEDIUM DENSITY.

Densities to be planned within the following ranges:

- 300 persons per hectare: predominately 1-2 story structures room occupancy 4 m<sup>2</sup> per person.
- 600 persons per hectare: expansion to 2-4 stories; with higher occupancy.

### CIRCULATION: PREDOMINANTLY PEDESTRIAN.

Different modes of use for streets to be planned for the following:

- Pedestrian dominant
- Pedestrian (dominant) and vehicles
- Vehicles and Pedestrians
- Vehicles (dominant) and Pedestrians
- Vehicles

Circulation networks to be developed in relation to the site: interior and exterior networks; control, responsibility and maintenance, public and semi-private areas served- paths, walkways, clusters, local streets, secondary streets, highways, etc..

PANORAMIC VIEW OF THE PROPOSED SITE FROM OUTER RING ROAD, NAIROBI: The photograph shows the generally flat undeveloped site. The existing residential developments of Harambee and Uhuru Estates are on the left, the Ngong Hills and the city center are in the background in the center of the photograph. The Eastleigh Air Force Airport buildings are on the extreme right.



UTILITIES, SERVICES; CONNECTION TO EXISTING NETWORKS

All utility systems to be interconnected into the existing / planned urban networks:

- Sewerage, Storm drainage
- Water Supply
- Electricity, Street lighting, Telephone
- Refuse collection
- Public transportation
- Paved roads, walkways.

COMMUNITY FACILITIES: LINKED WITH EXISTING

Community facilities to be proposed in relation to the existing facilities in the surrounding residential developments:

- Police protection
- Fire protection
- Health
- Schools, playgrounds
- Recreation, parks and open spaces
- Markets and light industries.

DEVELOPMENT MODES: INCREMENTAL AND / OR INSTANT.

Two modes to be considered: depending on project size:

- Incremental: construction of dwellings, secondary infrastructure, community facilities.
- Instant: Primary infrastructure networks including water supply, sewers, electricity, streets, street lighting.

IMPLEMENTATION: PROGRESSIVE DEVELOPMENTS.

The implementation to be staged in phases consisting of the following cycle till full development:

- Planning / design
- Construction, allocation of lots
- Habitation
- Evaluation
- Revision of policies as needed.

Time periods for the development to be:

- Initial project development: development of primary infrastructure and land subdivision (1-2 years).
- Progressive project development: development of dwellings, secondary infrastructure, community facilities.

FINANCING GROUPS: PUBLIC, PRIVATE AND PUBLIC SUBSIDIZED

Depending upon the size of the project and the prototypical nature the following sources for funding to be recommended:

- Public; for land and infrastructure development.
- Private and Public Subsidized: for dwelling development with subsidies from the public sector.

MANAGEMENT: PUBLIC, SEMI-PUBLIC, PRIVATE, SEMI-PRIVATE

The management / operations of the development is to be defined in terms of responsibility, maintenance and controls by:

- Public: Planning / design, primary infrastructure, networks, streets, land subdivision and allocation of lots (Local government)
- Semi-public: Community facilities (Local government and community organizations)
- Private - Semi-private: Dwellings and clusters (Co-operatives and individuals).



### SITE CONTEXT

*For the purposes of this study the following guidelines have been used for the selection/evaluation of the site. (The structure for the guidelines has been developed at the Urban Settlement Design Program, M.I.T.).*

#### LOCATION

- Location: Eastlands, Nairobi Metropolitan Area. Approximately 6 km east of the city center, adjacent to the existing residential developments of Eastlands on the west of the site, the Nairobi Industrial Park on the south and private agricultural land on the east.

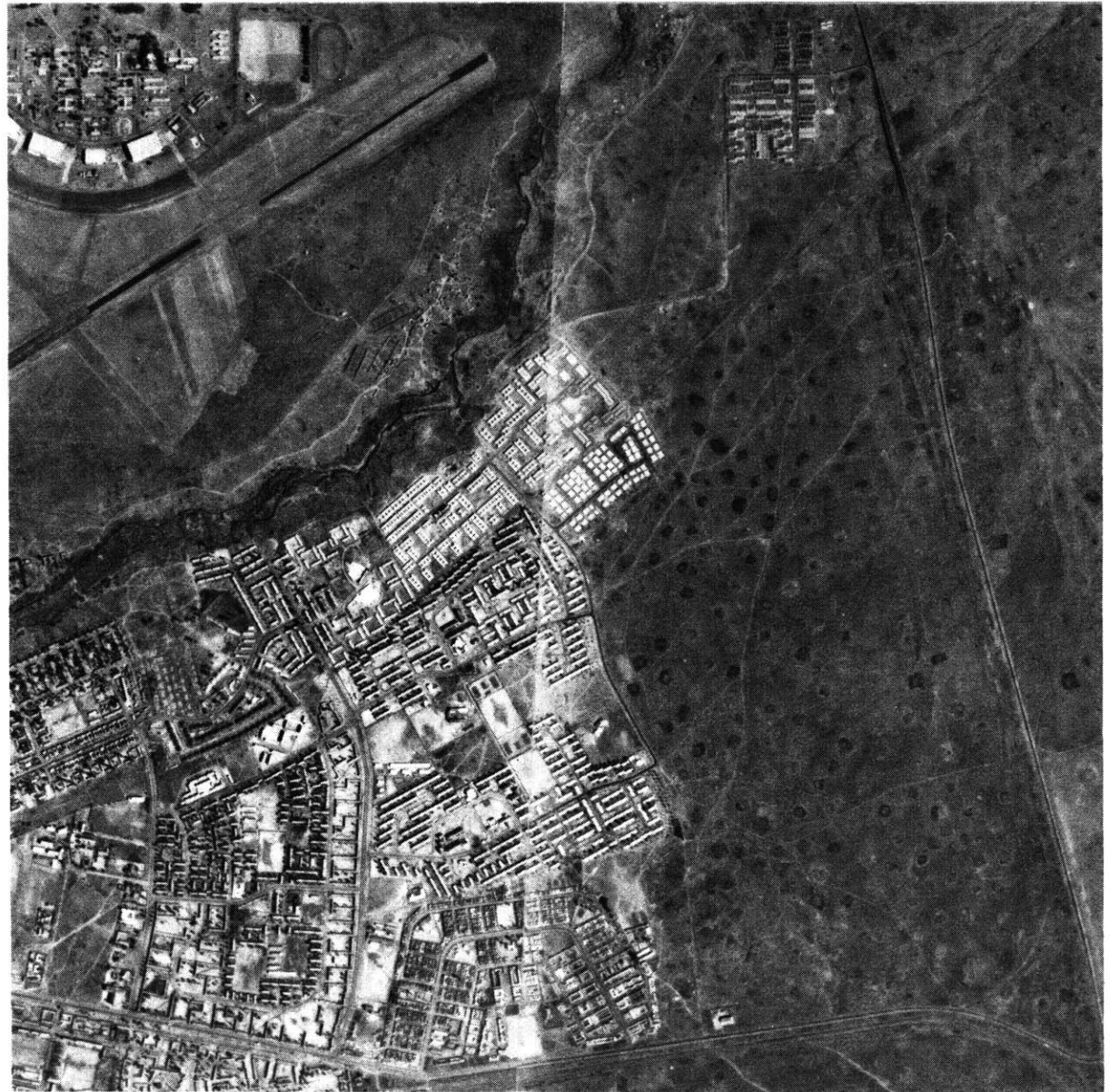
- Approaches/ Access: Jogoo Road on the south, Outer Ring Road on the east, Rabai Road on the west, Future Komo - Rock by-pass highway in the north.

- Transportation: Bus-route along Rabai Road connected to the existing network serving the city center and the Industrial Park to the south. The site is within walking and / or bicycling distances to the surrounding places of employment and community facilities.

#### AREA

- Size: Approximately 250 Hectares (excluding existing residential developments).

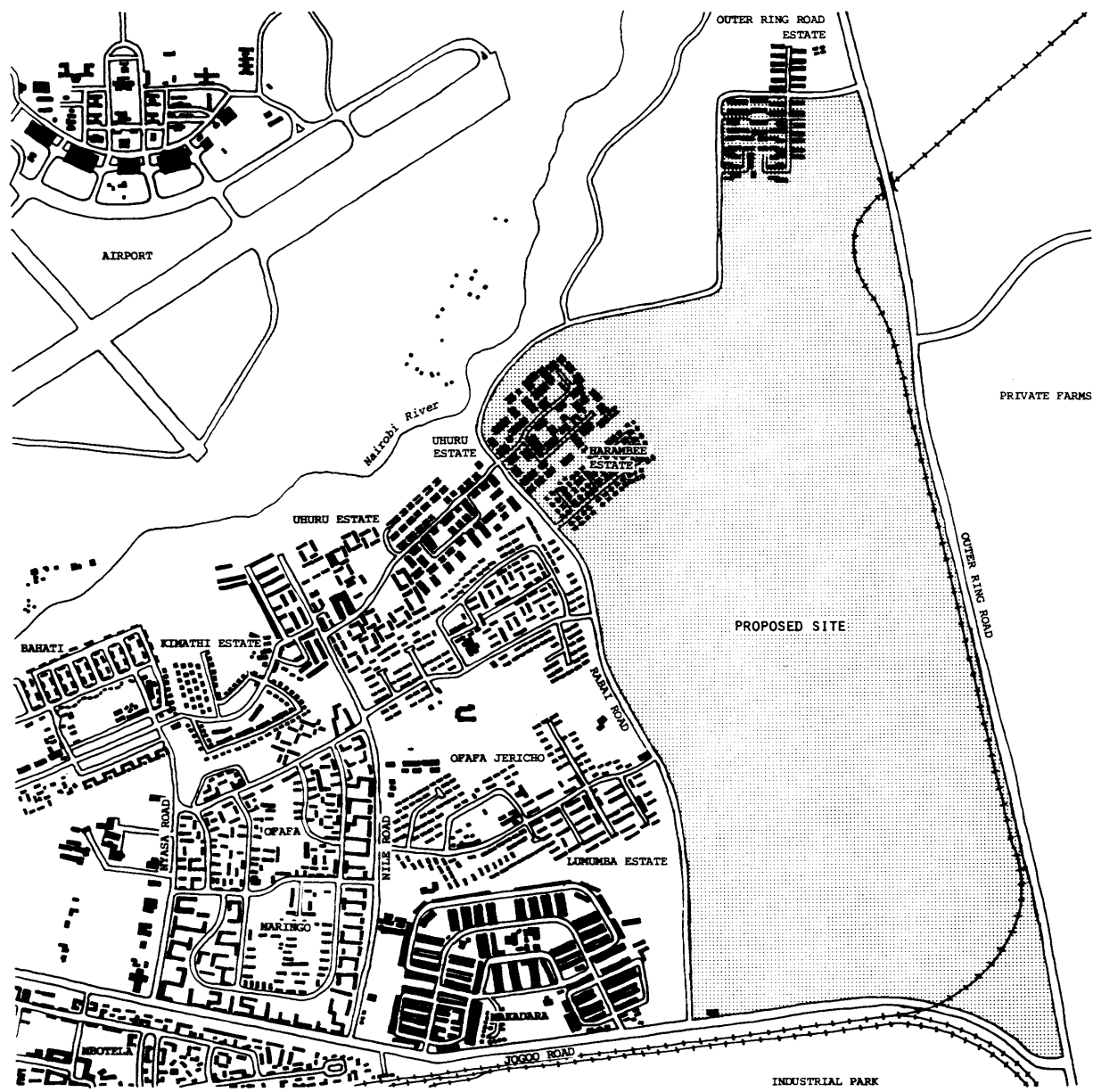
- Shape: Defined by man-made barriers/ boundaries on all the sides; railway line to the south and east of the site, which passes through the site connecting Nairobi to other towns in the north and the south of the city.



AIR PHOTOGRAPH

0 1 Km  
1:20000





EXISTING DEVELOPMENT



1:20000



TOPOGRAPHY

- Slopes: Mostly flat and devoid of any natural physical features, other than the Nairobi River in the north of the site.
- Soil: Uniform layer of about 1m of "black cotton" (a mixture of fine-grained soils and clays) over a subsoil and weathered lava strata to 7m depth. Suitable only for 1-2 story light frame structures. Drainage characteristics are poor; volume changes due to moisture variation.
- Climate: Within ranges of human comfort and suitable for outdoor activities throughout the year. (See NAIROBI URBAN CONTEXT); not a major constraint on the dwelling and environment design.
- Pollution: The polluted Nairobi River on the north of the site is subjected to odour nuisances from the Sewerage Works at Kariobangi, depending on the direction of the prevailing winds. Airport disturbances from the Air Force Airport at Eastleigh on the north-west of the site create a degree of noise nuisance. The railway running parallel to Outer Ring Road will continue to create noise and vibration nuisances with the intensity of use unless control measures are adopted. The Industrial Park on the south will continue to create smoke, fumes, dust and other nuisances with greater development and lesser pollution controls.
- Existing Structures, Easements, Rights of way: A social center near the junction of Rabai Road and Jogoo Road. An approximately 20m setback for right of way for the railway along the Outer Ring Road.

LAND TENURE / LAND COSTS

- Land tenure: Public ownership; except for a 84m strip of land between Outer Ring Road Estate and Outer Ring Road.
- Land Costs: Values range from \$0.7/m<sup>2</sup> for the undeveloped land to \$3.5/m<sup>2</sup> for the developed land. (Year of source: 1972).

LAND USE





- Residential: Existing residential developments of the Outer Ring Road Estate and of the Uhuru and Harambee Estates along the northern boundary of the site. The Bahati, Kimathi, Ofafa, Jericho, Lumbumba and Makadara Estates to the west of Rabai Road. All these estates have public subsidised dwelling units, mainly industrial row houses/apartments with limited private and no semi-private land for the dwellings (See CASE STUDIES- Examples BAHATI AND UHURU PHASE 4).

- Commercial: Existing commercial facilities are limited to small shopping centers scattered at few points in the residential areas. Most of the users in the locality are employed in the city center and the Industrial Park of the city, resulting in daily commuting to places of employment and high intensity of use along Jogoo Road. Informal / local markets have developed along Jogoo Road to meet local needs.


- Industrial: Existing Industrial Park on the south of the site provides a source of employment.

- Community Facilities: Most of the existing residential developments have primary schools, playgrounds, social services including community centers, churches, clinics.

AREAS

-  RESIDENTIAL
-  COMMERCIAL
-  INDUSTRIAL
-  OPEN SPACES

KEY

- Pk** Parking
- P** Police
- F** Fire Department
- S** School
- Ch** Church
- R** Recreation
- L** Library
- U** University
- H** Health
- PO** Post Office
- SS** Social Services
- M** Market
- C** Cemetery
-  Bus

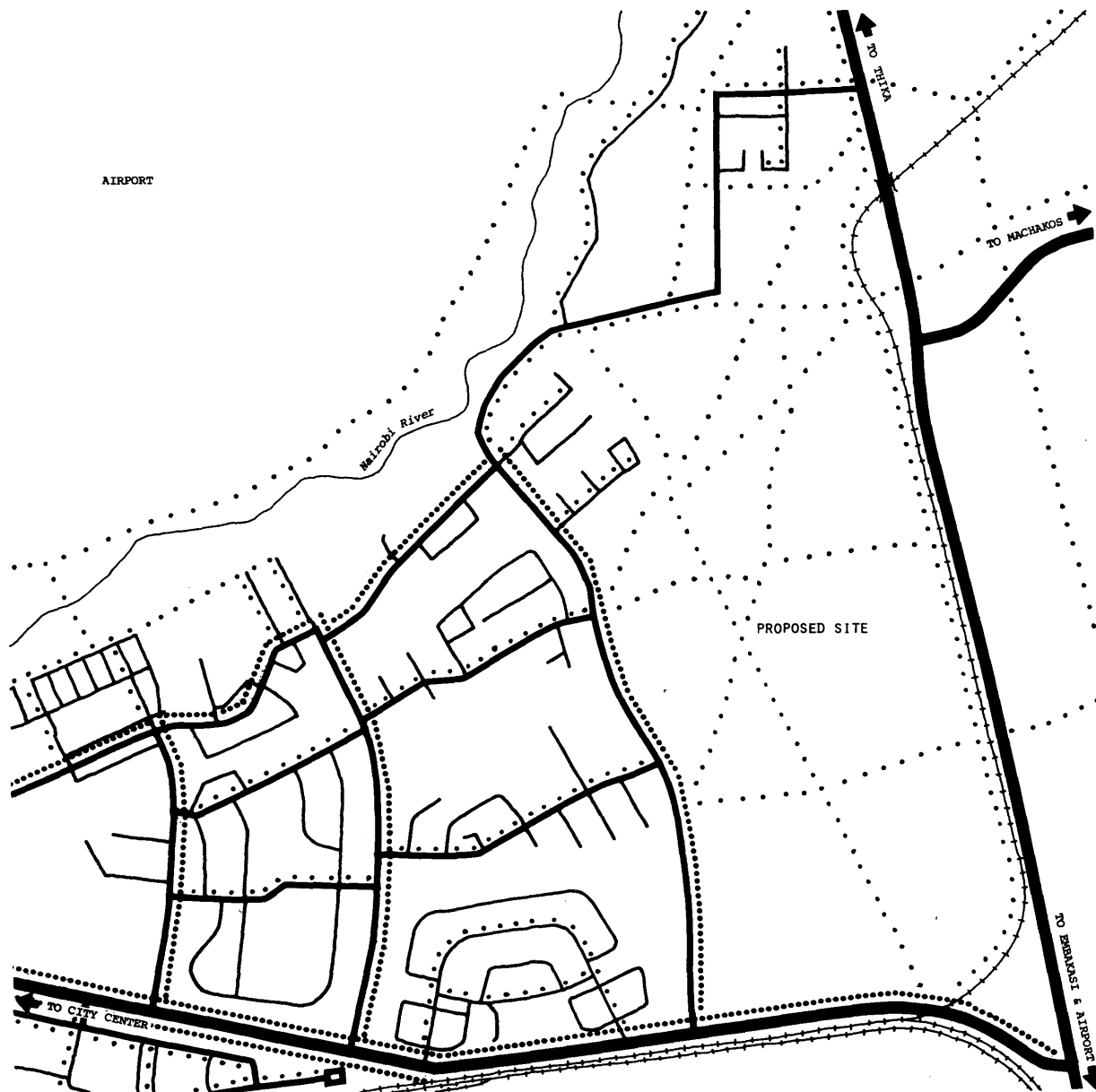


EXISTING LAND USE PATTERN



1:20000





EXISTING CIRCULATION PATTERN



CIRCULATION

- Vehicular: The internal network of vehicular streets in the surrounding residential developments is connected to Jogoo Road, which is a central street leading to the city center and is also connected to Outer Ring Road.

- Pedestrian: Pedestrian and bicycle circulation dominates and is along the local streets within the residential developments and also along Jogoo Road.

- Bus routes: A bus route serving the residential developments is connected to the existing urban networks through Jogoo Road and through Outer Ring Road. Bus services are limited with over-crowded buses. 'Matatu' popular taxis run services to meet the local needs.

UTILITIES.

- Water supply: Existing / planned networks to provide an adequate water supply; responsibility / control of the public sector (Nairobi City Council).

- Sewerage: Existing / planned networks to provide an adequate sewerage and storm drainage; responsibility / control of the public sector (Nairobi City Council.)

- Electricity and Street Lighting: Existing / planned networks to provide adequate street lighting. Main power lines and distribution lines for individual lots to be provided; responsibility / control of the semi-public agencies (Nairobi City Council, and E.A. Power and Lighting).

- Gas: Available as a private service for individual users.

- Telephone: Existing / planned networks to provide adequate installation of telephones; responsibility of the semi-public agencies (E.A. Posts and Telecommunications and E.A. Power and Lighting).

- Refuse collection: Existing / services are limited, planned services to provide an efficient service; responsibility of the public sector, (Nairobi City Council)

- Public Transportation: Existing / planned services to provide an adequate bus service; responsibility / control of semi-public agencies (Nairobi City Council and Kenya Bus Services).

KEY

———— VEHICULAR

..... PEDESTRIAN

### COMMUNITY CONTEXT

For the purposes of this study the following guidelines have been used for the development of the community. (The structure of these guidelines has been developed at the Urban Settlement Design Program, M.I.T.). Alternative developments were studied using these guidelines. One alternative is presented under these sections:

1. LAND USE PLAN.
2. CIRCULATION PLAN.
3. DEVELOPMENT PLAN.
4. BLOCK PLAN.

Each of these sections is outlined under the following topics:

- Assumptions
- Consequences
- Design Considerations.

#### LAND USE PLAN

The site has a geographic identity and therefore has been planned as a whole.

##### ASSUMPTIONS:

- That the primary use of the site is for a residential community with supporting commercial and community services.
- That the predominant commercial growth will develop along major circulation networks and on land with higher land costs.
- That the community facilities will be located within walking and / or bicycling distances of the residential areas served and on land with the lower land costs.

##### CONSEQUENCES:

- Greater percentage of land to be used for residential purposes.
- Smaller percentage of land to be used for commercial purposes. Tenements along the major circulation networks.
- Percentage of land to be used for community facilities depending upon the residential population served.

##### DESIGN CONSIDERATIONS:

	Ha	%
- Land for development:		
PRIVATE & SEMI-PRIVATE (Residential, Commercial)	150	60
PUBLIC (Circulation, Reserved land)	40	16
SEMI-PUBLIC (Schools, Playgrounds, etc.)	60	24
TOTAL	250	100

- POPULATION & DWELLING ROOM UNITS: 52,000 to 75,000 people at saturation. 15,000 to 21,000 units at saturation.
- SEMI-PUBLIC FACILITIES: located along the periphery of the site.
- MARKETS / RESERVED LAND: located along Rabai Road as a focus in the community.
- SCHOOLS / PLAYGROUNDS: located along the Outer Ring Road and Jogoo Road, providing a buffer zone from the railway.
- RESIDENTIAL AREAS: located between the above described areas and within walking and / or bicycling distances of schools, playgrounds, markets and other community facilities.

#### CIRCULATION PLAN

The site has been developed around a primary ordering framework provided by the circulation network.

##### ASSUMPTIONS:

- That the most direct / immediate access is from Rabai Road and that it provides a link with the surrounding existing residential developments.

- That the internal circulation network will define the lines of distribution / collection of the utilities and services and that this network is under public responsibility and control.

##### CONSEQUENCES:

- Land values to be highest along Rabai Road; main commercial growth to develop along Rabai Road and the transverse connectors within the residential areas.
- Circulation lengths to determine the efficiency of the layout and the economic viability of the development (land development costs, maintenance costs, etc.)
- Circulation in the clusters to increase the efficiency of the layout and to decrease the burden on the public sector.

##### DESIGN CONSIDERATIONS:

- Location of markets and reserved land along Rabai Road, where land values are anticipated to be highest.
- Minimization of circulation lengths within certain limits to maximize land for residential purposes.
- Circulation modes are considered as follows:
  1. PEDESTRIAN ONLY: exclusive use by pedestrians. Example: walkways.
  2. PEDESTRIANS AND VEHICLES MIXED: pedestrians dominate over vehicles; control of traffic frequency, character, and speed are mainly established by the street layout and use. Example: local streets, and in clusters.
  3. VEHICLES AND PEDESTRIANS MIXED: pedestrians dominate but do not control circulation; controls are established for the protection of pedestrians; crosswalks, traffic lights, rails, etc. Example: main commercial street, transverse connectors.
  4. VEHICLES ONLY: exclusive use by vehicles relatively high speed, with large volume of traffic flow. Example: Jogoo Road, Outer Ring Road.

#### DEVELOPMENT PLAN

The site has been developed in terms of stages, time, population to be settled. (Detail social, economic, and physical studies, which are beyond the scope of this study, would be additionally required to propose the final development plan).

##### ASSUMPTIONS:

- That the initial development will have supporting public and semi-public services and facilities, which aim to link the proposed with the existing services and facilities.
- That the direction of growth may be anticipated and that the growth will be incremental.

##### CONSEQUENCES:

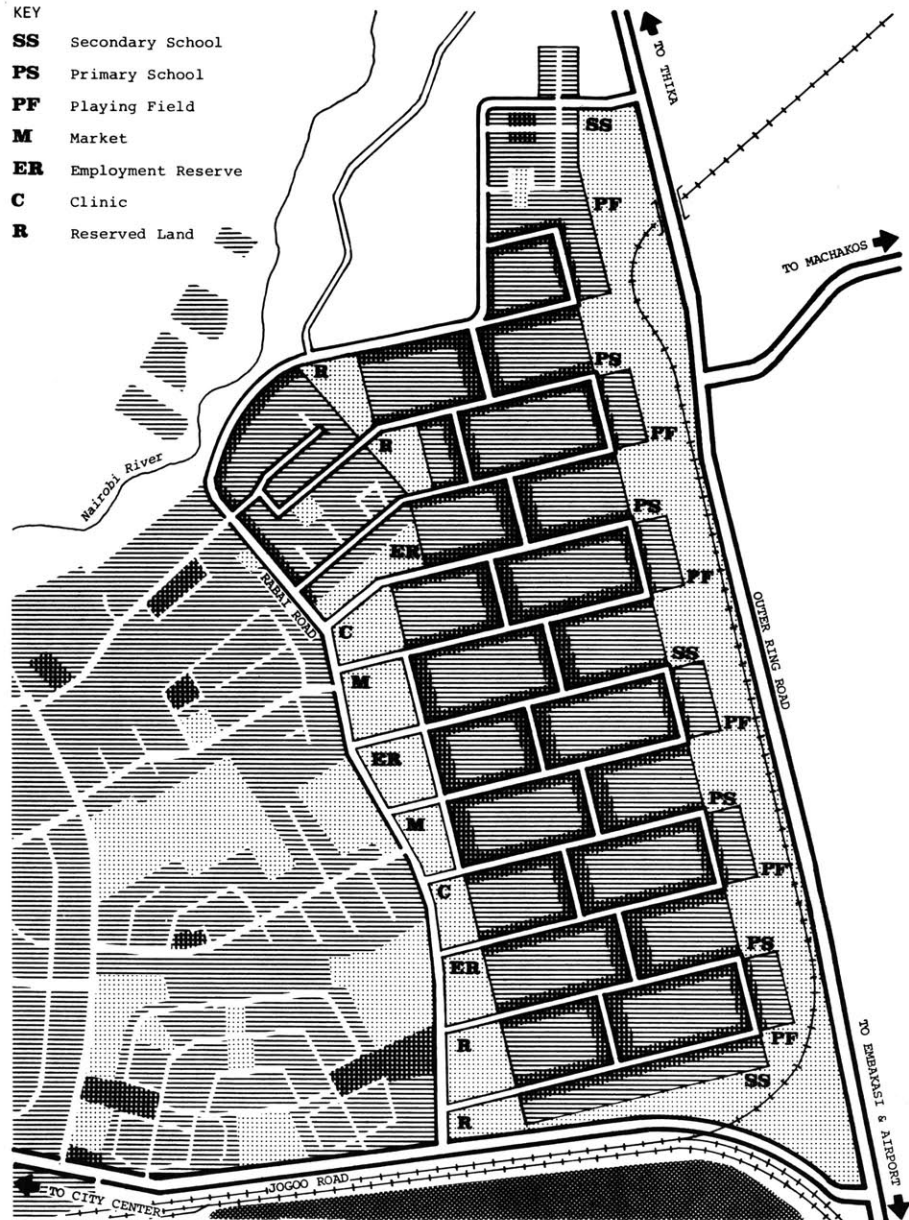
- Location of the initial development to be closest to the existing residential developments of the Outer Ring Road, Uhuru, and Harambee Estates.
- The incremental growth anticipated from the north towards the south of the site.

##### DESIGN CONSIDERATIONS:

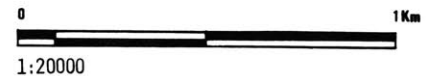
- INITIAL DEVELOPMENT: along Rabai Road, which permits easiest / direct access from Outer Ring Road (north) and from Jogoo Road (south); convenient pedestrian access to existing / planned public transportation; a natural progressive accretion of the different land uses, circulation and infra-structure; at any stage the consistency between land use / densities / commercial potential and intensity of circulation / activities is maintained.
- SUBSEQUENT DEVELOPMENT: along the main commercial street as a function of demand and growth is shown on the plan.

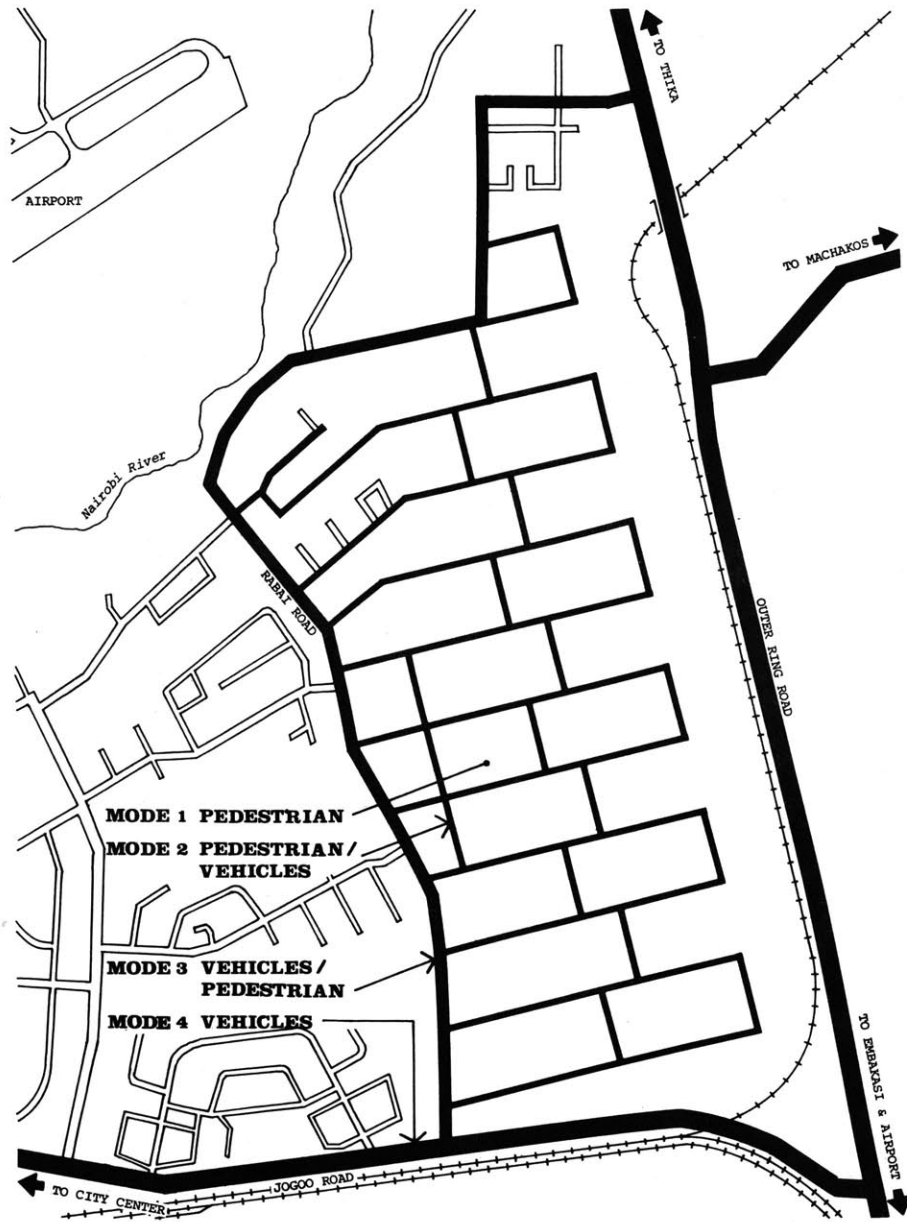
#### KEY

- SS Secondary School
- PS Primary School
- PF Playing Field
- M Market
- ER Employment Reserve
- C Clinic
- R Reserved Land

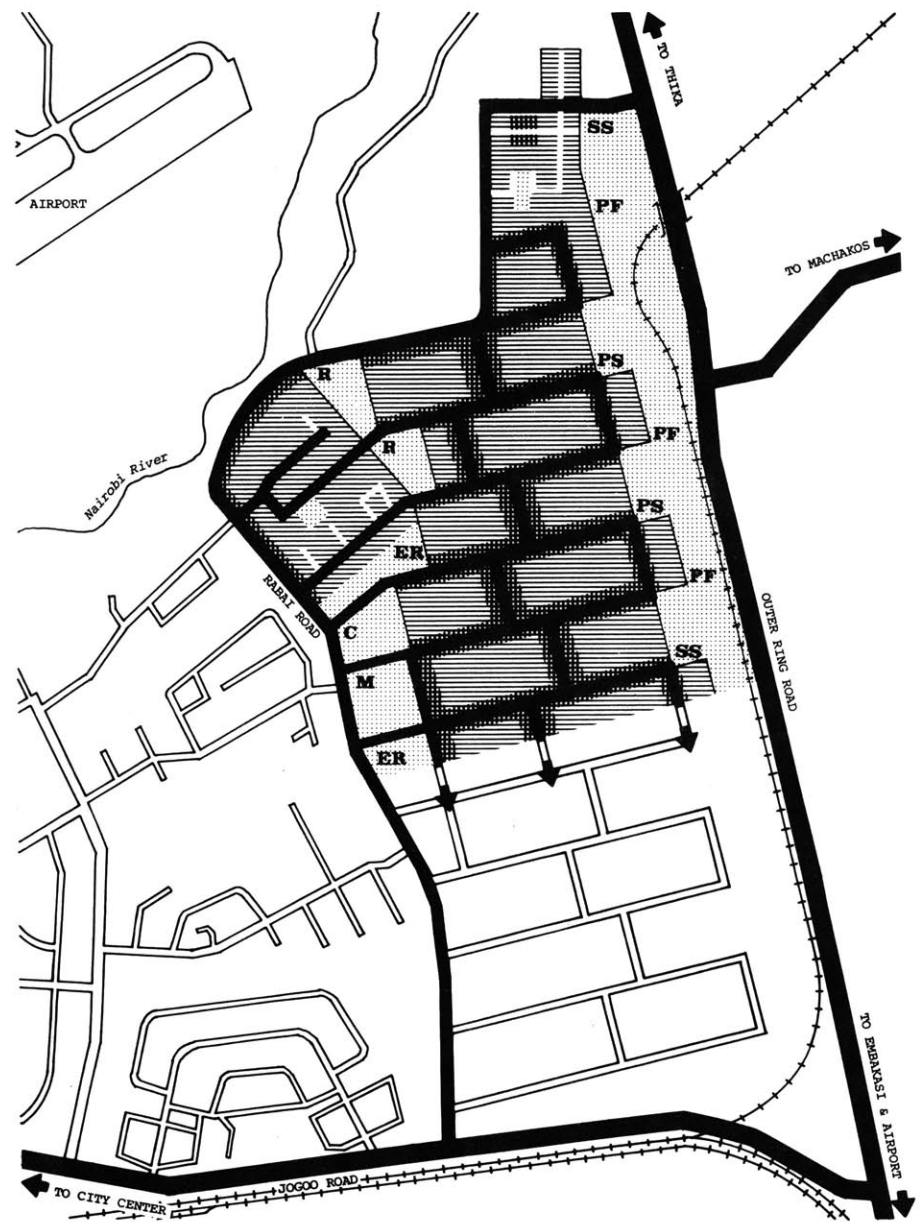


PROPOSED LAND USE PLAN





PROPOSED CIRCULATION PLAN



PROPOSED INITIAL DEVELOPMENT



**BLOCK PLAN**

This section concentrates on land subdivision and land utilization of block, lots and lot clusters.

**ASSUMPTIONS:**

- That a block is a primary residential parcel of land bounded and served by public streets and walkways.
- That a lot is a measured parcel of land having fixed boundaries and access to public streets and walkways. That a lot may be either an exterior lot, which has access only to public streets and walkways, or an interior lot, which has access to a semi-private cluster court connected to public streets and walkways.
- That a lot cluster is a group of lots around a semi-private court.

**CONSEQUENCES:**

- The layout is to be aimed at:
- Minimization of : public sector burdens, including lengths of circulation and infra-structure networks.
- Maximization of : private sector responsibilities, including the use of semi-private land for residential purposes.

**DESIGN CONSIDERATIONS:**

- The layout permits:
- FLEXIBILITY OF LAND USES : residential ; residential / commercial ; light industries ; schools, playgrounds, etc. ; markets, clinics, other uses.
- FLEXIBILITY OF RESIDENTIAL DENSITIES : tenements (medium and high densities) ; expandable row houses (medium and high densities).
- DIFFERENT TYPES OF LAND TENURE : lease ; rental ; sublet.
- EXPANSION AND TRANSFORMATION OF DWELLINGS AND LAND MODELS : horizontal by additional land for the lot ; vertical by additional units for the dwelling.

**PROPOSED BLOCK LAND UTILIZATION DATA**

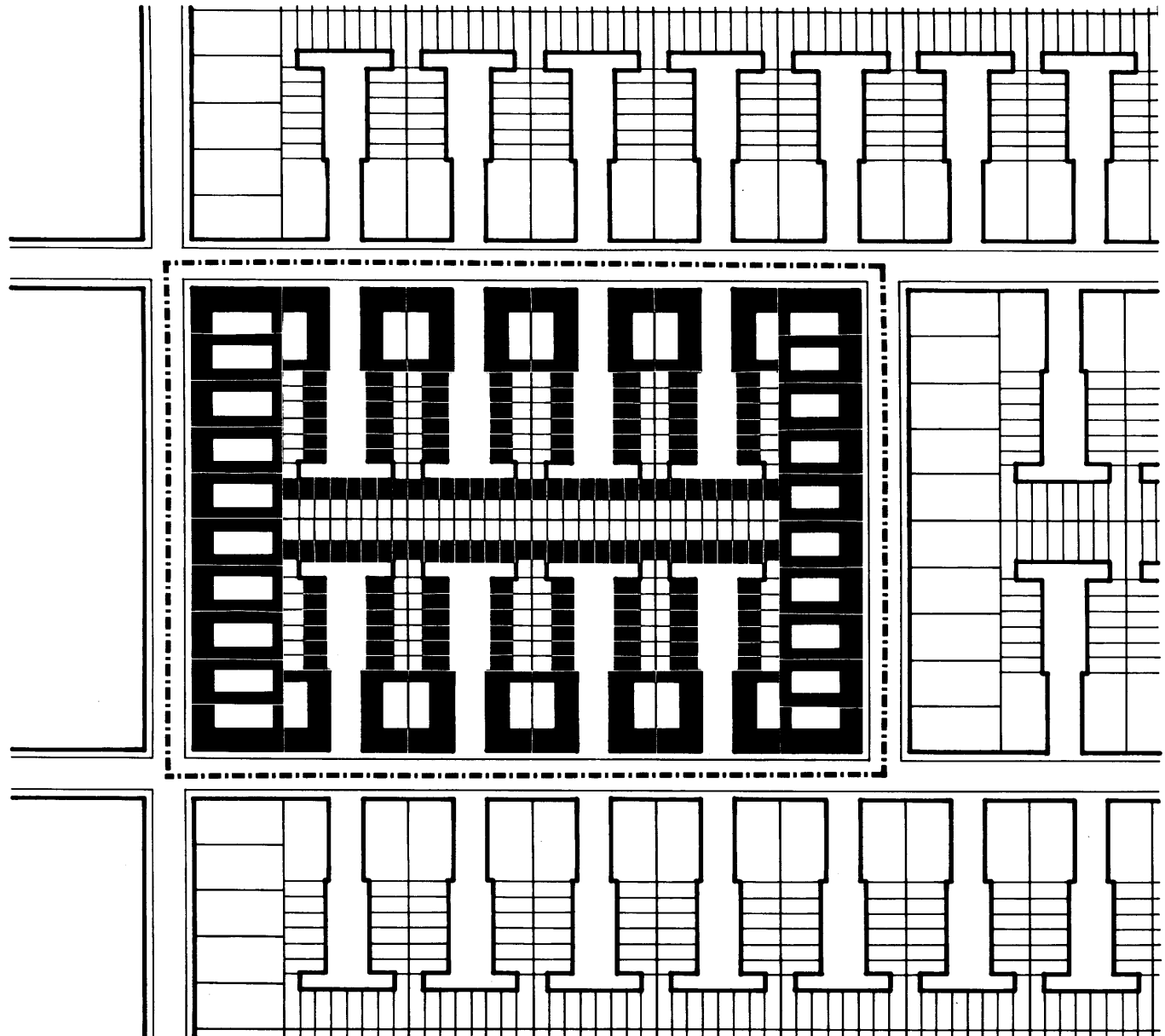
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	195	5.5	35
DWELLING UNITS	768	5.5	139
PEOPLE	2,304	5.5	420

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	0.8	15%
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	3.7	67%
SEMI-PRIVATE (cluster courts)	1.0	18%
<b>TOTAL</b>	<b>5.5</b>	<b>100%</b>

**NETWORK EFFICIENCY**

$$R = \frac{\text{network length(circulation)}}{\text{areas served(circulation, lots)}} = 180\text{m/Ha.}$$

$$\text{AVERAGE LOT AREA} = 280\text{m.sq.}$$

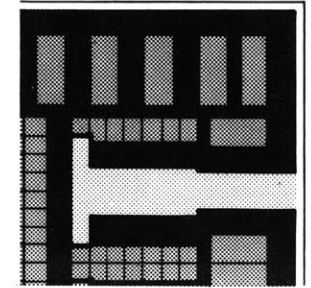


**PROPOSED BLOCK PLAN**



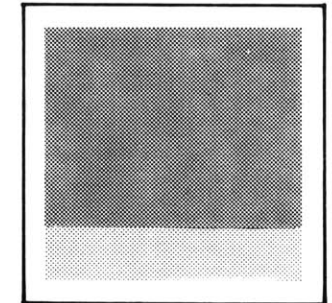
LAND UTILIZATION DIAGRAMS

1 Hectare



- PATTERN**
- Public: streets/walkways
  - Semi-Public: playgrounds
  - Semi-Private: cluster courts
  - Private: lots
  - dwellings

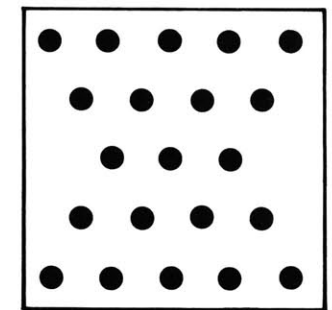
1 Hectare



**PERCENTAGES**

Streets/Walkways	15%
Playgrounds	18%
Cluster Courts	18%
Dwellings/Lots	67%

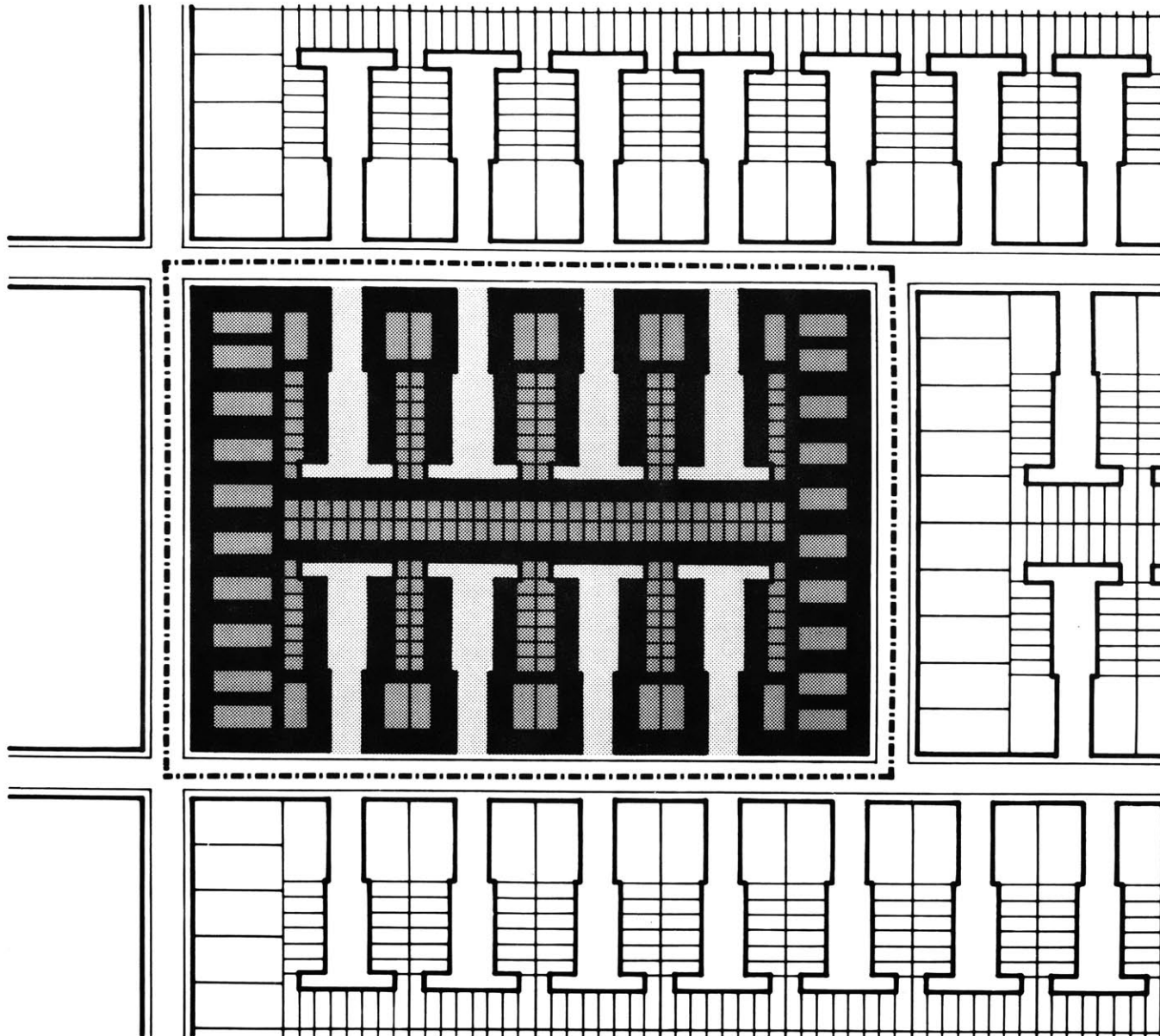
1 Hectare



**DENSITY**

Persons/Hectare	420
-----------------	-----

● 20 Persons



1:2500



**PROPOSED BLOCK LAND UTILIZATION**

**DWELLING CONTEXT**

The following dwellings and land models have been derived from the survey-evaluations of twenty existing dwellings and land case studies in Nairobi, Kenya. (See CASE STUDIES). These survey-evaluations have served as a reference source for understanding the different existing urban dwelling environments in the Nairobi Metropolitan Area. They have been useful as a tool for the formulation of these models. The two basic proposed models are:

- TENEMENTS.
- EXPANDABLE ROW HOUSES.

Each model has three options / variations showing different levels of services, dwelling areas, number of floors, tenure, utilization, development mode and target income groups. Also included in this section is a summary of:  
Dwelling Options  
Target Income Groups  
Basic Construction System.

**BASIC CONSTRUCTION SYSTEM**

**FOUNDATIONS:** Strip foundations of plain concrete, minimum width 60 cm.

**LOAD-BEARING WALLS:** Alternatives:

- (a) R.C., minimum width 15 cm,
- (b) Poured concrete columns with concrete blocks, stones, bricks infill, minimum width 15 cm.
- (c) Concrete blocks, stones, minimum width 20 cm.

**NON LOAD-BEARING WALLS:** Alternatives:

- (a) Concrete blocks, stones, bricks, compacted earth, minimum width 10cm.
- (b) Wooden panel, minimum width 5 cm.

**ROOF SLABS:** Poured in situ or precast reinforced concrete with asphalt, minimum width 10cm.

Structural timber with C.G.I. or asbestos sheete.

**FLOOR SLABS:** Poured in situ or precast reinforced concrete, minimum 10cm thick.

Hollow concrete blocks with reinforced concrete beams, minimum 10cm thick.  
Structural timber with boarding.

**VERANDAHS:** Poured in situ reinforced concrete, minimum 10cm thick.  
Structural timber with boarding.

**STAIRS:** Poured in situ reinforced concrete.  
Structural timber with boarding.

**CHIMNEYS:** Concrete blocks, stones, bricks, or reinforced concrete, minimum width 10cm.  
Cast iron steel frame with glass and burglar proofing.

**WINDOWS:** Wooden frame with glass or wooden planks and burglar proofing.

**DOORS:** Wooden frame with t&g board door.  
Wooden frame with flush door.

**SANITARY FITTINGS:** Water closet, shower, lavatory, hand wash basin.

**WASHING AREA:** Concrete slab and water tap.

**KITCHEN:** Sink, ventilation duct.

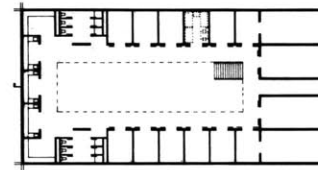
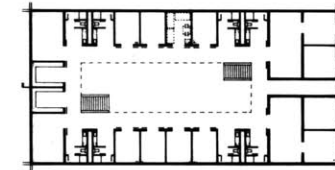
**WATER SUPPLY:** Connections, water storage tank, fixture man-holes.

**SEWERAGE:** Connections, man-holes, gully traps, fixtures, etc..

**ELECTRICITY:** Connections, meter boards, conduits, outlets, fittings, etc.

**WALL FINISHES:** Exposed/plastered masonry work, paint.

**FLOOR FINISHES:** Exposed/plastered concrete or wood.

**1 TENEMENTS TYPE A****2 TENEMENTS TYPE B****DWELLING OPTIONS****12 M<sup>2</sup> DWELLING  
1 ROOM/COMMUNAL FACILITIES**

Type: TENEMENT

Tenure: RENTAL

Construction Cost: \$ 480 @ \$ 40/m<sup>2</sup>

Land Value: \$ 120

@ \$ 10/m<sup>2</sup> of construction

Dwelling Unit Cost: \$ 600

Payments: \$ 70 /year

@ 3% interest for 10 yrs.

**TARGET INCOME GROUPS****\$ 325 ANNUAL FAMILY INCOME**

BUDGET: Housing:	\$ 41	12.5 %
Transportation:	\$ 30	9.2 %
Food/Clothing:	\$ 182	56.0 %
Health/Education:	\$ 36	11.1 %
Electricity:	\$ 12	3.7 %
Water:	\$ 12	3.7 %
Gas:	\$ -	- %
Municipal Tax:	\$ 6	1.9 %
Miscellaneous:	\$ 6	1.9 %

**SUBSIDY NEEDED PER FAMILY PER YEAR**

Housing	\$ 29
Market land value \$20/m <sup>2</sup> of construction	\$ 24
Infrastructure 1/3 cost of dwelling	\$ 20
<b>TOTAL</b>	<b>\$ 73</b>

**24 M<sup>2</sup> DWELLING  
2 ROOMS / SHARED FACILITIES**

Type: TENEMENT

Tenure: RENTAL

Construction Cost: \$ 960 @ \$ 40 /m<sup>2</sup>

Land Value: \$ 240

@ \$ 10/m<sup>2</sup> of construction

Dwelling Unit Cost: \$ 1,200

Payments: \$ 140 /year

@ 3% interest for 10 yrs.

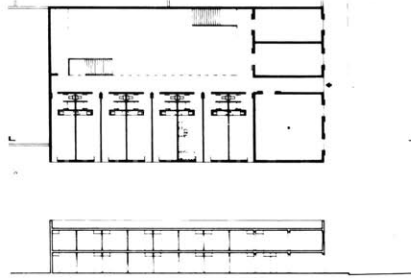
**\$ 325 ANNUAL FAMILY INCOME**

BUDGET: Housing:	\$ 41	12.5 %
Transportation:	\$ 30	9.2 %
Food/Clothing:	\$ 182	56.0 %
Health/Education:	\$ 36	11.1 %
Electricity:	\$ 12	3.7 %
Water:	\$ 12	3.7 %
Gas:	\$ -	- %
Municipal Tax:	\$ 6	1.9 %
Miscellaneous:	\$ 6	1.9 %

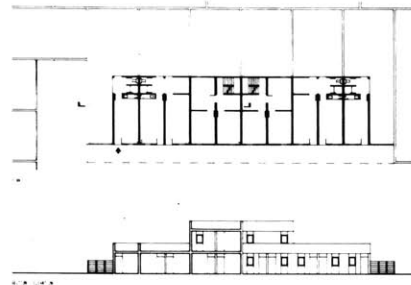
**SUBSIDY NEEDED PER FAMILY PER YEAR**

Housing	\$ 99
Market land value \$20/m <sup>2</sup> of construction	\$ 48
Infrastructure 1/3 cost of dwelling	\$ 40
<b>TOTAL</b>	<b>\$ 187</b>

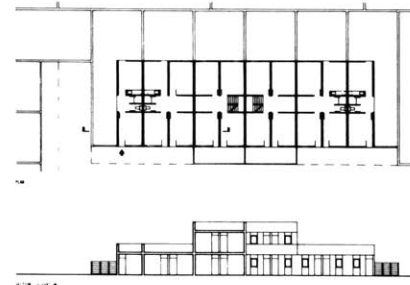
**3 TENEMENTS TYPE C**



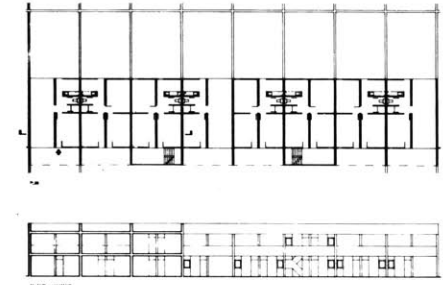
**4 EXPANDABLE HOUSE TYPE A**



**5 EXPANDABLE HOUSE TYPE B**



**6 EXPANDABLE HOUSE TYPE C**



**24 M<sup>2</sup> DWELLING**  
 1 ROOM/INDIVIDUAL FACILITIES  
 Type: TENEMENT  
 Tenure: RENTAL  
 Construction Cost: \$ 960 @ \$ 40/m<sup>2</sup>  
 Land Value: \$ 240  
 @ \$ 10/m<sup>2</sup> of construction  
 Dwelling Unit Cost: \$ 1,200  
 Payments: \$ 140 /year  
 @ 3% interest for 10 yrs.

**48 M<sup>2</sup> DWELLING**  
 2 ROOM/EXPANDABLE TO 5  
 Type: EXPANDABLE ROW HOUSE  
 Tenure: CONDOMINIUM/LEASE, RENTAL  
 Construction Cost: \$ 1,920 @ \$ 40/m<sup>2</sup>  
 Land Value: \$ 480  
 @ \$ 10/m<sup>2</sup> of construction  
 Dwelling Unit Cost: \$ 2,400  
 Payments: \$ 280 /year  
 @ 3% interest for 10 yrs.

**60 M<sup>2</sup> DWELLING**  
 3 ROOMS EXPANDABLE TO 7  
 Type: EXPANDABLE ROW HOUSE  
 Tenure: CONDOMINIUM/LEASE, RENTAL  
 Construction Cost: \$ 2,400 @ \$ 40 /m<sup>2</sup>  
 Land Value: \$ 600  
 @ \$ 10/m<sup>2</sup> of construction  
 Dwelling Unit Cost: \$ 3,000  
 Payments: \$ 350 /year  
 @ 3% interest for 10 yrs

**120 M<sup>2</sup> DWELLING**  
 6 ROOMS  
 Type: EXPANDABLE ROW HOUSE  
 Tenure: CONDOMINIUM/LEASE, RENTAL  
 Construction Cost: \$ 4,800 @ \$ 40 /m<sup>2</sup>  
 Land Value: \$ 1,200  
 @ \$ 10/m<sup>2</sup> of construction  
 Dwelling Unit Cost: \$ 6,000  
 Payments: \$ 703 /year  
 @ 3% interest for 10 yrs.

**\$ 325 ANNUAL FAMILY INCOME**

BUDGET: Housing:	\$ 41	12.5 %
Transportation:	\$ 30	9.2 %
Food/Clothing:	\$ 182	56.0 %
Health/Education:	\$ 36	11.1 %
Electricity:	\$ 12	3.7 %
Water:	\$ 12	3.7 %
Gas:	\$ -	- %
Municipal Tax:	\$ 6	1.9 %
Miscellaneous:	\$ 6	1.9 %

**SUBSIDY NEEDED PER FAMILY PER YEAR**

Housing	\$ 99
Market land value \$20/m <sup>2</sup> of construction	\$ 48
Infrastructure 1/3 cost of dwelling	\$ 40
<b>TOTAL</b>	<b>\$ 187</b>

**\$ 1,325 ANNUAL FAMILY INCOME**

BUDGET: Housing:	\$ 199	15.0 %
Transportation:	\$ 120	9.1 %
Food/Clothing:	\$ 720	54.4 %
Health/Education:	\$ 142	10.7 %
Electricity:	\$ 48	3.6 %
Water:	\$ 48	3.6 %
Gas:	\$ -	- %
Municipal Tax:	\$ 24	1.8 %
Miscellaneous:	\$ 24	1.8 %

**SUBSIDY NEEDED PER FAMILY PER YEAR**

Housing	\$ 81
Market land value \$20/m <sup>2</sup> of construction	\$ 96
Infrastructure 1/3 cost of dwelling	\$ 80
<b>TOTAL</b>	<b>\$ 257</b>

**\$ 1,325 ANNUAL FAMILY INCOME**

BUDGET: Housing:	\$ 199	15.0 %
Transportation:	\$ 120	9.1 %
Food/Clothing:	\$ 720	54.4 %
Health/Education:	\$ 142	10.7 %
Electricity:	\$ 48	3.6 %
Water:	\$ 48	3.6 %
Gas:	\$ -	- %
Municipal Tax:	\$ 24	1.8 %
Miscellaneous:	\$ 24	1.8 %

**SUBSIDY NEEDED PER FAMILY PER YEAR**

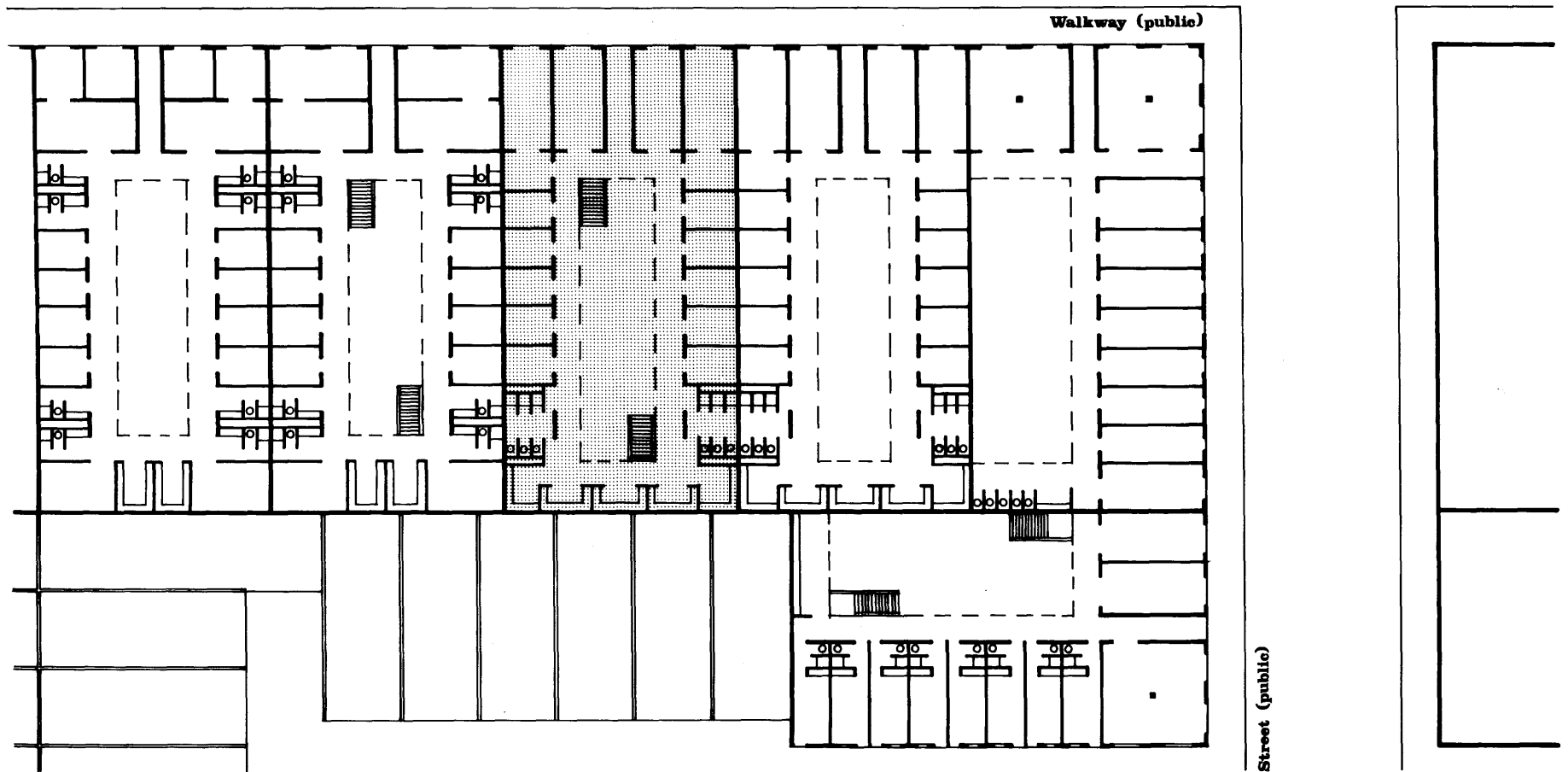
Housing	\$ 151
Market land value \$20/m <sup>2</sup> of construction	\$ 120
Infrastructure 1/3 cost of dwelling	\$ 100
<b>TOTAL</b>	<b>\$ 371</b>

**\$ 1,325 ANNUAL FAMILY INCOME**

BUDGET: Housing:	\$ 199	15.0 %
Transportation:	\$ 120	9.1 %
Food/Clothing:	\$ 720	54.4 %
Health/Education:	\$ 142	10.7 %
Electricity:	\$ 48	3.6 %
Water:	\$ 48	3.6 %
Gas:	\$ -	- %
Municipal Tax:	\$ 24	1.8 %
Miscellaneous:	\$ 24	1.8 %

**SUBSIDY NEEDED PER FAMILY PER YEAR**

Housing	\$ 504
Market land value \$20/m <sup>2</sup> of construction	\$ 240
Infrastructure 1/3 cost of dwelling	\$ 200
<b>TOTAL</b>	<b>\$ 944</b>



**TENEMENTS TYPE A**

**DWELLING GROUP**

**PHYSICAL DATA**  
(related to dwelling and land)

**DWELLING UNIT**  
type: ROOM  
area (sq m): 12  
tenure: RENTAL

**LAND/LOT**  
utilization: PRIVATE  
area (sq m): 648  
tenure: LEASE

**DWELLING**  
location: PERIPHERY  
type: TENEMENT  
number of floors: 1 (EXPANDABLE TO 2)  
utilization: MULTIPLE:  
INDIVIDUAL/FAMILY

**DWELLING DEVELOPMENT**

mode: INSTANT/INCREMENTAL  
developer: PRIVATE/PUBLIC  
builder: SMALL CONTRACTOR/ARTISAN  
construction type: MASONRY/CONCRETE OR MASONRY/WOOD

**MATERIALS**  
foundation: CONCRETE STRIP  
floors: CONCRETE  
walls: MASONRY OR WOOD  
roof: CONCRETE WITH ASPHALT OR C.G.I.-SHEETS ON TRUSSES

**DWELLING FACILITIES**

wc: 6-12 COMMUNAL (1 PER 2 ROOMS)  
shower: 6-12 COMMUNAL (1 PER 2 ROOMS)  
kitchen: 3-6 COMMUNAL (1 PER 2 ROOMS)  
rooms: 12-24  
other: LAUNDRY, COURTYARD, SHOPS, SMALL SCALE INDUSTRIES.

**SOCIO-ECONOMIC DATA**  
(related to user)

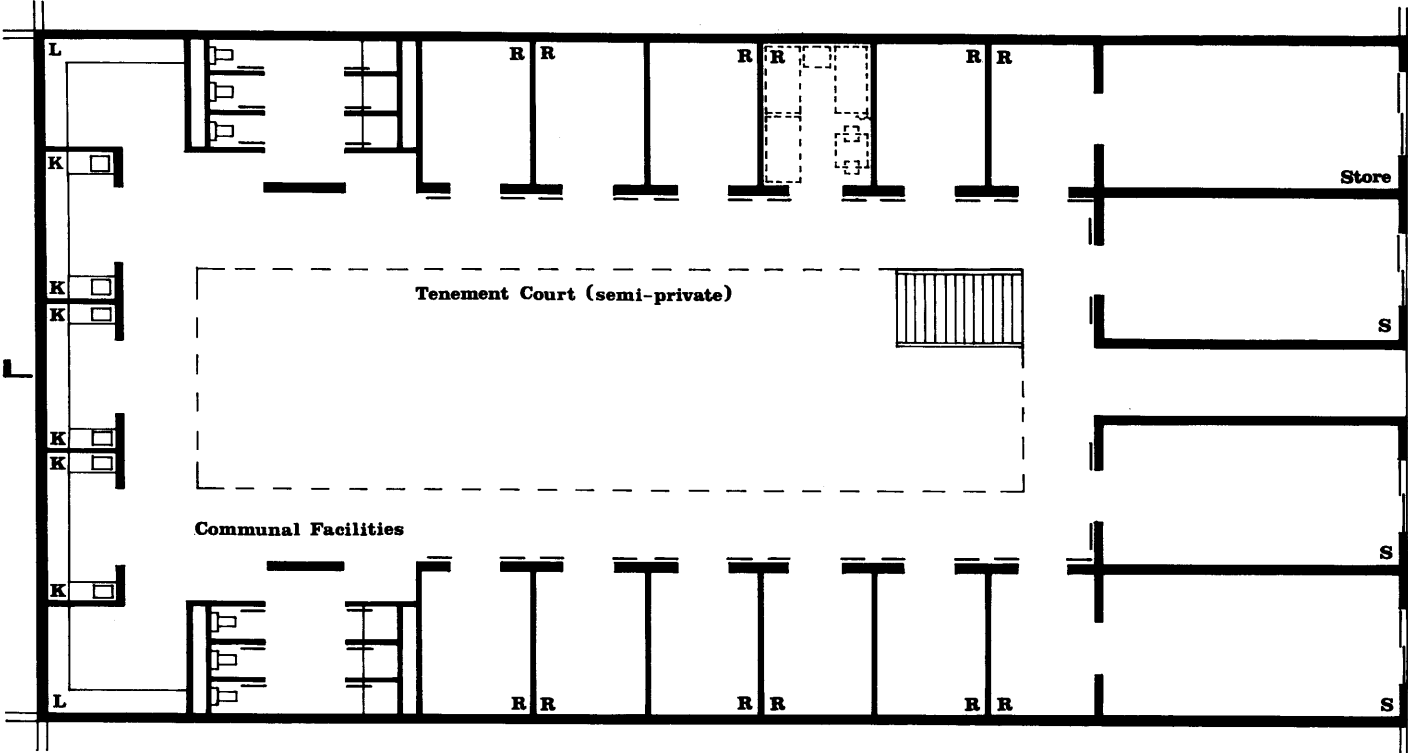
**GENERAL**  
user's income group: VERY LOW, LOW

**NUMBER OF USERS**  
married: 2  
single: 3  
children: 1 OR 2  
total: 2-4 (PER ROOM)

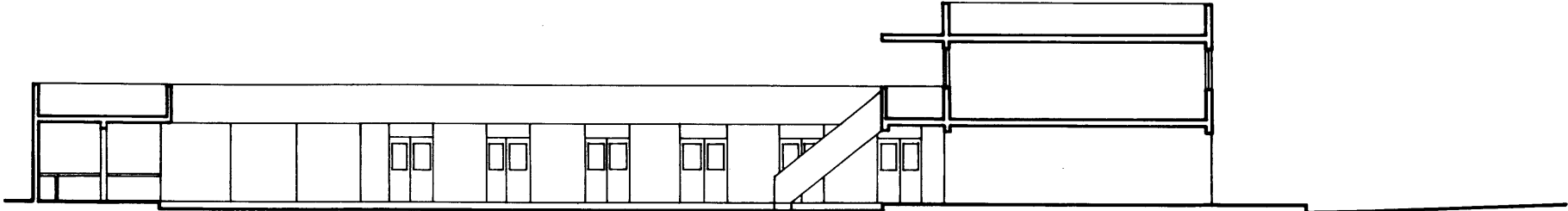
**KEY**

- R** Room (multi-use)
- K** Kitchen/Cooking Area
- L** Laundry



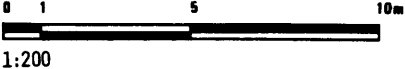


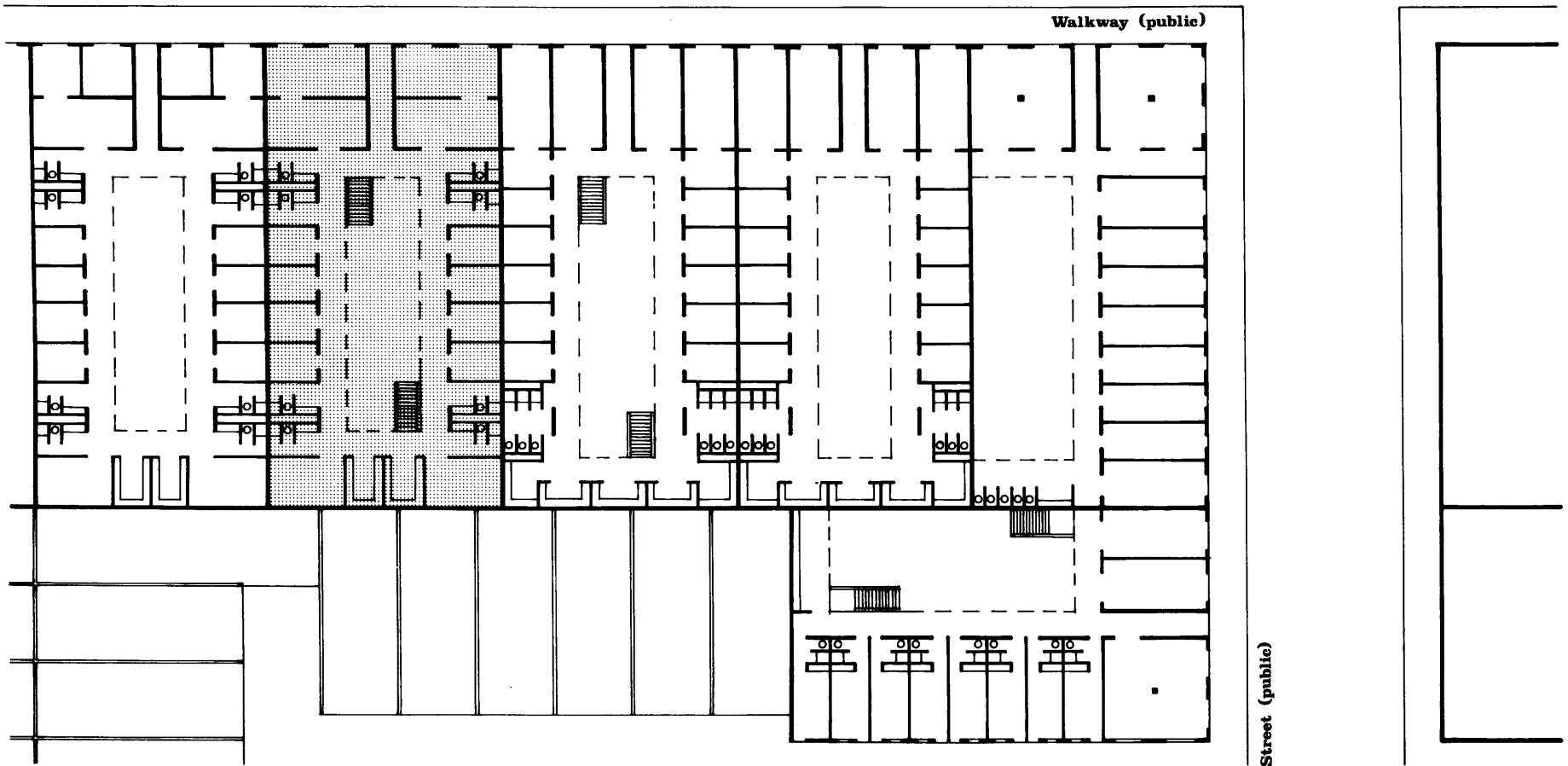
PLAN



SECTION / ELEVATION

PROPOSED DWELLING





**TENEMENTS TYPE B**

**DWELLING GROUP**

Street (public)



**PHYSICAL DATA**  
(related to dwelling and land)

**DWELLING UNIT**  
 type: ROOMS  
 area (sq m): 24  
 tenure: RENTAL

**LAND/LOT**  
 utilization: PRIVATE  
 area (sq m): 648  
 tenure: LEASE

**DWELLING**  
 location: PERIPHERY  
 type: TENEMENT  
 number of floors: 3 (EXPANDABLE TO 4)  
 utilization: MULTIPLE:  
 INDIVIDUAL/FAMILY

**DWELLING DEVELOPMENT**

mode: INSTANT/INCREMENTAL  
 developer: PRIVATE/PUBLIC  
 builder: SMALL CONTRACTOR/ARTISAN  
 construction type: MASONARY/CONCRETE

**MATERIALS**  
 foundation: CONCRETE STRIP  
 floors: CONCRETE  
 walls: MASONARY  
 roof: CONCRETE WITH ASPHALT

**DWELLING FACILITIES**

wc: 8-24 SHARED (1 PER 2 ROOMS)  
 shower: 8-24 SHARED (1 PER 2 ROOMS)  
 kitchen: 8-24 SHARED (1 PER 2 ROOMS)  
 rooms: 16-48  
 other: LAUNDRY, CORTYARD, SHOPS.

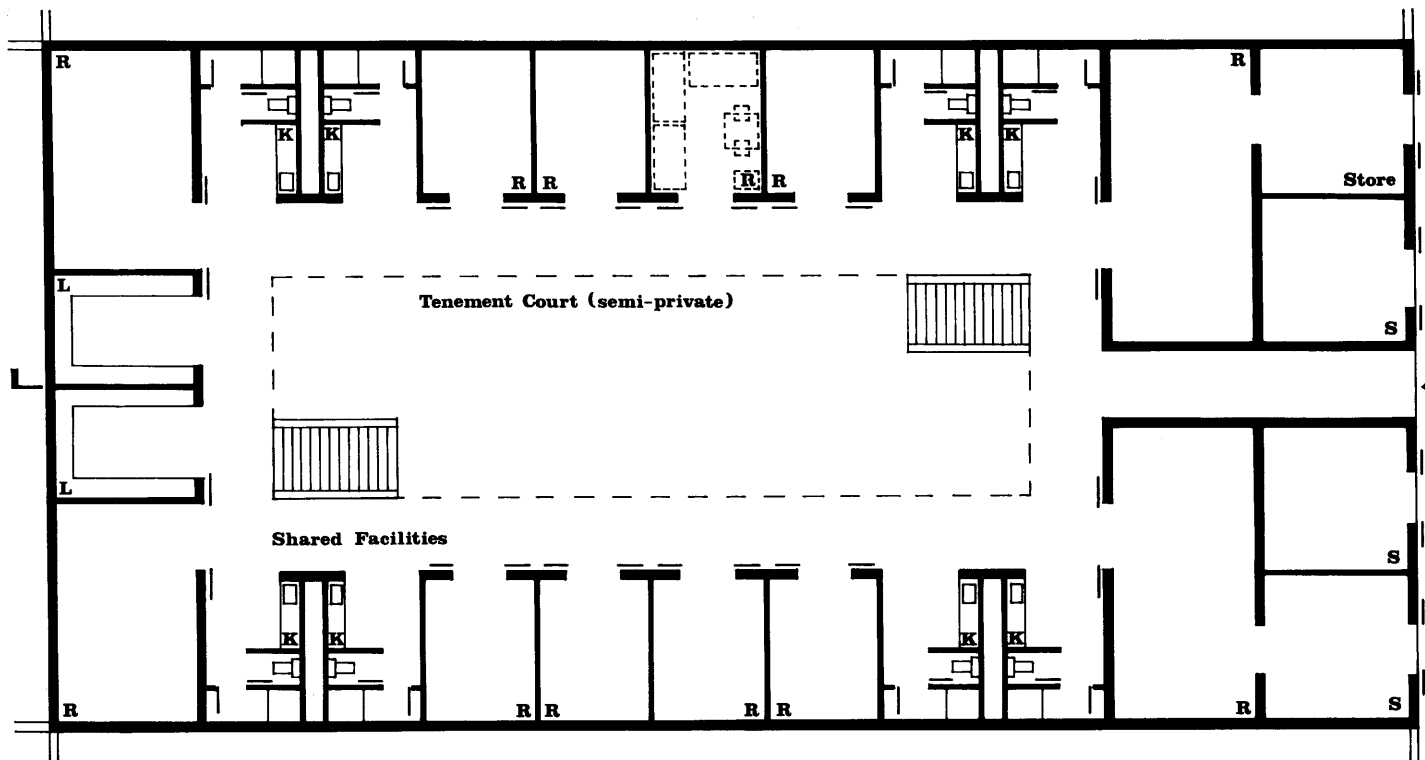
**SOCIO-ECONOMIC DATA**  
(related to user)

**GENERAL**  
 user's income group: VERY LOW, LOW

**NUMBER OF USERS**  
 married: 2  
 single: 3 OR 4  
 children: 2-4  
 total: 2-6 (PER 2 ROOMS).

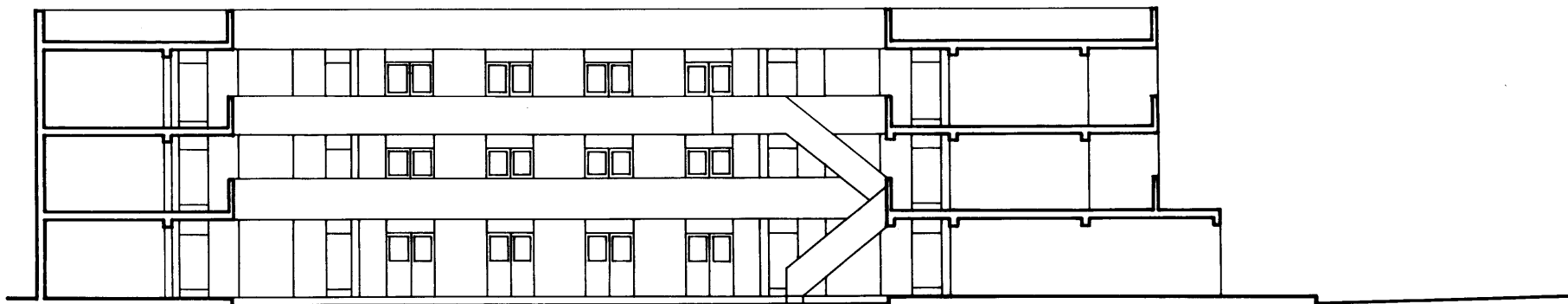
**KEY**

- R** Room (multi-use)
- K** Kitchen/Cooking Area
- L** Laundry



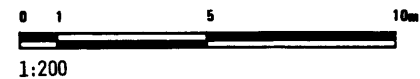
Street (public)

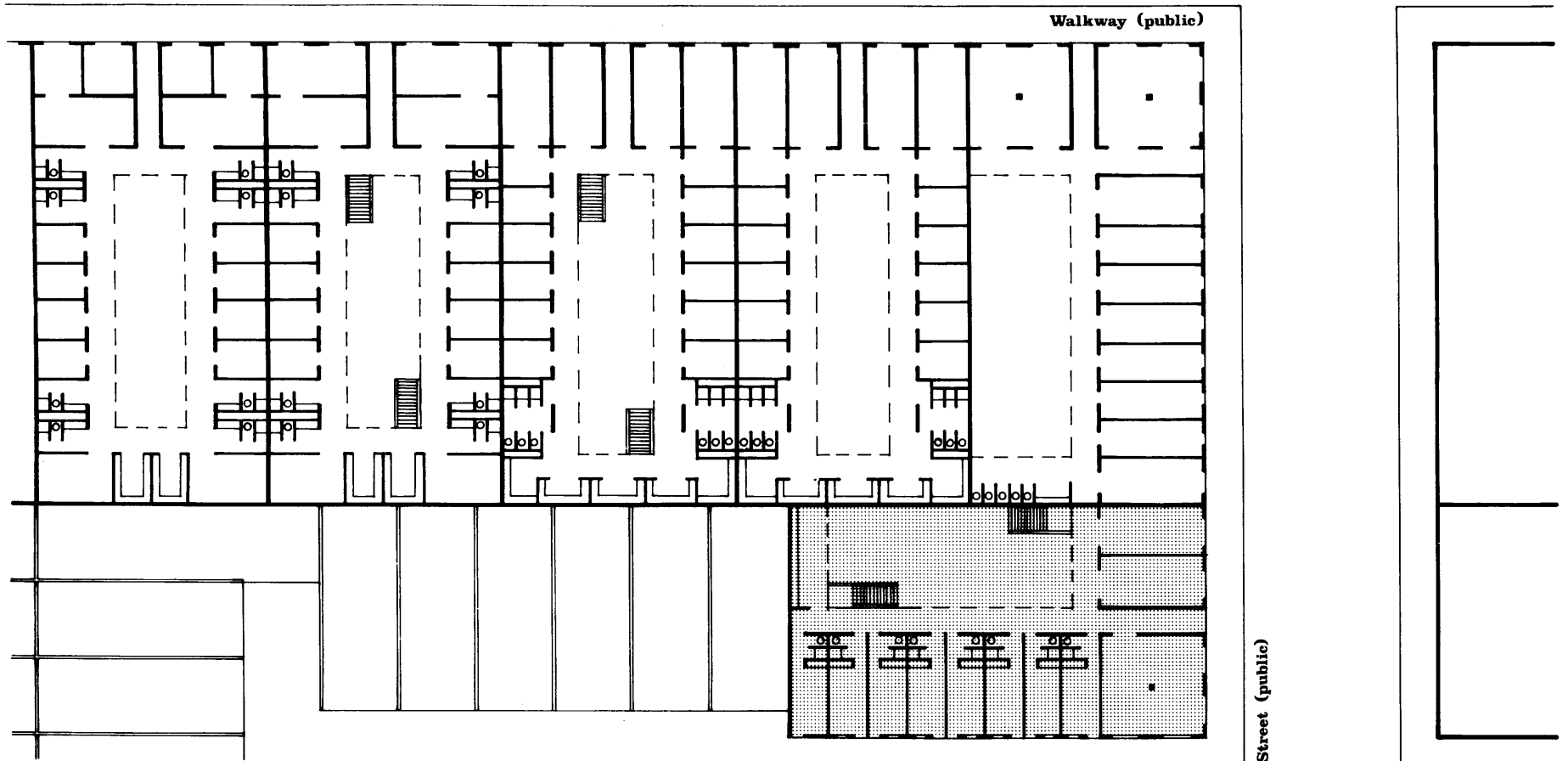
PLAN



SECTION / ELEVATION

PROPOSED DWELLING





**TENEMENTS TYPE C**

**DWELLING GROUP**

Street (public)



1:500

**PHYSICAL DATA**  
(related to dwelling and land)

**DWELLING UNIT**  
type: ROOM  
area (sq m): 24  
tenure: RENTAL

**LAND/LOT**  
utilization: PRIVATE  
area (sq m): 576  
tenure: LEASE

**DWELLING**  
location: PERIPHERY  
type: TENEMENT  
number of floors: 2 (EXPANDABLE TO 3)  
utilization: MULTIPLE:  
INDIVIDUAL/FAMILY

**DWELLING DEVELOPMENT**

mode: INSTANT/INCREMENTAL  
developer: PRIVATE/PUBLIC  
builder: SMALL CONTRACTOR/ARTISAN  
construction type: MASONRY/CONCRETE

**MATERIALS**

foundation: CONCRETE STRIP  
floors: CONCRETE  
walls: MASONRY  
roof: CONCRETE WITH ASPHALT

**DWELLING FACILITIES**

wc: 8-20 INDIVIDUAL (1 PER ROOM)  
shower: 8-20 INDIVIDUAL (1 PER ROOM)  
kitchen: 8-20 INDIVIDUAL (1 PER ROOM)  
rooms: 8-20  
other: LAUNDRY, COURTYARD, SHOPS.

**SOCIO-ECONOMIC DATA**  
(related to user)

**GENERAL**

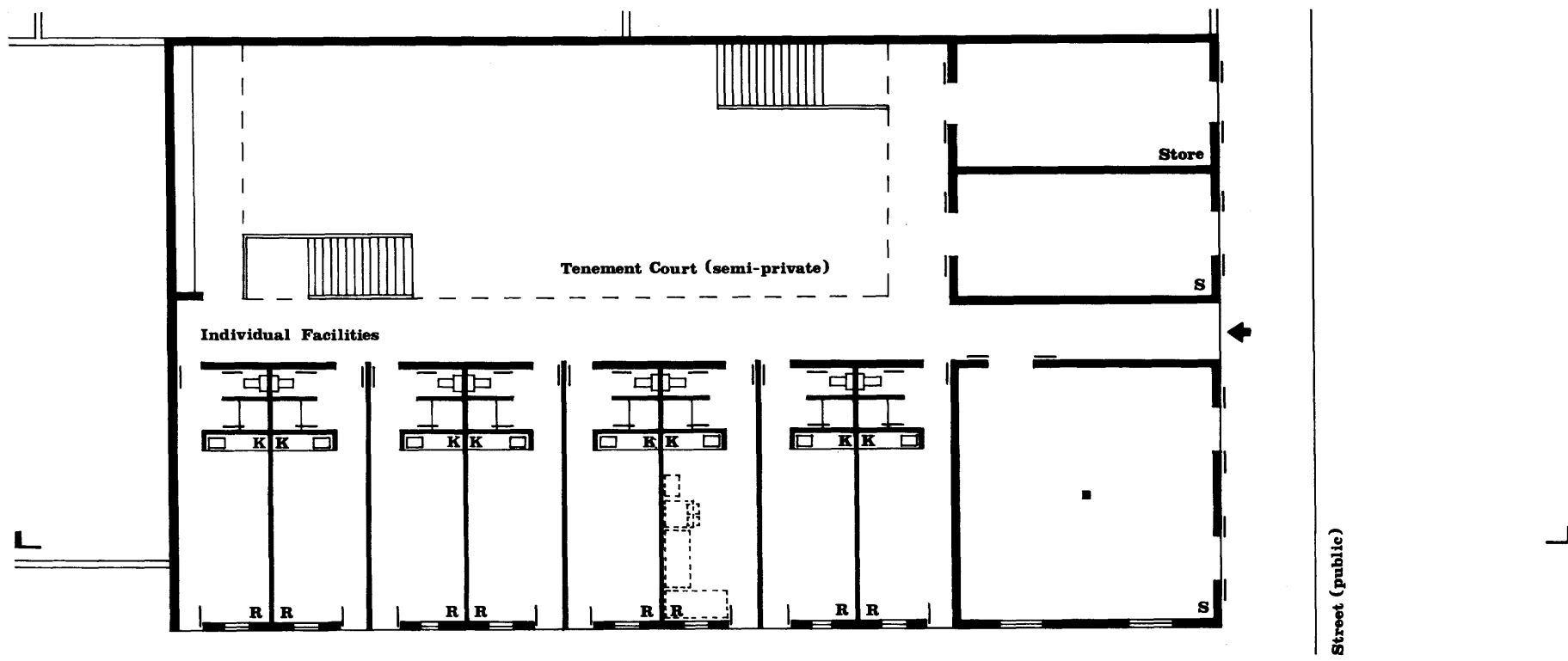
user's income group: LOW, MODERATELY LOW

**NUMBER OF USERS**

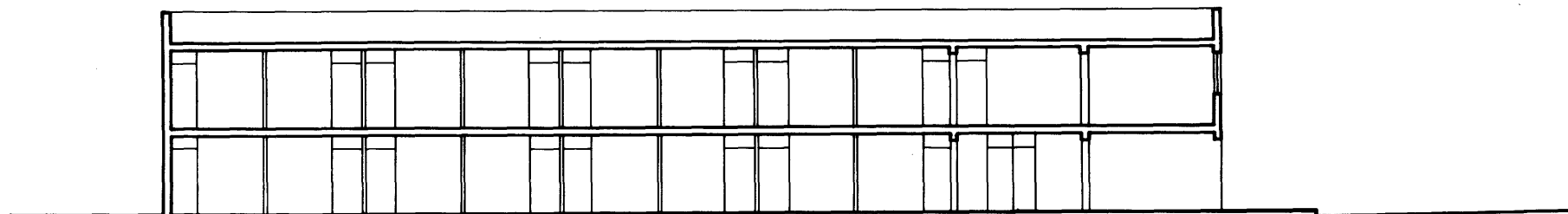
married: 2  
single: 3  
children: 1 OR 2  
total: 2-3 (PER ROOM)

**KEY**

- R** Room (multi-use)
- K** Kitchen/Cooking Area
- L** Laundry

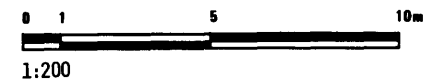


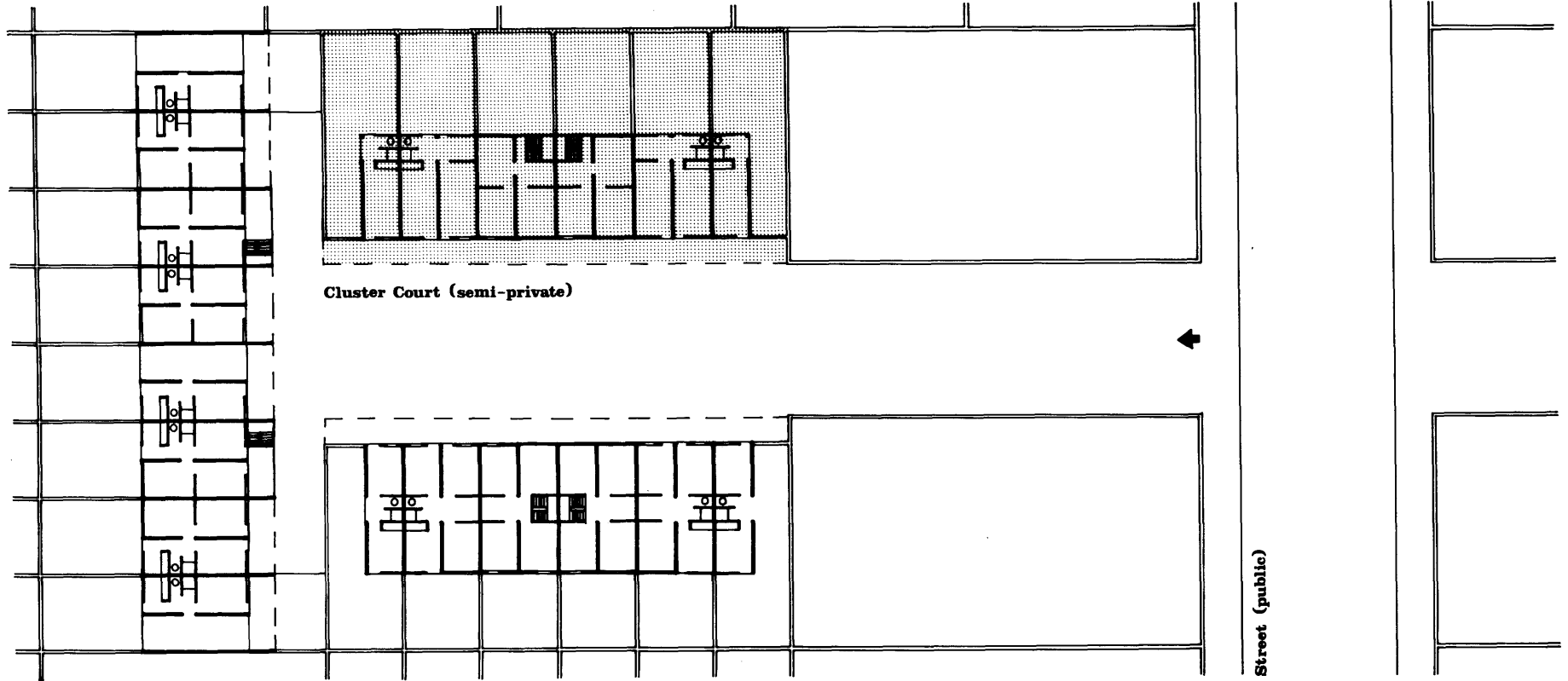
PLAN



SECTION / ELEVATION

PROPOSED DWELLING





**EXPANDABLE HOUSE TYPE A**

**DWELLING GROUP**

Street (public)



**PHYSICAL DATA**  
(related to dwelling and land)

**DWELLING UNIT**  
 type: HOUSE/ROOM  
 area (sq m): 24 (EXPANDABLE TO 96)  
 tenure: LEASE/RENTAL IN CONDOMINIUM

**LAND/LOT**  
 utilization: PRIVATE  
 area (sq m): 108  
 tenure: LEASE IN CONDOMINIUM

**DWELLING**  
 location: PERIPHERY  
 type: HOUSE  
 number of floors: 1 (EXPANDABLE TO 2)  
 utilization: SINGLE/MULTIPLE: FAMILY/INDIVIDUAL

**DWELLING DEVELOPMENT**

mode: INCREMENTAL  
 developer: PRIVATE/PUBLIC  
 builder: SELF-HELP/ARTISAN  
 construction type: MASONRY/CONCRETE OR MASONRY/WOOD

**MATERIALS**

foundation: CONCRETE STRIP  
 floors: CONCRETE  
 walls: MASONRY AND/OR WOOD  
 roof: CONCRETE OR WOOD WITH ASPHALT

**DWELLING FACILITIES**

wc: 1  
 shower: 1  
 kitchen: 1  
 rooms: 1-4  
 other: OUTDOOR WASHING, COURT WITH FENCE, CLUSTER COURT.

**SOCIO-ECONOMIC DATA**  
(related to user)

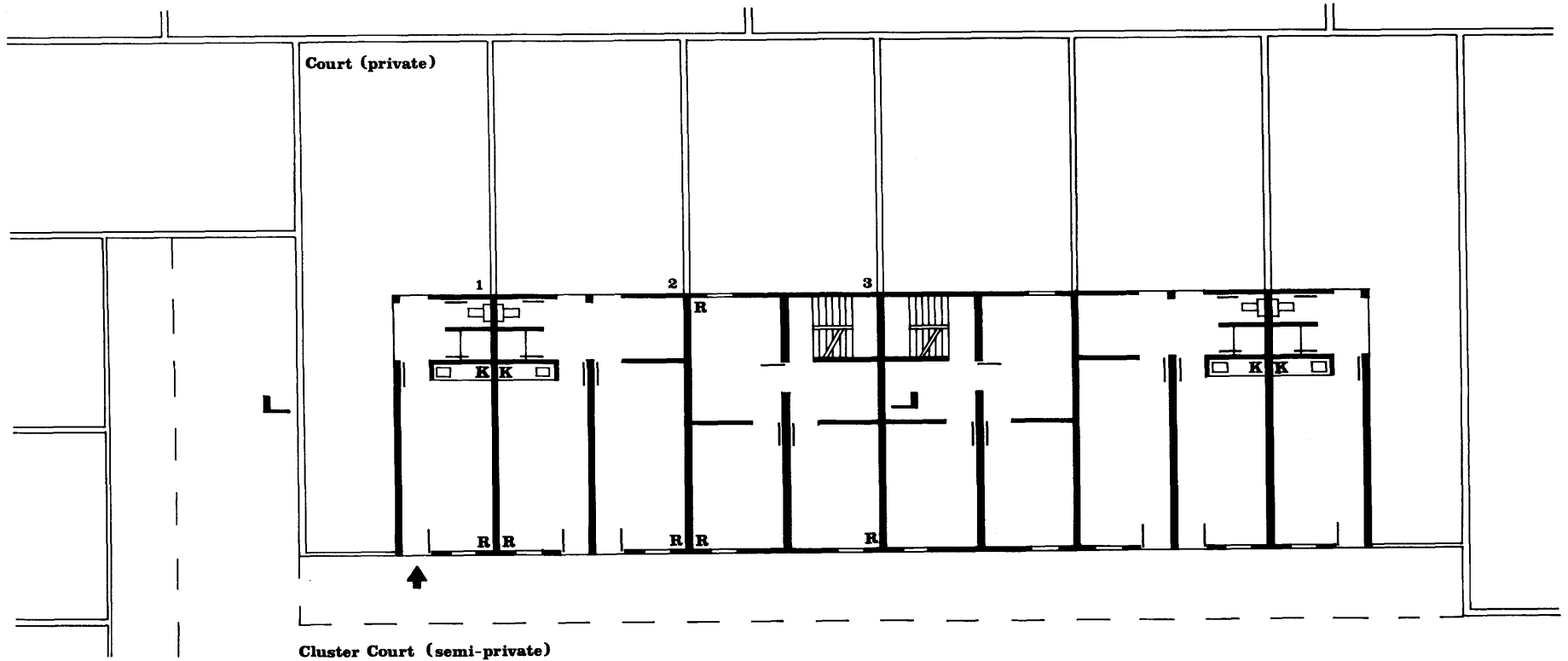
**GENERAL**  
 user's income group: LOW, MODERATELY LOW

**NUMBER OF USERS**

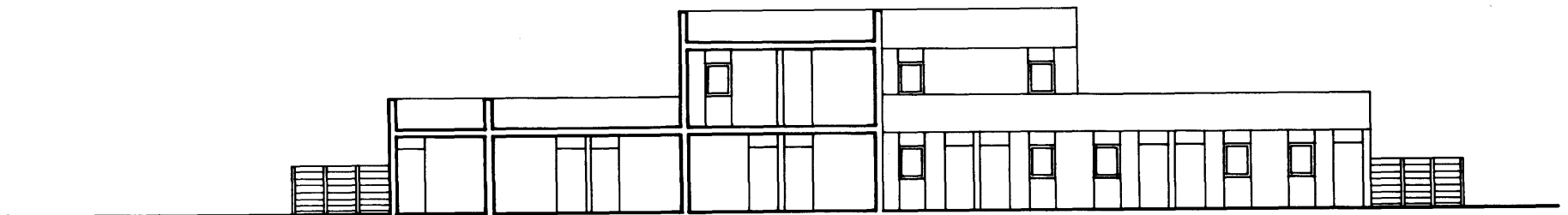
married: 2  
 single: 1 (IN ROOM FOR SUBLET)  
 children: 2 OR 3  
 total: 2-6

**KEY**

- R** Room (multi-use)
- K** Kitchen/Cooking Area
- L** Laundry

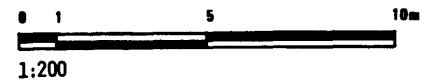


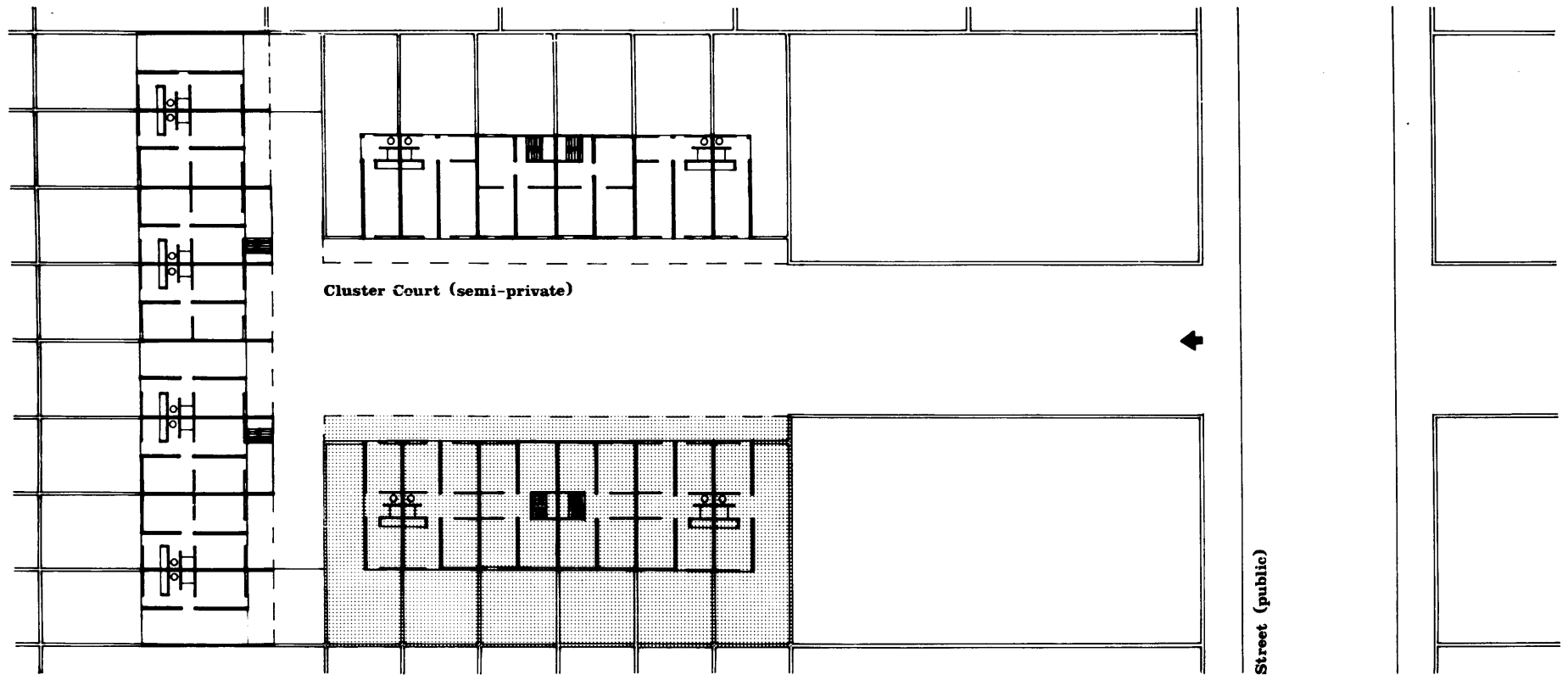
PLAN



SECTION / ELEVATION

PROPOSED DWELLING





**EXPANDABLE HOUSE TYPE B**

**DWELLING GROUP**

Street (public)



**PHYSICAL DATA**  
(related to dwelling and land)

**DWELLING UNIT**  
 type: HOUSE/ROOM  
 area (sq m): 30 (EXPANDABLE TO 120)  
 tenure: LEASE/RENTAL IN CONDOMINIUM

**LAND/LOT**  
 utilization: PRIVATE  
 area (sq m): 108  
 tenure: LEASE IN CONDOMINIUM

**DWELLING**  
 location: PERIPHERY  
 type: HOUSE  
 number of floors: 1 (EXPANDABLE TO 2)  
 utilization: SINGLE/MULTIPLE: FAMILY/INDIVIDUAL

**DWELLING DEVELOPMENT**

mode: INCREMENTAL  
 developer: PRIVATE/PUBLIC  
 builder: SELF-HELP/ARTISAN  
 construction type: MASONRY/CONCRETE OR MASONRY/WOOD

**MATERIALS**

foundation: CONCRETE STRIP  
 floors: CONCRETE  
 walls: MASONRY AND/OR WOOD  
 roof: CONCRETE OR WOOD WITH ASPHALT

**DWELLING FACILITIES**

wc: 1  
 shower: 1  
 kitchen: 1  
 rooms: 1-6  
 other: OUTDOOR WASHING, COURT WITH FENCE, CLUSTER COURT.

**SOCIO-ECONOMIC DATA**  
(related to user)

**GENERAL**  
 user's income group: LOW, MODERATELY LOW

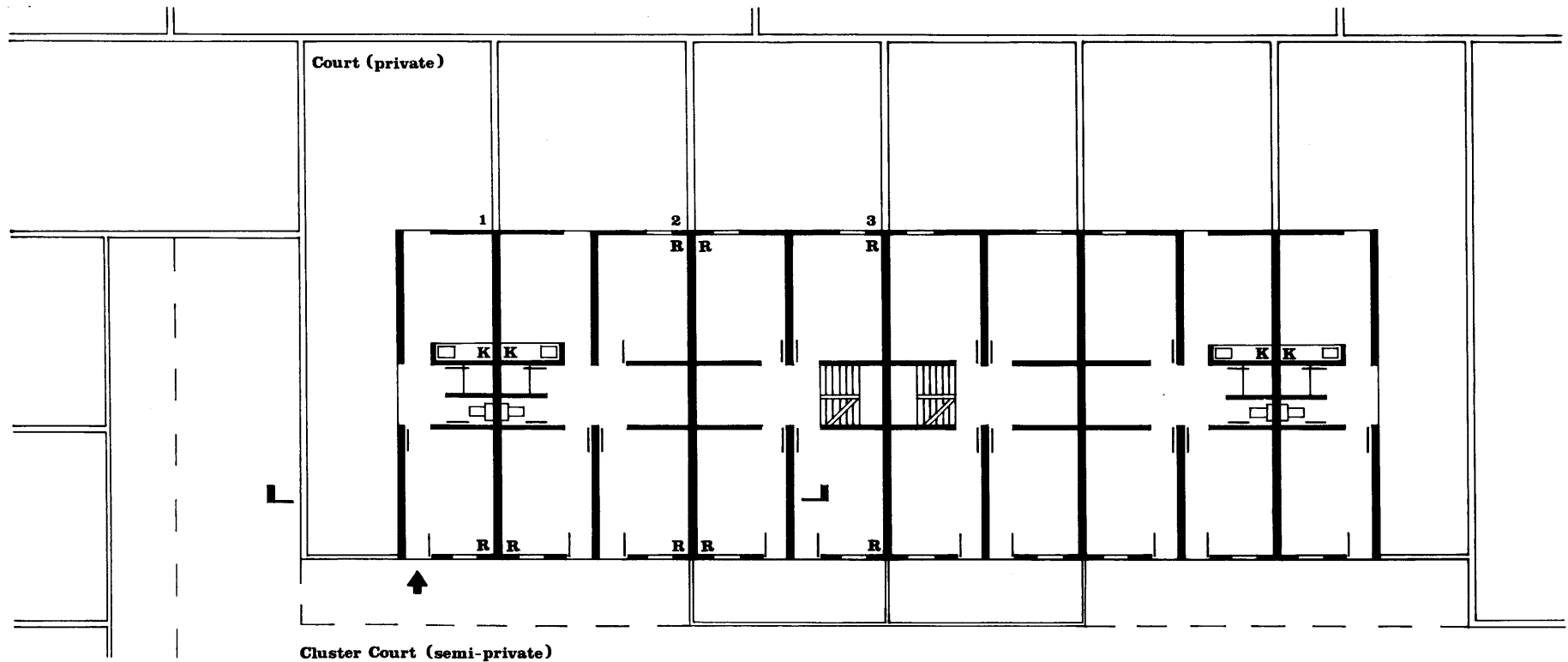
**NUMBER OF USERS**

married: 2  
 single: 1 (IN ROOM FOR SUBLET)  
 children: 3 OR 4  
 total: 2-7

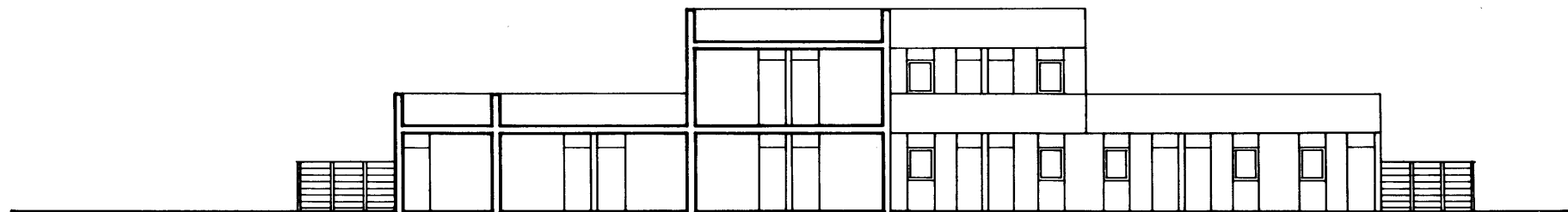
**KEY**

**R** Room (multi-use)  
**K** Kitchen/Cooking Area  
**L** Laundry



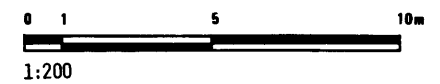


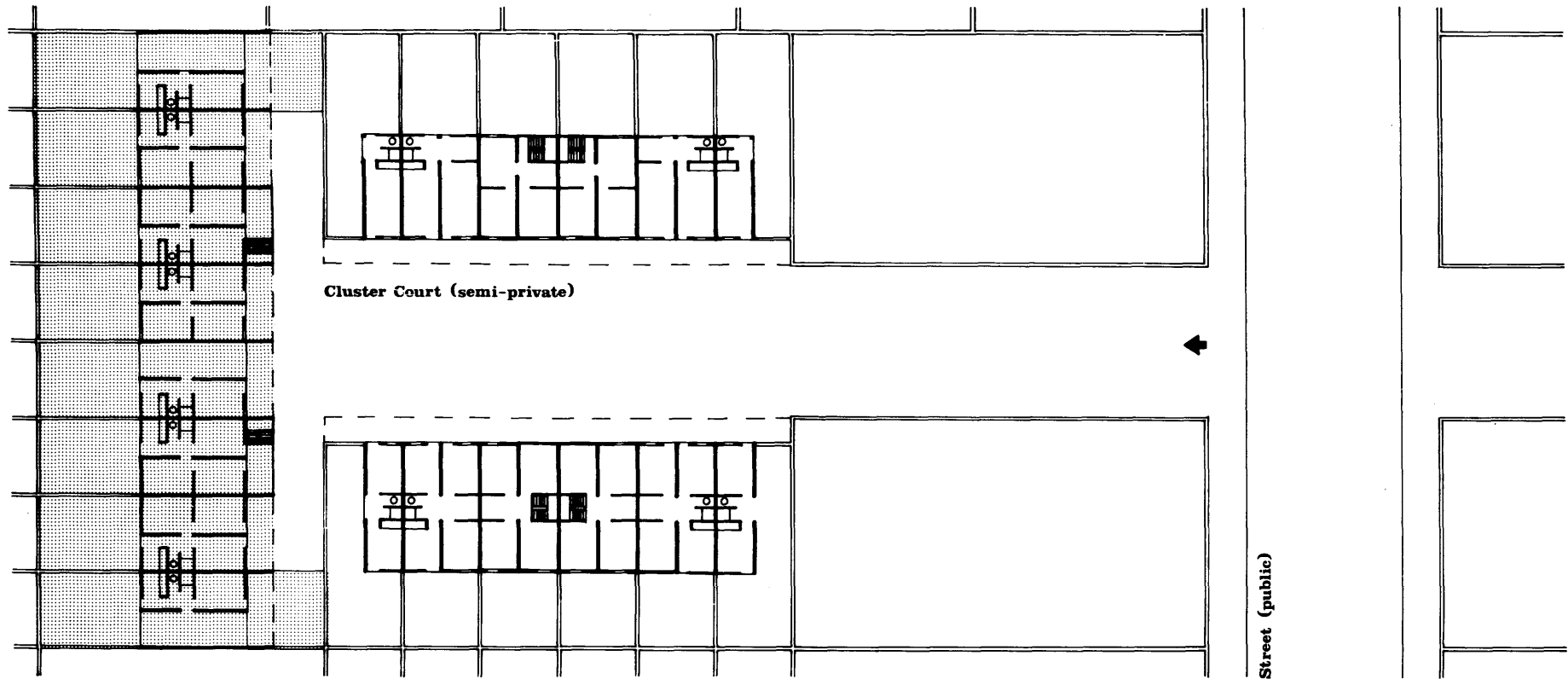
PLAN



SECTION / ELEVATION

PROPOSED DWELLING





EXPANDABLE HOUSE TYPE C

DWELLING GROUP

1:500

**PHYSICAL DATA**  
(related to dwelling and land)

**DWELLING UNIT**  
 type: HOUSE/APARTMENT  
 area (sq m): 60 (EXPANDABLE TO 120)  
 tenure: LEASE/RENTAL IN CONDOMINIUM

**LAND/LOT**  
 utilization: PRIVATE  
 area (sq m): 108  
 tenure: LEASE IN CONDOMINIUM

**DWELLING**  
 location: PERIPHERY  
 type: HOUSE/APARTMENT  
 number of floors: 2 (EXPANDABLE TO 3)  
 utilization: SINGLE/MULTIPLE: FAMILY/INDIVIDUAL

**DWELLING DEVELOPMENT**  
 mode: INCREMENTAL  
 developer: PRIVATE/PUBLIC  
 builder: ARTISAN/SELF-HELP  
 construction type: MASONRY/CONCRETE OR MASONRY/WOOD

**MATERIALS**  
 foundation: CONCRETE STRIP  
 floors: CONCRETE AND/OR WOOD  
 walls: MASONRY AND/OR WOOD  
 roof: CONCRETE AND/OR WOOD WITH ASPHALT

**DWELLING FACILITIES**  
 wc: 1-2 (1 PER UNIT)  
 shower: 1-2 (1 PER UNIT)  
 kitchen: 1-2 (1 PER UNIT)  
 rooms: 1-6 (3 PER UNIT)  
 other: OUTDOOR WASHING, COURT WITH FENCE, CLUSTER COURT, BALCONY.

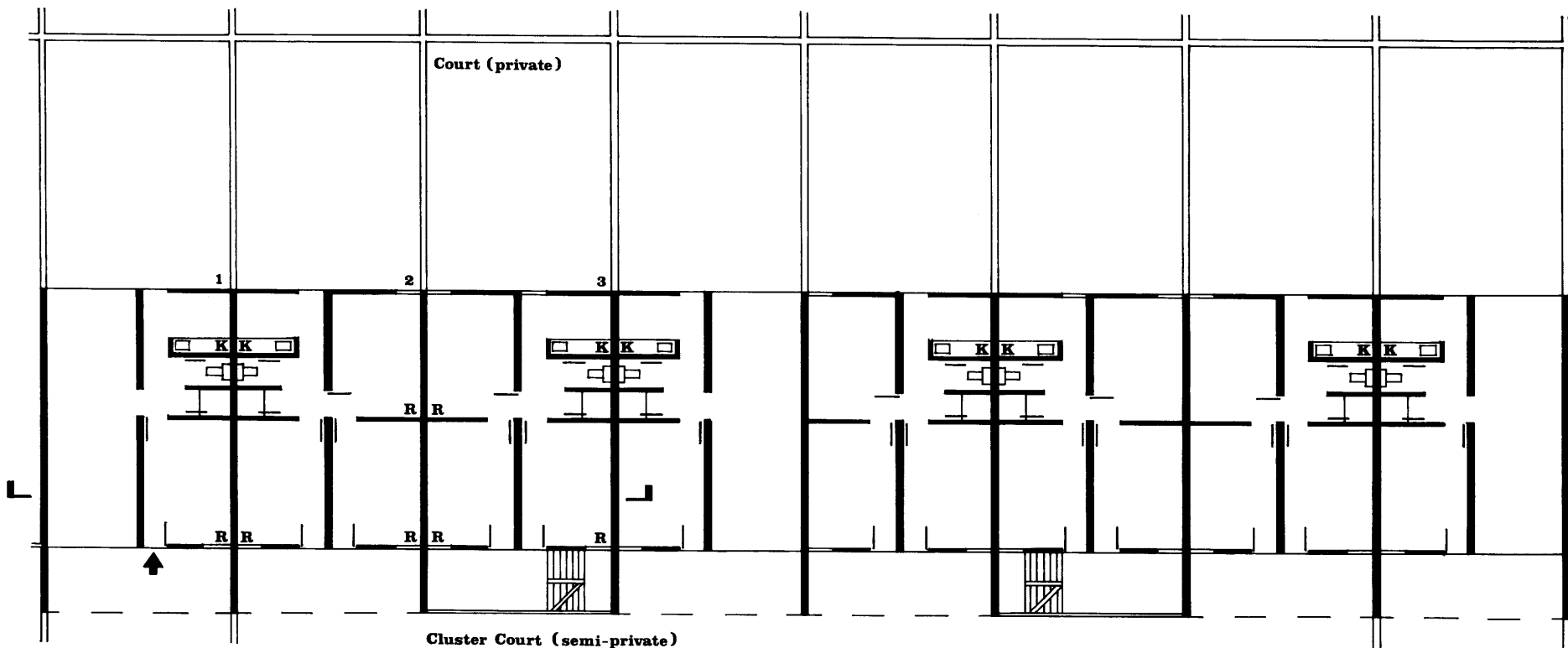
**SOCIO-ECONOMIC DATA**  
(related to user)

**GENERAL**  
 user's income group: LOW, MODERATELY LOW

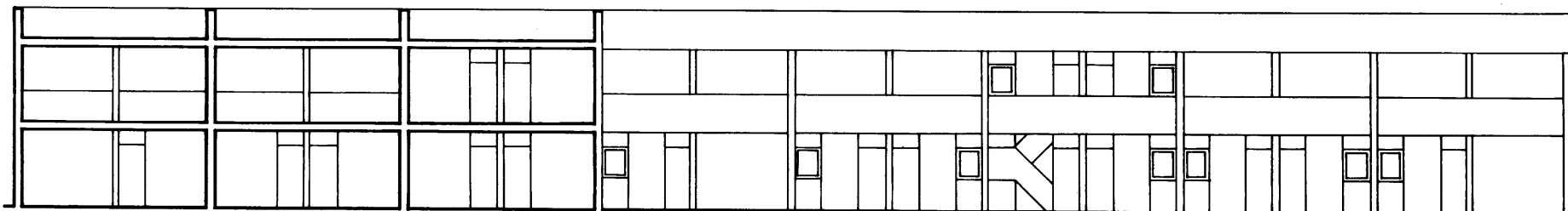
**NUMBER OF USERS**  
 married: 2  
 single: 2 TO 4 (IN APARTMENT)  
 children: 1-2 FOR SUBLET)  
 total: 2-7

**KEY**

- R** Room (multi-use)
- K** Kitchen/Cooking Area
- L** Laundry

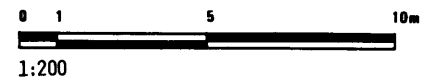


PLAN



SECTION / ELEVATION

PROPOSED DWELLING



## GLOSSARY

Definitions of terms which are generally understood / accepted and are essential to the presentation / understanding of the text are included in the Glossary, which has been prepared at the Urban Settlement Design Program, M.I.T.

The criteria for the preparation of the definitions have been as follows:

- First Preference: definitions from "Webster's Third New International Dictionary"; Merriam-Webster, 1971.

- Second Preference: definitions from technical dictionaries.

- Third Preference: definitions from the participants in the above program, used when existing definitions did not satisfactorily make clear with what meaning extend and limits, terms were used.

**ACCESSES** - 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, airlines, etc.).

**AIRPORT DISTURBANCE** - the act or process of destroying the rest, tranquility or settled state of (the site by the annoyance of airport noise, vibration, hazards, etc.) (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.

**BARRIER** - (a boundary) as a topographic feature or a physical or psychological quality that tends to separate or restrict the free movement (to an from the site) (Merriam-Webster 1971).

**BOUNDARY** - 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 materials, use of occupancy, location and maintenance of all buildings and structures within the city and certain equipment specifically regulated" therein (ICBO 1967, sec. 102).

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

**COMMUNITY**: the people living in a particular place or region and usually linked by common interests; the region itself, any population cluster.

**DESIGN**: the arrangement of elements that make up a work of art, machine or other man-made object.

**DEVELOPMENT**: gradual advance or growth through progressive changes; a developed tract of land.

**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 adjoining them (paths of travel) (Merriam-Webster 1971).

**DUST/DIRT** - fine dry pulverized particles of earth, grit, refuse, waste, litter, etc. (Merriam-Webster 1971).

**DWELLING**: The general, global designation of a building/shelter in which people live. A dwelling contains one or more 'dwelling units'.

**DWELLING CONSTRUCTION TYPES**: Primary dwelling construction types and materials are grouped in the following categories:

**Shack** Roof: structure - rods, branches. infill - thatch, mats, flattened tin cans, plastic or canvas sheets, cardboard, scrap wood, and / or mud.

**Walls**: structure - rods, branches, poles. infill - thatch, mats, flattened tin cans, plastic or canvas sheets, cardboard, scrap wood, and / or mud.

**Floor**: structure/infill - compacted earth.

**Mud and Wattle** Roof: structure - wattle. infill - thatch, flattened tin can, or corrugated iron sheets.

**Walls**: structure - wattle. infill - mud.

**Floor**: structure/infill - compacted earth.

**Wood** Roof: structure - wood rafters. infill - thatch, flattened tin cans or corrugated iron sheets.

**Walls**: structure - wood frame. infill - rough hewn wood planks.

**Floor**: structure/infill - compacted earth, wood joists, flooring.

**Masonry/Wood** Roof: structure - wood rafters. infill - corrugated iron or asbestos sheets, or terracotta tiles.

**Walls**: structure/infill - murrain, stone, brick, block or tile masonry without columns.

**Floor**: structure/infill - poured concrete slab on/off grade, wood joists, flooring.

**Masonry/Concrete** Roof: structure/infill - poured reinforced concrete with tar and gravel, or terracotta tiles.

**Walls**: structure/infill - murrain, stone, brick, block or tile masonry without columns, or with columns for multi-story dwellings.

**Floor**: structure/infill - poured concrete slab on/off grade.

**Concrete** Roof: structure/infill - poured or precast reinforced concrete with tar and gravel, or terracotta tiles.

**Walls**: structure - poured or precast walls or frame. infill - metal, wood, masonry, plastic.

**Floor**: structure/infill - poured or precast concrete slab.

**DWELLING BUILDER**: Four groups are considered:

**Self-Help Built**: where the dwelling unit is directly built by the user or occupant.

**Artisan Built**: where the dwelling unit is totally

or partially built by a skilled craftsman hired by the user or occupant; payments can be monetary or an exchange of services.

**Small Contractor Built**: where the dwelling unit is totally built by a small organization hired by the user, occupant, or developer; 'small' contractor is defined by the scale of operations, financially and materially; the scale being limited to the construction of single dwelling units or single complexes.

**Large Contractor Built**: where the dwelling unit is totally built by a large organization hired by a developer; 'large' contractor is defined by the scale of operations, financially and materially; the scale reflects a more comprehensive and large size of operations encompassing the building of large quantities of similar units or a singularly large complex.

**DWELLING DENSITY**: The number of dwellings, dwelling units, people or families per unit hectare. Gross density is the density of an overall area (ex. including lots, streets). NET density is the density of selected, discrete portions of an area (ex. including only lots).

**DWELLING DEVELOPER**: Three sectors are considered in the supply of dwellings:

**Popular sector**: The marginal sector with limited or no access to the formal financial, administrative, legal, technical, institutions involved in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Popular sector generally for 'self use' and sometimes for profit.

**Public Sector**: The government or non-profit organizations involved in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Public sector for service (non-profit or subsidized housing).

**Private sector**: The individuals, groups or societies have access to the formal financial, administrative, legal, technical institutions in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Private sector generally for profit.

**DWELLING FLOORS**: The following number are considered:

**One**: single story; generally associated with detached, semi-detached and row/group dwelling types.

**Two**: double story; generally associated with detached, semi-detached and row/group dwelling types.

**Three or More**: generally associated with walk-up and high rise dwelling types.

**DWELLING GROUP**: The context of the dwelling in its immediate surroundings.

**DWELLING LOCATION**: Three sectors of the urban area considered:

**City center**: the area located within a walking distance (2.5 km radius) of the commercial center of a city; relatively high residential densities.

**Inner ring**: the area located between the urban periphery and the city center (2.5 to 5 km radius); relatively lower residential densities.

**Periphery**: the area located between the rural areas and urban inner ring (5 or more km radius); relatively low residential densities.

**DWELLING PHYSICAL STATE**: A qualitative evaluation of the physical condition of the dwelling types: room, apartment, house; (the shanty unit is not evaluated).

**Bad**: generally poor state of structural stability, weather protection and maintenance.

**Fair**: generally acceptable state of structural stability, weather protection and maintenance without deviation.

**DWELLING UNIT**: A self-contained unit a dwelling for an individual, a family, or a group.

**DWELLING UNIT AREA**: The dwelling unit area (m<sup>2</sup>) is the built-up, covered area of a dwelling unit.

**DWELLING UNIT COST**: The initial amount of money paid for the dwelling unit or the present monetary equivalent for replacing the dwelling unit.

**DWELLING UNIT TYPE**: Four types of dwelling units are considered:

**Room**: A SINGLE SPACE usually bounded by partitions and specifically used for living; for example, a living room, a dining room, a bedroom, but not a bath/toilet, kitchen, laundry, or storage room. SEVERAL ROOM UNITS are contained in a building/shelter and share the use of the parcel of land on which they are built (open spaces) as well as common facilities (circulation, toilets, kitchens).

**Apartment**: A MULTIPLE SPACE (room/set of rooms with bath, kitchen, etc.). SEVERAL APARTMENT UNITS are contained in a building and share the use of the parcel of land on which they are built (open spaces) as well as some common facilities (circulation).

**House**: A MULTIPLE SPACE (room/set of rooms with or without bath, kitchen, etc.). ONE HOUSE UNIT is contained in a building/shelter and has the private use of the parcel of land on which it is built (open spaces) as well as the facilities available.

**Shanty**: A SINGLE OR MULTIPLE SPACE (small, crudely built). ONE SHANTY UNIT is contained in a shelter and shares with other shanties the use of the parcel of land on which they are built (open spaces).

**DWELLING TYPE**: The physical arrangement of the dwelling unit:

**Detached**: individual dwelling unit, separated from others.

**Semi-Detached**: two dwelling unit, sharing a common wall (duplex).

**Row/Grouped**: dwelling units grouped together linearly or in clusters.

**Walk-Up**: dwelling units grouped in two to five stories with stairs for vertical circulation.

**DWELLING UTILIZATION:** The utilization indicates the type of use with respect to the number of inhabitants/families.

**Single:** an individual or a family inhabiting a dwelling.

**Multiple:** a group of individuals or families inhabiting a dwelling.

**FINANCING:** The process of raising or providing funds.

**Self Financed:** provided by own funds. **Private/Public Financed:** provided by loan. **Public Subsidized:** provided by grant or aid.

**DWELLING DEVELOPMENT MODE:** Two modes are considered:

**Incremental:** The construction of the dwelling and development of the local infrastructure to modern standards by stages, often starting with provisional structures and underdeveloped land. This essentially traditional procedure is generally practiced by squatters with de facto security of tenure and an adequate building site.

**Instant:** The formal development procedure in which all structures and services are completed before occupation.

**EASEMENT - servitude:** a right in respect of an object (as land owned by one person) in virtue of which the object (land) is subject to a specified use or enjoyment by another person for the benefit of another thing (Merriam-Webster 1971).

**ELECTRICITY - electrification:** the process (network) for supplying (the site) with electric power (Merriam-Webster 1971).

**EXISTING STRUCTURE -** something constructed or built (on the site).

**FIRE/EXPLOSION HAZARDS - danger:** the state of being exposed to harm; liable to injury, pain, or loss from fire/explosion (at or near the site) (Merriam-Webster 1971).

**FIRE PROTECTION -** measures and practices for preventing or reducing injury and loss of life or property by fire (Merriam-Webster 1971).

**FUMES -** gaseous emissions that are usually odorous and sometimes noxious (Merriam-Webster 1971).

**GAS -** a system for supplying natural gas, manufactured gas, or liquefied petroleum gas to the site and individual users.

**INFRASTRUCTURE:** The underlying foundation or basic framework for utilities and services: streets, sewage, water, network, storm drainage, electrical network, gas network, telephone network, public transportation, police and fire protection, refuse collection, health, schools, playgrounds, parks, open spaces.

**LAND - MARKET VALUE:** Refers to: 1) the present monetary equivalent to replace the land; 2) the present tax based value of the land; or 3) the present commercial market value of the land.

**LAND TENURE:** The act, right, manner or term of holding land property. Types are categorized by how land is held and for what period of time. Legal definitions are established to determine the division of property among various owners, or the relationship between owner or occupier, or between creditor

and owner; and between private owners and the public, and includes the assessment of taxes on private land rights and the regulation of land use through government control.

**LAND UTILIZATION:** A qualification of the land around a dwelling in relation to user, physical controls, and responsibility.

**Public:** (streets, walkways, open spaces) **User:** anyone/unlimited **Physical controls:** partial or complete **Responsibility:** public sector and user

**Semi-Public:** (open spaces, playgrounds, schools) **User:** limited group of people **Physical controls:** partial or complete **Responsibility:** public sector and user

**Private:** (dwellings, lots) **User:** owner or tenant or squatter **Physical controls:** complete **Responsibility:** user

**Semi-Private:** (cluster courts) **User:** group of owners and/or tenants **Physical controls:** partial or complete **Responsibility:** users

**LAND UTILIZATION: PHYSICAL CONTROLS:** The physical/legal means or methods of directing, regulating and coordinating the use and maintenance of land by the owners/users.

**LAND UTILIZATION: RESPONSIBILITY:** The quality/state of being morally/legally responsible for the use and maintenance of land by the owners/users.

**LOCATION - situation:** the way in which something (the site) is placed in relation to its surroundings (the urban context) (Merriam-Webster 1971).

**METROPOLITAN AREA -** "an area in which economic and social life is predominantly influenced by a central city, to which it is linked by common interests though not often by common policies. The metropolitan area may have one city or more as well as outlying districts or satellite communities. No physical or legal boundaries mark its borders, but roughly speaking these are the outer limits or commuting to or from the central city" (Abrams 1971).

**MODE OF TRAVEL -** manner of moving from one place (the site) to another (other parts of the urban context).

**NATURAL FEATURES -** prominent objects in or produced by nature.

**NEIGHBORHOOD:** a section lived in by neighbors and having distinguishing characteristics.

**NOISE -** any sound (affecting the site) that is undesired such as that produced by: traffic, airports, industry, etc.) (Merriam-Webster 1971).

**ODOR -** a quality of something that affects the sense of smell (Merriam-Webster 1971).

**PERCENT RENT/MORTGAGE:** The fraction of income allocated for dwelling rental or dwelling mortgage payments; expressed as a percentage of total family income.

**PLANNING:** the establishment of goals, policies and procedures for a social or economic unit, i.e., city.

**POLICE PROTECTION -** police force: a body of trained men entrusted by a government with the maintenance of public peace and order, enforcement of laws, prevention and detection of crime (Merriam-Webster 1971).

**POSITION -** the point or area in space actually occupied by a physical object (the site) (Merriam-Webster 1971).

**PROJECT:** a plan undertaken; a specific plan or design.

**PUBLIC TRANSPORTATION:** that segment of URBAN TRANSPORTATION which is available to the public without restriction. As public transport, it may also be regulated as to its operation, charges, and profits (Abrams, 1971).

**REFUSE COLLECTION -** the service for collection and disposal of all the solid wastes from a community.

**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 which one may lawfully use, the strip of land devoted to or over which is built a public road, the land occupied by a railroad, the land used by a public facility (Merriam-Webster 1971).

**SANITARY SEWERAGE -** the system of artificial usually subterranean conduit to carry off sewage (composed of Excreta: waste matter eliminated from the human body; Domestic Wastes: used water from a home/community containing 0.1% total solids; and some Industrial Wastes but not water from ground, surface or storm.

**SETTLEMENT:** occupation by settlers to establish a residence or colony.

**SLOPE -** degree or extent of deviation (of the land surface) from the horizontal (Merriam-Webster 1971).

**SMOKE -** the gaseous products of burning carbonaceous materials made visible by the presence of carbon particles (Merriam-Webster 1971).

**SOIL -** soil structure: the arrangement of soil particles in various aggregates differing in shape, size, stability, and degree of adhesion to one another (Merriam-Webster 1971).

**STORM DRAINAGE -** storm sewer: a sewer (system) designed to carry water wastes except sewage (exclusively: storm water, surface runoff, or street wash) (Merriam-Webster 1971).

**STREET LIGHTING -** a service for urban street illumination to improve vision at night.

**SUBSISTENCE INCOME:** Average amount of money required for the purchase of food and fuel for an average family of 5 people to survive (\$325/year in Nairobi, 1972).

**TELEPHONE -** an electrical voice communication network interconnecting all subscribing individuals and transmitting over wires.

**TENURE:** Two situations of tenure of the dwelling units and/or the lot/land are considered: **Legal:** having formal status derived from law. **Extralegal:** not regulated or sanctioned by law.

Four types of tenure are considered:

**Rental:** where the users pay a fee (daily, weekly, monthly) for the use of the dwelling unit and/or the lot/land.

**Lease:** where the users pay a fee for long-term use (generally for a year) for a dwelling unit and/or the lot/land from the owner (an individual, a public agency, or a private organization).

**Ownership:** where the users hold in freehold the dwelling unit and/or the lot/land which the unit occupies.

**Employer-Provided:** where the users are provided a dwelling unit by an employer in exchange for services; i.e., domestic live-in servant.

**TOPOGRAPHY -** the configuration of a (land) surface including its relief and the positions of its natural and man-made features (Merriam-Webster 1971).

**TRANSPORTATION -** means of conveyance or travel from one place (the site) to another (other parts of the urban context) (Merriam-Webster 1971).

**URBAN AREA:** All developed land lying within the urban fringe (politically undefined development lying between the city and the country) including a central city and any of its satellite communities; it is not a political/governmental unit (Bartholomew, 1955).

**URBANIZATION:** the quality of state of being or becoming urbanized: to cause or take on urban characteristics.

**USER INCOME GROUPS:** Based upon the subsistence (minimum wage) income per year, five income groups are distinguished. (The subsistence income per year in Nairobi is approximately \$325.)

The income group with no household income available for housing, services, or transportation.

**Low** (1 x subsistence level) \$325/year: The income group that can afford limited subsidized housing.

**Moderate Low** (4 x subsistence level) \$1,300/year: The income group that has access to public/private commercial housing (rental).

**Middle** (15 x subsistence level) \$4,875/year: The income group that has access to private commercial housing (ownership).

**High** (above 15 x subsistence level) above \$4,875: The income group that represents the most economically mobile sector of the population.

**VIBRATION -** a quivering or trembling motion (such as that produced by: heavy traffic, industry, aircraft, etc.) (Merriam-Webster 1971).

**VIEWS -** that which is revealed to the vision or can be seen (from the site) (Merriam-Webster 1971).

**WATER SUPPLY -** source, means, or process of supplying water (as for a community) usually involving reservoirs, pipelines, and often the watershed from which the water is ultimately drawn (Merriam-Webster 1971).

## ABBREVIATIONS

### QUALITY OF SERVICES, FACILITIES AND UTILITIES

- None: when the existence of services, facilities and utilities are unavailable to the dwelling group area.
- Limited: when the existence of services, facilities and utilities are available to the dwelling group area in a limited manner due to proximity.
- Adequate: when the existence of services, facilities and utilities are available in/to the dwelling group area.

### QUALITY INFORMATION

The quality of information given in the drawings, charts, and descriptions have been qualified in the following manner:

- Tentative: when based upon rough estimation of limited sources.
- Approximate: when deducted from different and/or not completely reliable sources.
- Accurate: when taken from reliable or actual sources.

## EQUIVALENTS

### Linear Measure

- 1 millimeter = 0.03937 inches  
 1 centimeter = 0.3937 inches  
 1 meter = 39.37 inches  
           = 3.28083 feet  
           = 1.09361 yards  
 1 kilometer = 3280.83 feet  
               = 1093.61 yards  
               = 0.62137 miles  
 1 inch = 25.4 millimeters  
           = 2.54 centimeters  
           = .0254 meters  
 1 foot = .3048 meters  
 1 yard = .9144 meters  
 1 mile = 1.50935 kilometers

### Square Measure

- 1 square millimeter = 0.00155 square inches  
                       = 1973.5 circular mils  
 1 square centimeter = 0.155 square inches  
 1 square meter = 1550 square inches  
                   = 10.7639 square feet  
                   = 1.196 square yards  
 1 hectare = 10,000 square meters = 2.4711 acres  
 1 square kilometer = 0.386109 square miles  
                       = 247.11 acres  
 1 square inch = 645.2 square millimeters  
                   = 6.452 square centimeters  
 1 square foot = 0.0929 square meters  
 1 square yard = 0.836 square meters  
 1 acre = 0.4087 hectare  
 1 square mile = 640 acres = 258.9 hectares

DOLLAR EQUIVALENTS: The value of the dollar is used is equal to:  
7 Kenya Shillings

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