

RATIONALIZING URBAN LAND UTILIZATION;  
GUIDELINES FOR HOUSING DEVELOPMENTS IN  
GREATER KHARTOUM, SUDAN

by  
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Submitted to the Department of Architecture  
in partial fulfillment of the requirements for the  
Degree of  
Master of Science in Architecture Studies at the  
Massachusetts Institute of Technology

June, 1986

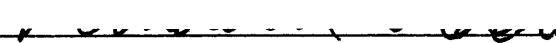
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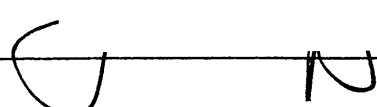
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*to my parents,  
and  
to Mona, of course.*

**Rationalizing Urban Land Utilization:  
Guidelines for Housing Developments in Greater Khartoum, Sudan**

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**ABSTRACT**

The housing crisis in Greater Khartoum manifests itself in a very high demand for housing and a deficient supply mechanism. This unsatisfied demand is reflected in high rents and land prices, high occupancy rates, and sprawling squatter areas. Due to the low priority of the housing sector vis-a-vis the "productive" sectors, public investment in housing has been reduced to insignificant amounts resulting in less services, fewer serviced sites, and negligible investment in direct housing construction.

Ironically, the only resource that exists in abundance --land-- is irrationally wasted by adopting high space standards. The extremely low densities that result precludes economic servicing of housing areas given the tight budgets of beneficiaries and public agencies. The extent of infrastructure and services needed in new housing developments, and the inability of public agencies to provide them often oblige agencies to slow down urbanization of new housing extensions.

This study analyzes the housing problem in Greater Khartoum and proposes to tackle it through a "least effort" approach in the form of guidelines at two levels: First, at the level of existing neighborhoods, it calls for reevaluating the land utilization pattern, capturing any underutilized spaces and converting them into housing plots. An added advantage of this process is that it allows communities to participate in decisions pertinent to their neighborhoods; and, second, at the level of new neighborhoods, it spells out the criteria for appropriate space and facilities allocation, and provides planning indices geared towards rational land utilization. A model layout that demonstrates the application of the guidelines in residential area planning is appended to the study.

Thesis Supervisor: Reinhard K. Goethert  
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## AKNOWLEDGEMENTS

I would like to express my gratitude to my advisor Reinhard Goethert for his continued assistance and insightfulness throughout the various stages of conceptualizing and producing this study. I am also indebted to him for the use of his computer program in generating Table 3.7.

Since the first manuscript of this study was written in October 1985 several people have read it and made invaluable comments on it. I am grateful in this connection to Prof. H. Caminos, Prof. W. Doebele, and Prof. N. Hamdi.

To my friends and former colleagues Salah El-Nuss, Hydar El-Tuhami, Mudhar El-Fil and Abdalla El-Sammani I owe special thanks for providing me with valuable, up-to-date information.

I am also thankful to my colleagues Avo Asdourian for his meticulous editing, and Ashwani Vashishth for his help in printing the photographs.

The financial support of the Government of the Sudan is greatly appreciated. Without it my study at M.I.T. would have been a sweet daydream.

G.M.H.

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**TABLE OF CONTENTS**

ABSTRACT	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	v
LIST OF FIGURES	vi
LIST OF PHOTOGRAPHS	vii
<i>Chapter One:</i>	
THE HOUSING PROBLEM IN GREATER KHARTOUM	
I. Introduction	1
II. Symptoms of the Problem	7
III. The Key Generators of the Problem	20
IV. Summary and Conclusions	29
V. Tackling the Housing Problem	30
<i>Chapter Two:</i>	
A STRATEGY FOR REMEDIAL ACTION IN EXISTING RESIDENTIAL AREAS: CASE STUDY AL-DEUM EAST	
I. Introduction	32
II. Further Evaluation	33
III. A Strategy for Remedial Action	37
IV. Conclusion	43
<i>Chapter Three:</i>	
LAND PLANNING GUIDELINES FOR NEW RESIDENTIAL AREAS	
I. Introduction	45
II. The Indices and Guidelines	48
III. Application of the Guidelines in Residential Area Planning	71
<i>Appendices:</i>	
APPENDIX I: THE COUNTRY CONTEXT	74
APPENDIX II: HISTORY OF URBANIZATION IN GREATER KHARTOUM	78
APPENDIX III: HOUSING IN THE NATIONAL DEVELOPMENT PLANS	83
APPENDIX IV: THE CASE STUDIES	
1. Al-Riyadh First-Class Area	89
2. Al-Amarat Second-Class Area	93
3. Al-Mahdiyya Al-Hara 2 Third-Class Area	97
4. Al-Deum East Third-Class Area	101
5. Old Omdurman Third-Class Area	105
BIBLIOGRAPHY	109

**LIST OF TABLES**

Table 1.1: Estimated Urban Housing Need, 1981–1990	8
Table 1.2: Estimated Supply of Housing Units 1973–1980	10
Table 1.3: Housing Characteristics from the 1973 Census	12
Table 1.4: Housing Services in 18 Urban Areas	13
Table 3.1: Recommended Plot Sizes	49
Table 3.2: Effect of Varying the Plot Proportions	52
Table 3.3: Effect of Varying the Block Length	53
Table 3.4: Approximate Planning Indices for Primary Schools	65
Table 3.5: Approximate Planning Indices for Intermediate Schools	66
Table 3.6: Summary of Areas for Communal Facilities	69
Table 3.7: Population, Plot Numbers, Gross Density and Land Utilization Indices Corresponding to Various Site and Plot Areas	70

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**LIST OF FIGURES**

Fig 1.1: Map of Greater Khartoum	2
Fig 1.2: Growth of Greater Khartoum in 60 Years	18
Fig 1.3: Minimum Set Backs Stipulated by the Building Regulations	25
Fig 1.4: Graphic Synopsis of the Case Studies	26
Fig 2.1: Comparison Between Existing and Reference Layouts	34
Fig 2.2: Graphic Comparison Between Existing and Reference Layouts	35
Fig 2.3: Open Space Utilization in Al-Deum	38
Fig 2.4: Alternative Layouts for Filling the "Voids" in Al-Deum	44
Fig 3.1: A 180x50 m Urban Block	51
Fig 3.2: Three Urban Blocks	51
Fig 3.3: Grid Vs. Gridiron Blocks	55
Fig 3.4: Types of Circulation Routes	57
Fig 3.5: Major Streets	59
Fig 3.6: Minor/Local Streets	59
Fig 3.7: Pedestrian Walkways	60
Fig 3.8: Residential Courts	60
Fig 3.9: Model Layout for Residential Areas in Greater Khartoum	73
Fig I.1: Map of the Sudan Showing the Location of Greater Khartoum	76
Fig IV.1: Location of the Case Studies within Greater Khartoum	88
Fig IV.2: Segment in Al-Riyadh and its Land Utilization Indices	92
Fig IV.3: Segment in Al-Amarat and its Land Utilization Indices	96
Fig IV.4: Segment in Al-Mahdiyya and its Land Utilization Indices	100
Fig IV.5: Segment in Al-Deum and its Land Utilization Indices	104
Fig IV.6: Segment in Omdurman and its Land Utilization Indices	108

**LIST OF PHOTOGRAPHS**

Photo 1: Residual Rain Water in a Neighborhood Open Space, and...	14
Photo 2: ...in a Residential Street	14
Photo 3: Garbage Spilling Over a Neighborhood Open Space and...	15
Photo 4: ...Over Two-Thirds of a Major Street	15
Photo 5: Garbage Collection and...	16
Photo 6: ...Incineration, all Takes Place Within Residential Areas	16
Photo 7: Excessive width of Residential Streets in Khartoum is Adopted in...	17
Photo 8: ...Secondary Towns in the Sudan	17
Photo 9: Aerial View of Part of Al-Riyadh	90
Photo 10: Al-Riyadh. General View	91
Photo 11: Al-Riyadh. Major Street	91
Photo 12: Aerial View of Part of Al-Amarat	94
Photo 13: Al-Amarat. Street View	95
Photo 14: Al-Amarat. An Open Space	95
Photo 15: Aerial View of Part of Al-Mahdiyya	98
Photo 16: Al-Mahdiyya. Main Drainage Ditch	99
Photo 17: Al-Mahdiyya. A Residential Street	99
Photo 18: Aerial View of Part of Al-Deum	102
Photo 19: Al-Deum. A Residential Street	103
Photo 20: Al-Deum. An Open Space	103
Photo 21: Aerial View of Part of Omdurman	106
Photo 22: A Street in Old Omdurman	107
Photo 23: Omdurman. A Street View	107



CHAPTER ONE  
THE HOUSING PROBLEM IN  
GREATER KHARTOUM

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This chapter addresses the extent of the housing problem in Khartoum Conurbation. Some conspicuous symptoms of the problem will be illustrated and analysis of the key generators behind them will be carried out. The chapter presents some conclusions and suggests a "plan of attack" to be elaborated in the subsequent parts. The chapter is introduced by description of the urban context and the general traits of housing in it.

## I. INTRODUCTION

### 1. THE URBAN CONTEXT

Greater Khartoum lies around the confluence of the White and the Blue Niles, at latitude 15°-30' north. It comprises a large metropolitan area composed of the three cities of Khartoum, Khartoum North, and Omdurman (hence the nickname the "Three Towns"), and numerous satellite villages (Fig 1.1). Khartoum province, which comprises less than 0.8% of the total area of Sudan, is predominantly a flat plain the only significant relief feature on it is the Markhiyyat Mountains northwest of Omdurman.

The area enjoys a semi-arid tropical climate. Mean maximum and minimum temperatures are 43 and 18° C, respectively, in summer; 37 and 10° C in winter. The rainy season generally extends from July to October with an annual average of 150 mm. Sandstorms prevail on most of the summer.

The confluence of the two Niles had been an important trade depot for the caravans that traveled across the Sahara and the traders that penetrated deep into Africa. The strategic importance of the area was realized during the Turco-Egyptian occupation (1820-1884) when Khartoum proper was established as the capital in 1830. During the Mahdiyya (1884-1898) Khartoum was abandoned and Omdurman became the new capital. In 1898 Khartoum was reestablished as the seat of administration of the Anglo-Egyptian "condominium".

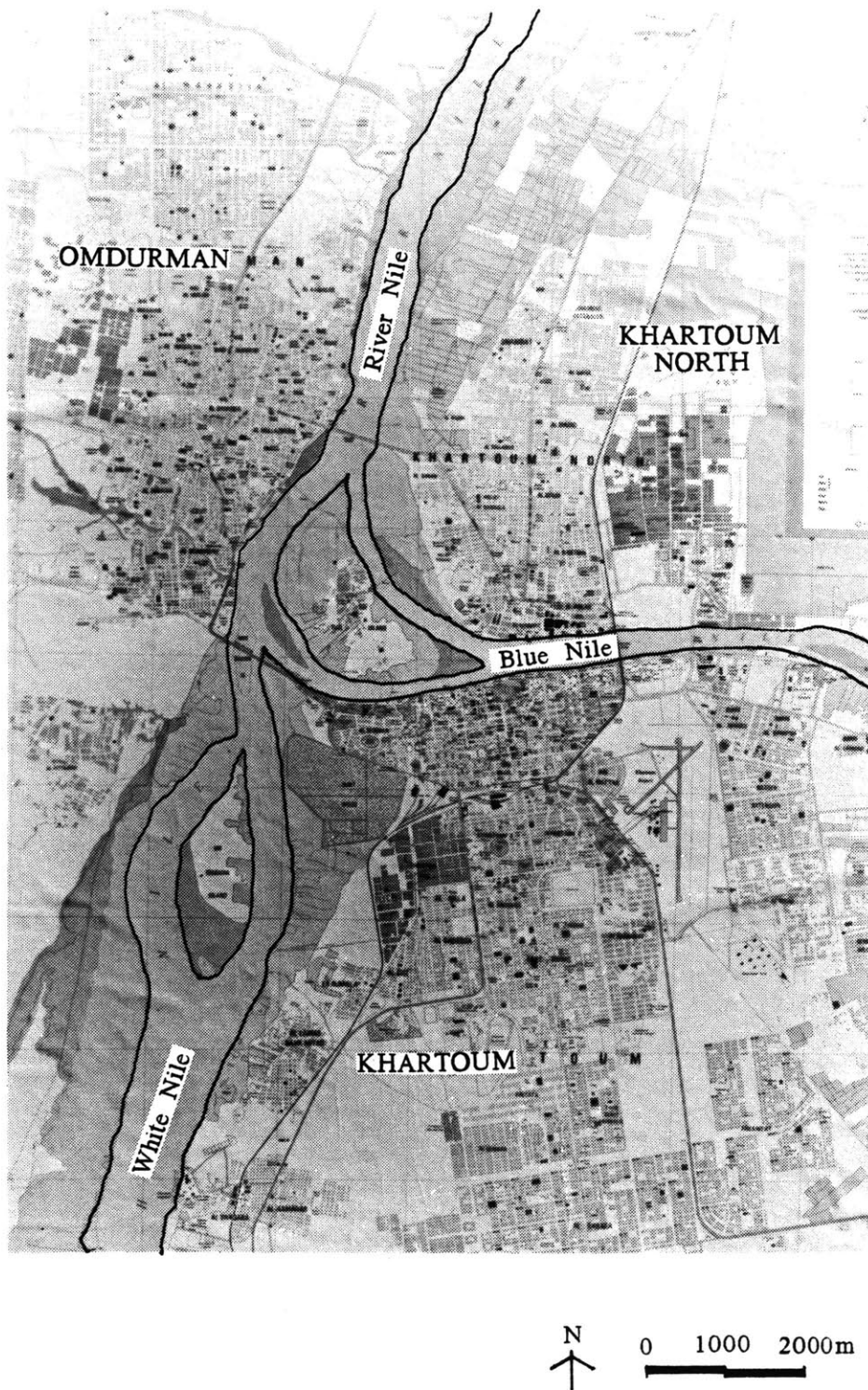


Fig 1.1: Map of Greater Khartoum.

(Source: Sudan Survey Department, General Map of Greater Khartoum, 1981)

Khartoum's population grew from 25,000 in 1913, to 93,000 in 1956, to 350,000 in 1973, and to 476,000 in 1983 (36% increase in the last 10 years). Omdurman's population grew from 60,000 in 1898 to 113,000 in 1956, to 300,000 in 1973, and to 526,000 in 1983 (75% increase in the last 10 years). Khartoum North assumed some importance as a base for dock yards and industry. Its population grew from 39,000 in 1956 to 150,000 in 1973 to 431,000 in 1983 (127% increase in the last 10 years).

At present, the "Three Towns" cover an approximate area of 300 sq.km. extending 20-25 km. in a north-south direction and 18-22 km. in an east-west direction. They have a combined population of more than 1.3 million people, which constitutes more than 30% of the urban population in the whole country. Khartoum proper is the main administrative and commercial center. It houses various government agencies, the international airport, and foreign embassies. Omdurman remains primarily a residential city with some commercial importance, and Khartoum North a residential area with major industrial concentrations.

## 2. THE HOUSING CONTEXT

Basically, there are three modes of housing development in Greater Khartoum; i) State-built projects; ii) Sites and Services projects; and iii) Informal developments.

### 1. State-built Projects

Under this system the state provides a complete package of dwelling units and physical and social infrastructure for two target groups;

- a) Government employees sent on official missions from one part of the country to another. Government agencies own some 500 houses in urban areas which they lease to their employees on a seniority basis. The rents collected from these houses are generally below market rates.<sup>1</sup>

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<sup>1</sup> United States Agency for International Development (USAID), *Sudan Shelter Sector Assessment*, 1978, p III-10

- b) Some civil servants and workers are provided, on a hire-purchase basis, with "economical" houses constructed by the Ministry of Construction and Public Works (MCPW).

The criteria of selection of beneficiaries for these "economical" houses require that a recipient should have a permanent job, a family, and should not own a house/piece of land in another urban area. Chosen from a long waiting list, an applicant is required to pay a down payment equals to 10% of the cost of the house and the services provided, and to pay the balance in installments over a period of 20 years.<sup>1</sup>

The share of state-built projects in the total urban housing stock is very minute. The total number of units built since the adoption of the policy in 1955 does not exceed 2500 units, of which 1048 units were built in Khartoum North alone between 1961 and 1969.<sup>2</sup>

## 2. Sites and Services Projects

Unlike in other countries, sites and services is the *major* form of urban housing in the Sudan. For instance 96% of the housing units planned for the span of the Six-Year Plan, 1976/77-1982/83, were included as sites and services projects.<sup>3</sup>

The Department of Housing, MCPW, prepares the urban layouts of new projects and hand them over to the Public Electricity and Water Corporations, the Department of Roads and Bridges, and to local councils in order to carry out the implementation. Lack of coordination between these agencies often results in conflicts that retard the urbanization process.

According to their income, people apply for plots in either first-, second- or third-class areas. The applicant should be Sudanese, has a family, a steady income,

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<sup>1</sup> Abuelzein, O. A., *Appropriate Strategies in Aid of Housing for Low-income Families with Particular Reference to Greater Khartoum*, Unpublished M.Phil. Diss., University of Newcastle-upon-Tyne, 1983 , p 72

<sup>2</sup> Department of Housing, Ministry of People's Local Government, *Housing Plan 1975-79* July 1975, (Arabic), p 41. For a detailed evaluation of state-built projects see Abuelzein, *op. cit.*

<sup>3</sup> USAID, *op. cit.*, p III-3

and has been living in that urban area for at least 10 years without owning a house/land. Each criterion is given a number of points, the total of which determines the eligibility of the applicant to get a plot.

Allottees pay for land, administrative costs, and the cost of "basic services" (i.e. roads, solid waste collection and disposal, run-off drainage, and communal facilities). On the other hand, 80% of the production and distribution costs of electricity and potable water is borne by the government, whereas the remaining 20% is borne by beneficiaries, who also pay monthly for their consumption.

75% of the private finance of dwellings is provided through informal channels which might include any combination of personal savings, interest-free loans borrowed from friends and relatives, sale of jewelry and other pieces of property, etc. The remaining 25% is obtained through loans from commercial banks, the Estates Bank, or from different employers.<sup>1</sup>

### 3. Informal Settlements

Informal settlements in Greater Khartoum can be grouped into two categories; those built on government-owned land and those built on privately-owned land parcels illegally subdivided and sold by their legal owners. Barren land and villages on the natural direction of growth of the city usually form the first nuclei of informal settlements.

There is no precise indication of the actual size of these settlements since they continue to grow every day. However, the 1973 census revealed that illegal settlements constitute 30% of the total number of dwelling units in urban areas.<sup>2</sup> If we take into account fourth-class areas, which were essentially illegal settlements that have been legalized and upgraded, we conclude that more than one-third of the urban housing stock is provided through informal developments.

Squatters are generally migrants from rural areas and neighboring countries, or urban dwellers who have been displaced by soaring rents and cost of living. The choice of

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<sup>1</sup> USAID, *op. cit.*, p III-47

<sup>2</sup> Housing National Committee, MCPW. *Draft of Final Report.* n.d., Table 3.4.1.

settlement is usually influenced by proximity to employment concentrations, and by the presence of relatives and friends in a certain settlement. Settlements that are predominantly inhabited by peoples from certain tribes or from a certain region are common (e.g., al-Gama'ir, to the northeast of Omdurman, which is inhabited mainly by people from western and southern Sudan.

A considerable amount of houses in illegal settlements is built by land speculators who build as many houses as they can and sell/rent them to newly arriving squatters. The other amount is built by the squatters themselves with the aid of neighbors and friends, from any available building material.

Potable water is usually bought from vendors who obtain water from neighboring areas or directly from the river. Human waste is disposed off either in pit latrines or on open spaces around the settlement. Solid waste, however, is dumped anywhere within the settlement.

Since most informal settlements grow on land owned by the government, and since bulldozing is often met with considerable public resentment, legalization becomes inevitable whenever the government decides to urbanize the area occupied by squatters.

The legalization process is usually preceded by a cursory survey carried out by the Department of Housing to determine the eligibility of each family to receive a legal land title. Eligibility is decided by the size of the squatter family, the number of years it resided in the area, and whether it owns another piece of land elsewhere or not.

Although most legalized settlements are redeveloped into third-class areas, some of them are upgraded into fourth-class areas. Land titles in fourth-class areas should be renewed annually and the government reserves the right not to renew land titles if it intends to redevelop the area.

## II. SYMPTOMS OF THE HOUSING PROBLEM

There are numerous symptoms that indicate the extent of the housing problem in Greater Khartoum. Most conspicuous among these are a high need for housing coupled with a deficient supply, low overall level of services, and an inflated sprawl epitomized by very low residential densities, and large pockets of open spaces.

### 1. HIGH NEED FOR HOUSING

A high need for housing in an urban center like Greater Khartoum, which accommodates as much as 30% of the total urban population in the Sudan, is not a very unusual phenomenon. Greater Khartoum has grown in population from 808,000 inhabitants in 1973 to 1,344,000 people in 1983 at an approximate annual growth rate of 5.9%, of which only 2.3% is accounted for by natural growth. The remainder results from incoming migration from rural areas and other urban centers.

Need for housing is a rather subjective issue that varies through time and place. The type of housing a family needs at a certain moment in its life-cycle is not necessarily what policy makers and housing experts perceive. Furthermore, the way one approaches and defines this need determines to a great extent the kind of conclusions and recommendations one is bound to arrive at. Some people argue that expressing housing need in terms of a quantitative deficit is bound to give distorted figures depending on what one counts. Although this position has some validity (especially when considering for example, what should be counted as sub-standard housing units,) it is nonetheless, worthwhile to attempt to determine the quantitative deficits of housing (once the appropriate criteria for counting is established) in order to have a feel of the extent of the problem, and the amount of resources required to meet the housing need.

Precise determination of the need for housing is hampered by the lack of sufficient, up-to-date information on the subject. The housing data of the 1983 census has not been released yet, and those of the 1973 census were denounced as inaccurate and more biased towards understatement of the population. The first Six-Year Development Plan, 1977/78-1983/84, did not spell out the total need for housing during the six years of its duration. Rather it sets a goal of providing 194,000 housing units in the major urban centers of the country (comprising all the settlements of at least 20,000

inhabitants, plus some provincial capitals of less than 20,000 people) within the six years of its duration. This goal, however, was regarded as being very modest representing less than 50% of the actual need.<sup>1</sup> Using relatively higher estimates of population increase, a team from the USAID had estimated the need for urban housing in the whole country between 1978 and 1985 at 525,000 units.<sup>2</sup>

The most recent attempt to estimate this need, however, was undertaken by the Housing National Committee, MCPW, formed in July 1979 to formulate a long-term housing program and policy within the framework of the second Six-Year Plan, 1983-1990. Depending on projected increases in the number of households, and assuming that every household is to be provided with a separate plot/dwelling unit, the Committee forecasts a need for 450,000 additional urban housing units.<sup>3</sup> It also estimates a backlog of 50,000 units carried over from the period between 1973 and 1980.<sup>4</sup> The Committee also sets a goal of upgrading 50% of the "sub-standard" units informally provided in urban areas prior to 1980. Taking these figures for what they worth, the need for urban housing in the *whole* country for the period 1981-1990 was estimated as follows.

plots for new households	450,000
estimated backlog	50,000
50% of sub-standard units	80,000
total need (units/plots)	580,000

*Table 1.1: Estimated Urban Housing Need, 1981-1990*  
(Source: Housing National Committee. *op. cit.*, pp 109-112)

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<sup>1</sup> Housing National Committee, *op.cit.* p 92.

<sup>2</sup> USAID, *op. cit.*, p III 26

<sup>3</sup> National Housing Committee, *op. cit.*, Table 3.1.6.

<sup>4</sup> National Housing Committee, *op. cit.*, p 39



The reservations I have against these figures revolve around two points;

- i) Formation of new households doesn't necessarily generate a need for an equivalent number of dwelling units. Studies have shown that 40-50% of households in Greater Khartoum live in rental units,<sup>1</sup> most of which provided through informal subdivision of existing units. Evidence suggest that this doubling-up provides an additional source of income to many families, and suitable housing for many burgeoning families who can't afford to have their own separate dwelling at an early stage of the household formation. Estimation of the housing need for this category should be more elaborate to take into account the willingness and the ability of new households to have separate units. Accordingly, the 450,000 figure derived by the Committee might be overestimated.
- ii) The standards against which "sub-standard" units are compared are normative standards of construction, space, and services. Viewing these "sub-standard" units within a time frame as "slums in progress", and acknowledging the continuous efforts of their owners to improve them as their means allow, indicate that most of these units should not be a major concern for the housing agency; and, therefore, should not appear as a major item in the estimation of housing need.

## 2. DEFICIENT SUPPLY OF HOUSING

Considering the supply side, the Committee estimates the number of dwelling units provided in all urban areas between 1973 and 1980 as follows.

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<sup>1</sup> USAID, *op. cit.* Appendix A 28

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plots legally subdivided and developed	25,000
units illegally provided	50,000
plots legally subdivided but not developed	50,000
<hr/>	
total units gained	125,000
<hr/>	

*Table 1.2: Estimated Supply of Housing Units, 1973-1980*  
*(Source: Housing National Committee, op. cit., p 39)*

Provided over seven years, this supply of housing units/plots occurred at an approximate rate of 18,000 units per year. On the other hand, if the 580,000-units need is to be met within the ten-year span of the current housing plan, additional units have to be supplied at an annual rate of 58,000 units per year. Therefore 10% of the GNP should be devoted to the housing sector --far beyond the less-than-2% devoted to housing in the previous plans.<sup>1</sup>

Regardless of the accuracy of all these figures, the large disparity between the need for and the supply of housing units is exemplified by the following phenomena.

### 2.1. Soaring Rents

The cost of rental units, which provide housing for 40-45% of households in Greater Khartoum, more than tripled between 1970 and 1978.<sup>2</sup> From that on it kept "sky rocketing" at unprecedented paces. While the USAID study of the rental housing market has concluded that on average, the percentage of household income that has to be spent on housing (including rent, utilities, and maintenance) ranges between 35-40%,<sup>3</sup> a more recent study has shown that a single-room house in a remote third-class area that has no services whatsoever rents for £S60 --equivalent to the

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<sup>1</sup> Housing National Committee, *op. cit.*, p 9

<sup>2</sup> USAID, *op. cit.*, p III 25

<sup>3</sup> *Ibid.*

minimum official wage.<sup>1</sup> The same study also indicated that while the minimum official wage has increased by 90% since 1978, rents have increased by 1000%.

It has been noted<sup>2</sup> that a spiralling effect in rents is usually triggered by corporations and foreign embassies who rent dwelling units in first-class areas, at very high rents, and convert them into offices. In effect, some high and upper-middle income households are forced to compete for rental units in second and third-class areas increasing their rents and forcing households within the lower income brackets to seek housing in remote fourth-class areas and often in squatter settlements.

## 2.2. High Occupancy Rates

From a total of 132,726 units recorded in Greater Khartoum at the time of the 1973 census, 39% had only one room, of which almost 40% is occupied by households of 5-6 persons (Table 1.3.)

---

<sup>1</sup> *al-Sahafa*, September 11, 1985.

<sup>2</sup> Ahmed, A/K. M. "The Urban Housing Problem in the Sudan". In *Housing Symposium*. A Special issue of *SFSU Bulletin*, CEDUST ed. Faculty of Arts, University of Khartoum, 1980.

	Sudan (urban)	Greater Khartoum
total number of dwelling units	471,490	132,726
average number of rooms	2.0	2.2
persons per household	5.4	5.9
persons per room	2.7	2.7
houses with only one room	43%	39%
households with 5-6 persons living in one room	40%	38%

*Table 1.3: Housing Characteristics from the 1973 Census  
(Source: USAID, op. cit., p 111 15)*

Bearing in mind that the officially accepted norm is two persons per room, it becomes clear that overcrowding is not a very unusual phenomenon in Greater Khartoum, especially in third and fourth-class areas.

### 2.3. "Illegal" Settlements

Popular settlements, officially considered "illegal" because they mushroom on illegally subdivided land, have become major sources of housing for an appreciable number of people within the lower end of the income scale. There is no consensus among concerned authorities and researchers as to the exact size of these settlements because they grow at unpredictable paces. However, they are believed to accommodate 30-40% of the population in Greater Khartoum. The massive population exodus to Khartoum in late 1984 to mid 1985 that followed the mass starvation in the eastern and western regions has pushed these percentages even higher. To give an indication of the size of "illegal" housing construction, it was mentioned earlier that almost two-thirds of the dwelling units provided between 1973 and 1980 were provided through "illegal" land developments.

### 3. LOW LEVEL OF SERVICES

A survey of 18 urban areas undertaken in 1972/73 by the Department of Housing, MCPW, and a United Nations housing expert indicated the percentages of housing units that had services as follows.

---

12%	had paved roads
24%	had storm water drainage
3%	had sewer connections
54%	had electricity
63%	had individual water connections

---

*Table 1.4: Housing Services in 18 Urban Areas  
(Source: National Housing Committee, op. cit., p 38)*

The situation in Greater Khartoum could be considered as slightly better off than in other urban areas, especially in the first category where few roads have been paved in the past few years. It's worth mentioning that the extremely low percentage of units that have water-borne sewer connections (3% of the total urban units, situated within the Central Business District and in few first-class areas in Khartoum) does not constitute a major problem. Living in a hot-dry region at very low residential densities, people in Greater Khartoum make do with pit latrines, septic tanks and soak-away pits.

In some areas that lack adequate storm water drains, run-off water from domestic uses is disposed of on roads and open spaces causing disintegration of the top soil and erradication of paved roads. Residual rain water often accumulates on streets and open spaces blocking access routes and impeding efficient utilization of open spaces. (Photographs 1, 2)



*Photo 1: Residual Rain Water in a Neighborhood Open Space, and...*



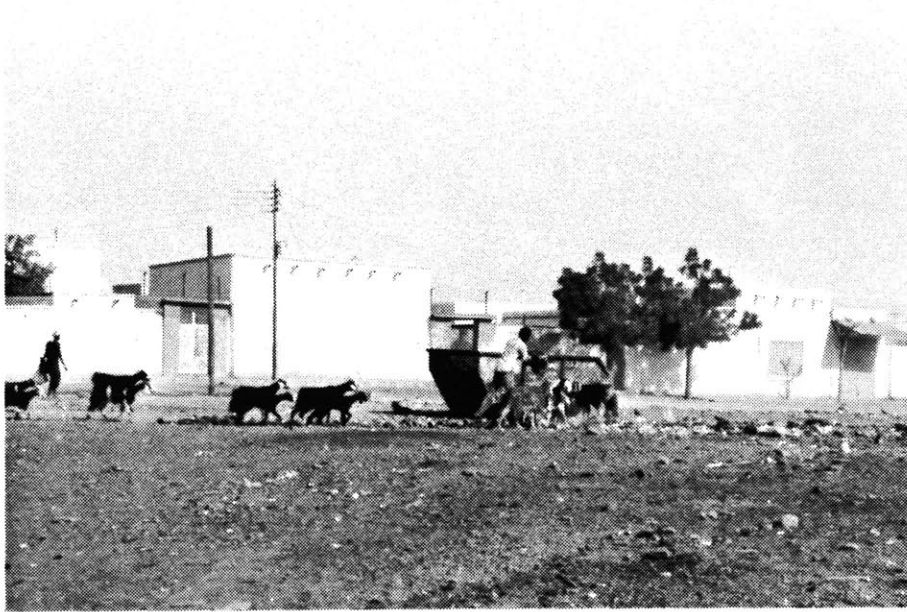
*Photo 2: ...in a Residential Street Demonstrates the Inadequacy of Maintaining the Discharge System in the City.*



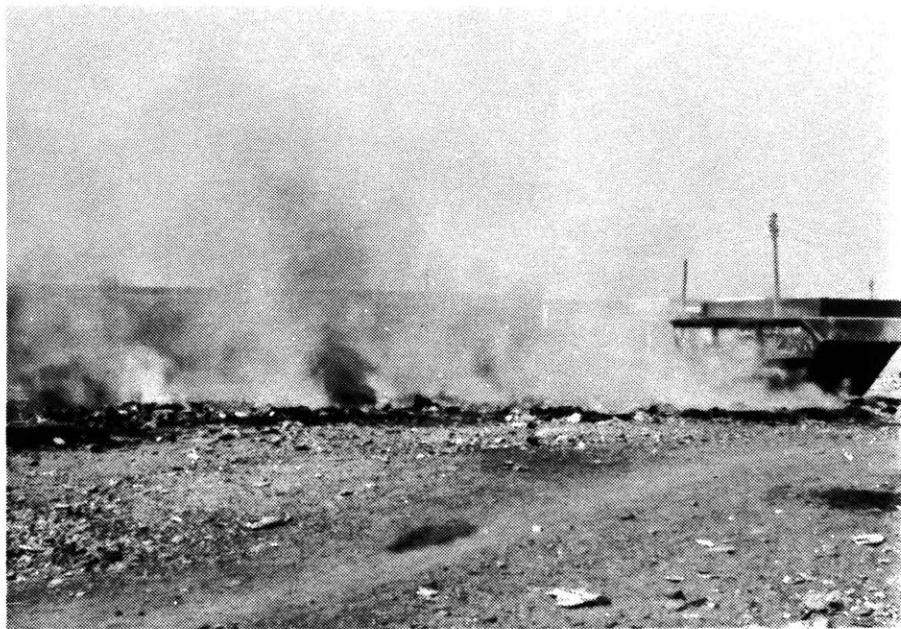
*Photo 3: Garbage Spilling Over a Neighborhood Open Space and...*



*Photo 4: ...Over Two-Thirds of a Major Street Also Testifies to the Inefficiency of the Municipal Disposal System.*



*Photo 5: Garbage Collection and...*



*Photo 6: ...Incineration, all Takes Place Within Residential Areas.*





*Photo 7: Excessive width of Residential Streets in Khartoum is Adopted in...*



*Photo 8: ...Secondary Towns in the Sudan Despite the Rarity of Cars in Most of Them.*

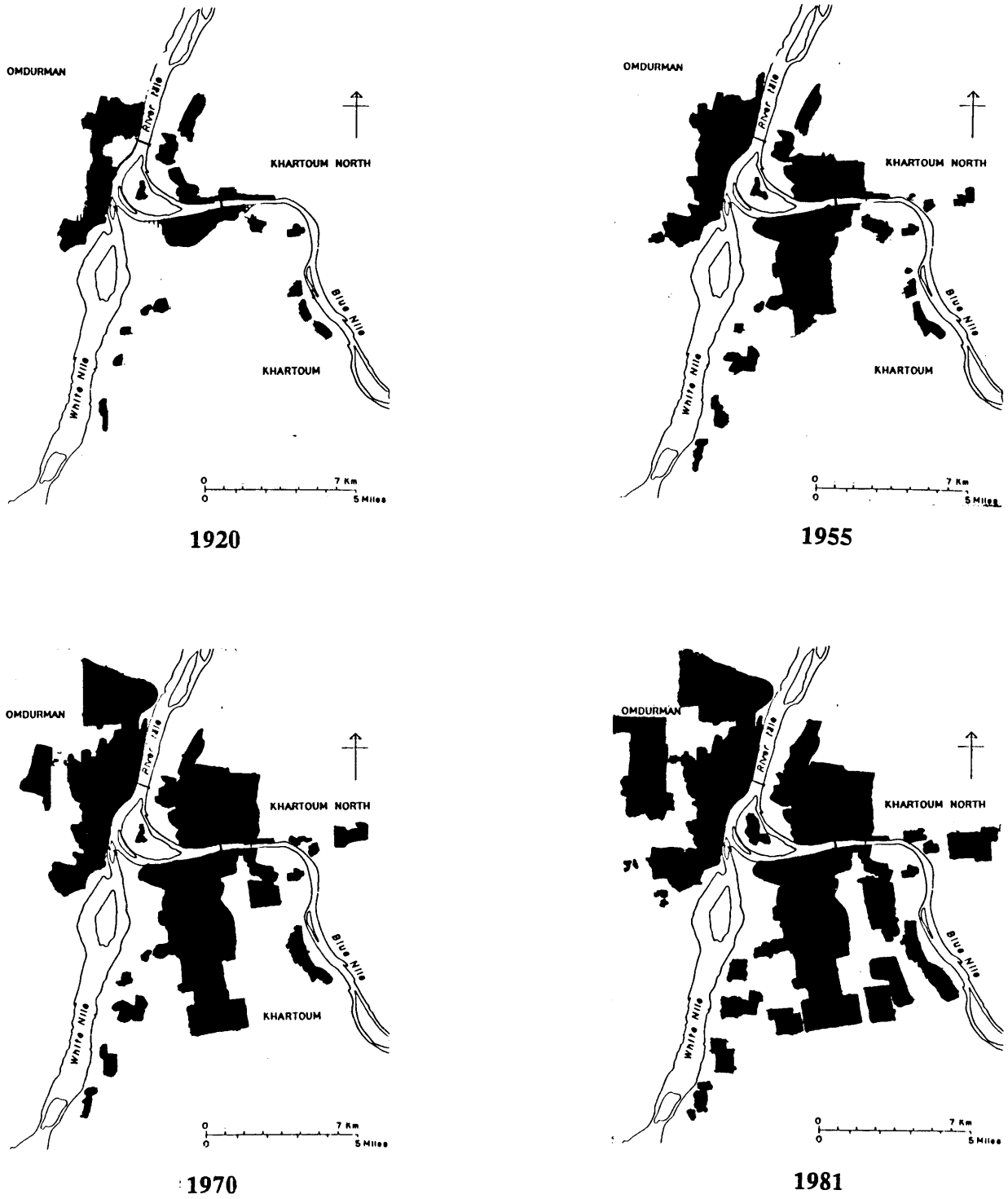


Fig 1.2: Growth of Greater Khartoum in 60 Years.  
(Source: Sudan Survey Department, *op. cit.* and El-Bushra, E. *op. cit.*)

The frequency of solid waste collection from residential areas has decreased considerably in recent years (except for few first-class areas and major streets in Khartoum). Consequently, solid waste spills over access roads and open spaces. (Photographs 3, 4). Incineration of garbage at collection points within neighborhoods becomes a common practice when the municipal machinery fails to dispose it off otherwise. (Photographs 5, 6)

The provision of services, which is by definition a prerequisite for every site-and-services development, often proceeds at very slow paces. Instances of "new" residential extensions not been provided with electricity and water 10-20 years after plots had been allotted and service charges collected are very common. The repercussions being fewer housing starts, slow paces of plot development,<sup>1</sup> and a high percentage of vacant new units awaiting the extension of basic services such as potable water and electricity.

#### 4. INFLATED CITY SPRAWL

With such a high rate of urbanization and a high annual growth rate, proliferation of Greater Khartoum is an inevitable consequence. Fig 1.2. depicts the growth of Greater Khartoum from 1920 to the present. This expansion, however, is more than inflated. Within the three towns exist areas of extremely low densities caused by large plots, wide roads, and large open spaces. Gross residential densities range between 30-50 persons/hectare in first- and second-class areas, and between 60-100 persons/hectare in third- and fourth-class areas. The following are but some repercussions of this inflated sprawl.

- a) Extravagant lengths (hence costs) of streets and utilities networks .
- b) A good deal of time, energy, and money is usually wasted in intra-town commuting. Journeys to work become extremely tiring especially at peak hours and at times of petroleum shortages. Moreover social linkages between relatives

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<sup>1</sup> from a total of 75,000 plots distributed between 1973 and 1980, two-thirds were not developed as of 1980. (Housing National Committee, *op. cit.*, p 39)

and old friends usually weaken with distance when a family relocates to another residential area within Greater Khartoum.

- c) Lower-income groups, who are dependent for their livelihood on selling their services and products to middle- and higher-income groups, are vulnerable to distance. With such inflated distances they are disadvantaged and have to spend more time and money to reach their potential markets.
- d) Low residential densities result in a considerable loss of taxes on private properties, and renders the cost of services per person very high.

Ironically, this inflated pattern of growth is adopted as a model for other urban areas in the country. The same large plots, large open spaces, and wide streets are adopted all over the country regardless of local conditions. (Photographs 7, 8)

### III. THE KEY GENERATORS OF THE PROBLEM

The main factors that contribute to the housing problem in Greater Khartoum appear to be a continually shrinking public investment in housing, coupled with a wasteful use of meager resources by adopting "unrealistic" space and services standards. Excessively high space standards appear again as the key factor that leads to the sprawl of the city with all its aforementioned ramifications.

#### 1. SHRINKING PUBLIC INVESTMENT IN HOUSING

Housing *per se* does not have a high priority in the allocation of public investments vis-a-vis other agricultural and industrial development projects. This fact is best illustrated by dwindling over time of the share of the public sector in the total housing investment. From a 20% share in the Ten-Year Plan, 1960/61-1970/71, the *planned* public sector share has shrunk to 14% in the Five-Year Plan, 1971/72-1976/77, to a mere 6.3% in the first Six-Year Plan, 1977/78-1983/84.<sup>1</sup> The budget of the

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<sup>1</sup> USAID, *op. cit.*, p III 4

Department of Housing for fiscal 1985/86 is £S187,000 --sufficient for designing and building 20 houses only! The salaries of the Department's personnel for the same fiscal year is £S800,000.<sup>1</sup>

As a direct consequence, the supply of state-built housing units was reduced to insignificant numbers. For instance only 3% of the new housing units that were planned to be built within the span of the first Six-Year Plan had been planned as state-built units. Furthermore, and due to financial problems, out of a total of 5000 units planned for the span of the same plan, only 408 units were under construction in Greater Khartoum and Atbara as of 1982.<sup>2</sup> Alternatively, very little foreign money is sometimes used in financing state-built projects. In January 1985, for instance, the Department of Housing, MCPW, announced that it intends to build 200 low-cost housing units in Greater Khartoum and other provincial capitals utilizing a loan from the government of South Korea.<sup>3</sup>

Similarly, the provision of services (viz. electricity and water supply) the cost of which is borne by the government and beneficiaries at a 80:20 ratio, is usually delayed because of this shrinkage in public investment. Without the government paying its 80%-share, the two public corporations entrusted with supplying these services cannot deliver them promptly. Meanwhile, the 20%-share collected from beneficiaries once their plots are allotted to them loses its value as time elapses because of inflation. In many cases inflation adjustments had to be collected from allottees several years after service charges had been initially collected from them.

Dwindling financial resources also hamper site preparation, compaction and building of roads and pavements, digging and construction of drainage trenches, collection and disposal of solid waste entrusted with local councils.

It's not surprising, therefore, that the quantitative and qualitative needs stipulated in the previous housing plans have not been fully realized.

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<sup>1</sup> Interview with the Deputy General Manager, Department of Housing. *al-Ayam*, October 30, 1985

<sup>2</sup> Abuelzein, O. A., *op. cit.*, pp 73-74 and Table 28.

<sup>3</sup> *al-Ayam*, January 17, 1985.

## **2. LIMITED LEGAL ACCESS TO LAND**

The land leased by the government in site-and-services developments is the major source of legal land titles in Greater Khartoum. In addition to the slow pace of plots distribution caused by meager financial resources, the criteria of selection of beneficiaries for new site-and-services extensions favor big families, and families that have been residing in Greater Khartoum for 10 years or more. In effect smaller families and recent migrants are excluded and have to sacrifice on other essential expenditure in order to afford the high rents charged in the rental market, let alone the prohibitive prices of land/dwellings sold in the free market.

The only resort for the majority of these families is either to double-up with other families, or to squat on publicly-owned land in whatever squatter settlement convenient to them. "Illegal" settlements, therefore, are more than a natural consequence of this high need for housing unmatched by a deficient supply mechanism.

## **3. INEFFICIENT USE OF AVAILABLE RESOURCES**

The shrinking public investment in housing is also coupled with a wasteful use of land and money by adopting extravagant space and service standards.

### **3.1. Adoption of High Standards of Services**

Officially, first-class areas are expected to have paved roads and sidewalks, electricity and water connections to each house, storm water trenches permanently built and covered, sewers and/or septic tanks, and lighting on all streets and open spaces. Second-class areas are expected to have more-or-less the same level of services as first-class areas. Whereas third-class areas are expected to have paving on major roads only, individual electricity and water connections to each house, major storm water ditches dug and permanently built, shared septic tanks or individual pit latrines, and lighting on every street and open space. Moreover, all areas are expected to have communal garbage receptacles to be disposed off regularly by local councils.

Although these standards are chosen to match according to the incomes of the user group receiving the service, they are far beyond the financial capabilities of the majority of users. More often than not local councils and other public implementation

agencies take the burden of delivering these services without prompt recovery of their capital investments, or at extremely subsidized prices. Since these agencies themselves are handicapped by slender resources they can afford to deliver services to few areas only, while others have to wait as much as 10-20 years before they can receive any service.

### 3.2. Adoption of High Space Standards

Perpetuating the same extravagant space standards adopted in the 1940's in an urban center that has increased its population fivefold since then, while financial resources have continually been shrinking, is perhaps one of the major factors that add to the exacerbation of the housing problem in Greater Khartoum. Large residential plots, (800, 600, and 400 sq.m.), large open spaces, and wide streets once accepted as the norm are unaffordable by today's measures. The analysis of typical neighborhoods (Fig 1.4) reveals that the amount of taxable, private spaces (mainly houses) constitute only 40-57% of the total area, whereas the amount of public untaxable spaces (streets, open spaces, and government reserves) constitute 40-52%.

Moreover, within each residential plot a considerable amount of space has to be left open as stipulated by the local building regulations. Except for third-class areas and corner plots, the minimum amount of space that has to be left open is as shown in Fig 1.3. (In third-class areas the minimum width of one of the side yards could be reduced to 1.50 meters, and for corner plots the front yard could be eliminated altogether). Exceptions for these rules are included to permit the construction of subsidiary structures such as kitchens, storage spaces, toilets, etc.<sup>1</sup> In case of a 30x20 sq.m. plot, for instance, the amount of open space constitutes as much as 56% of the total plot area.

Apparently, these stipulations are intended to allow for free air circulation between buildings and to provide for the customary outdoor living and sleeping. It is equivocal, however, whether leaving such wide open spaces in such a hot-dry region is climatically desirable, especially when there are already adequate open spaces outside the plot. Outdoor sleeping and the social requirement of segregation of sexes could be

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<sup>1</sup> Khartoum Municipal Council, *Local Building Regulations*, 1958. (Arabic). Sections 45-49.

facilitated by careful layout of built-up spaces without the need for such extravagant open spaces.

Coupled with stipulations for high service standards, as those enlisted in section 3.1., these high space standards have resulted in excessively long roads to be compacted and paved, long utilities networks to be extended and maintained, and in vast open spaces to be regularly cleaned. Moreover, they have resulted in an appreciable loss of revenue that could have been generated from taxation had some open spaces been allotted for private uses.

#### 4. WASTEFUL PATTERNS OF LAND UTILIZATION: CASE STUDIES

The physical layout of streets, residential blocks, open spaces, and communal facilities follows a gridiron pattern, a pattern which persists in almost all urban areas of the country. Since this pattern generates residential blocks bounded with streets on four sides, it yields a high percentage of streets per private area served. When this percentage is combined with the percentage of land designated for open spaces, the percentage of untaxable land under public control becomes as high as 40-50% of the total area of the settlement.

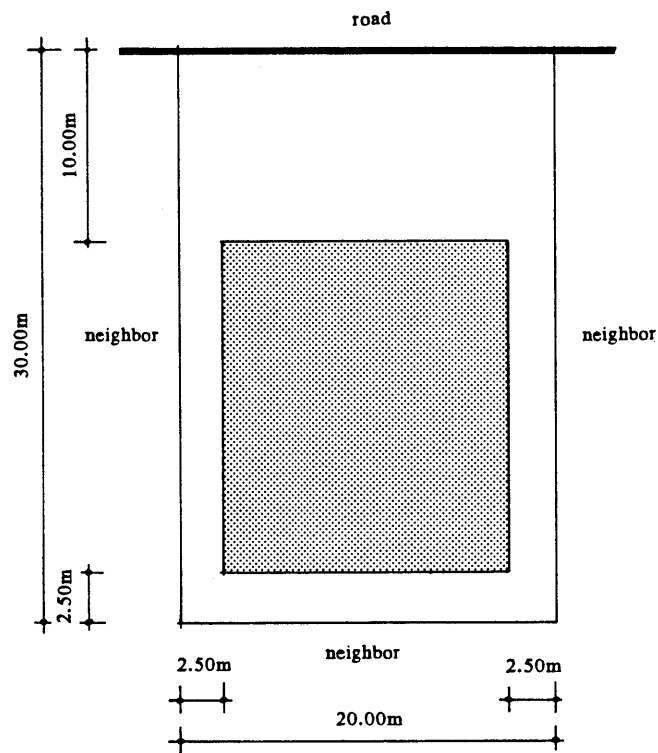
The wastefulness of this land utilization pattern is illustrated by evaluating representative neighborhoods in Greater Khartoum. Five cases are selected as case studies: al-Riyadh first-class area; al-Amarat second-class area; al-Mahdiyya al-Hara 2 third-class area; al-Deum East third-class area; and a segment from the old part of Omdurman. (See Appendix IV).

The cases are evaluated in terms of their land utilization (i.e. public/private land percentages), and their circulation networks (i.e. network/area ratio). By translating each physical layout into these indices and comparing them with "optimum" indices, a general idea about the cost-effectiveness of land utilization in each case study can be deduced. Subsequently, any appropriate remedial action can be undertaken.<sup>1</sup>

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<sup>1</sup> For a detailed illustration of this approach to evaluating urban layouts see Caminos, H. "A Method for the Evaluation of Urban Layouts". In *Industrialization Forum*, vol. 3, no. 2, December 1971. See also Caminos, H. and Goethert, R. *Urbanization Primer*, MIT Press, Cambridge, MA., 1980.





*Fig 1.3: Minimum Set-Backs Stipulated by the 1958 Building Regulations.  
(In this 30x20 m plot the permissible built-up area does not exceed  
44% of the total plot area)*

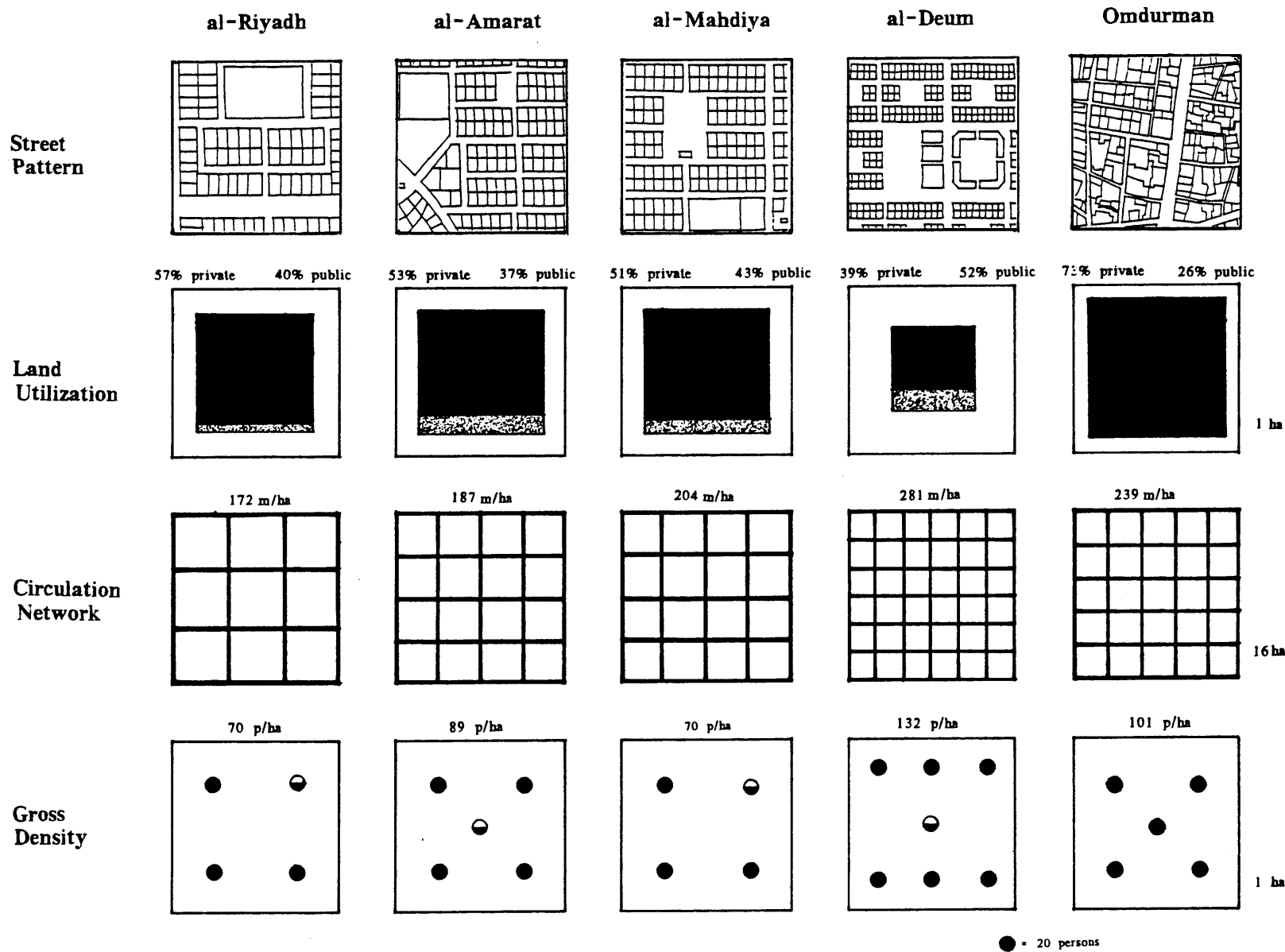


Fig 1.4: Graphic Synopsis of the Case Studies.

### Synopsis of the Case Studies

A synoptic graphic representation of the case studies is depicted in Fig 1.4. For a more detailed illustration see Appendix IV.

#### *Land Utilization*

- Except for the case of Old Omdurman which indicates 72% private land, the other four cases indicate very low percentages of land devoted to private uses (viz. dwellings). These range from 57% in al-Riyadh to a mere 39% in al-Deum East.
- Excluding Old Omdurman, the other areas indicate high percentages of public land (viz. circulation routes and open spaces). These range from 37% in al-Amarat to 52% in al-Deum. Omdurman, on the other hand indicate only 27% of public land, of which only 0.3% is open spaces. Compared to the 20-25% generally accepted as an "optimum" range for public land in urban residential areas<sup>1</sup> the wastefulness of land utilization in Greater Khartoum is evident.
- Semi-public spaces (i.e. the land devoted for communal facilities) constitute 2.5% of al-Riyadh, 11% of al-Amarat, 5.9% of al-Hara 2, 8.5% of al-Deum, and a mere 0.5% of Omdurman. This inconsistency in the distribution of communal facilities is indicative of the randomness by which facilities are provided in Greater Khartoum.
- Even if we assume a gross population density of 180 p/ha at the saturation stage of development in al-Riyadh, for instance, which has a gross density of 45 p/ha at present, experience in already consolidated neighborhoods have shown that the optimum percentage of land that will be needed for communal facilities for this kind of population density will not exceed 12% of the total area. This means that almost 1.5 hectares of the area left open in the segment under study would be redundant. This could be utilized to provide 20 additional plots of the same plot sizes currently adopted (1300-600 sq.m.), or 60 additional plots of modest areas (e.g. 250 sq.m.)

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<sup>1</sup> In an ideal land utilization pattern public land constitutes only the land devoted to circulation. Well defined, and effectively controlled open spaces are either semi-private land under community control, or semi-public land under the joint responsibility of both the community and the local authority. They will not be the no-man's land that they are in these case studies.

### *Circulation Networks*

- In any residential area, the circulation network is of particular importance because all the linear services (e.g. water and electricity networks) follow the circulation pattern --the longer is the circulation network, the higher is the urbanization cost.
- The case studies indicate long circulation networks that range from 15 km in al-Deum to 11 km in al-Riyadh. The total circulation network length is highest in al-Deum because of its smaller block width which requires a road every 30 meters. Roads on the transverse direction are also more frequent compared to the other cases (every 105-120 m.)
- More than 55% of the plots in al-Riyadh have roads on two or more sides which is a very inefficient layout. Nevertheless, the area indicates the shortest network length because of its large plots. If the plots were 400 sq.m., say, the resultant network would have been 3-4 times as long.

### *Plot Sizes*

- The average plot size ranges from 920 sq.m. in al-Riyadh to 600 in al-Amarat, to 500 in al-Hara 2, to 200 sq.m. in al-Deum, to 600 sq.m. in Old Omdurman. This variation in size is reflective of the housing classification system which provide large plots for high-income groups and small plots for low-income groups irrespective of the family sizes. case.

### *Densities*

- In all five cases, large plots, numerous open spaces, and wide streets have resulted in very low residential densities that range from 45 p/ha in al-Riyadh to 132 p/ha in al-Deum. These low densities are symptomatic of the inflated sprawl of the city; and constitute one of the major generators of the housing problem in Greater Khartoum.<sup>1</sup>

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<sup>1</sup> For an elaborate study of residential densities in Greater Khartoum refer to Elsammani, A. A., *Alternatives for Increasing Housing Densities in Khartoum with Reference to Low-Income Groups*. Unpublished M.Sc. Diss. University of Khartoum, 1984.

#### IV. SUMMARY AND CONCLUSIONS

1. The housing problem in Greater Khartoum is characterized by a high need for housing coupled with a deficient supply. The National Housing Committee, MCPW, estimates a total need for 580,000 units in the major urban centers of the country by the year 1990. Fulfilling this need requires 10% of the GNP to be devoted to the housing sector. Compared to the 5% recommended by the UN as an appropriate percentage for developing countries, and bearing in mind that only 2% of the GNP in the Sudan had been devoted to housing in previous development plans, it becomes evident that fulfilling this need within the current plan is by no means attainable.
2. The housing sector does not have a high priority in the allocation of public investments vis-a-vis the "productive sectors". This is reflected in the dwindling public investment in housing from 20% of the total housing investment in 1960-70 to a mere 6.3% in 1977-83.
3. The high demand for housing and the excessive pressure on infrastructure and services characteristic of housing in Greater Khartoum results from rapid population increase due to migration. Excessive rural-urban migration is a major topic by itself outside the scope of this study. Suffice it to say that the housing problem in Greater Khartoum is part and parcel of larger problems such as regional inequalities, unbalanced economic growth, biased policies in favor of Khartoum, etc. Unless these problems are seriously addressed at the national level the waves of human migration to Khartoum will not come to a halt.
4. The repercussions of this high need and deficient supply are manifested in high rents, high occupancy rates, and in expanding informal settlements. Although the latter has become a major source of housing for a large number of people, they are viewed by authorities as cancerous growth that have to be promptly exterminated.
5. Ironically, the scarcity of resources devoted to housing at the national level is coupled with an inefficient utilization of available resources. Land, for instance, is being wasted by adopting high space standards --viz. large plots, wide streets,

and excessively large open spaces. Whatever slender resources allocated for housing, is being underutilized by adopting high standards of services --viz. individual water and electricity connections, street lighting, and paved roads.

6. The inflated sprawl of the city created by high space standards, results in extremely low residential densities and long circulation and utilities networks, which, in turn, results in high costs of services per beneficiary. Subsidizing these costs drains the limited financial allocations of public agencies, and leads to a slow-down of new developments.

## V. TACKLING THE HOUSING PROBLEM

The preceding analysis has shown that the housing situation in Greater Khartoum is in a state of crisis. The demand for housing is so high and the supply of land titles and dwelling units is so deficient that "illegal" settlements are growing by leaps and pounds. Public agencies are too short of resources to meet the demand for their services. And the Conurbation is sprawling beyond the limits dictated by the economics of urban services.

Although the task of tackling this problem may seem formidable, it is by no means insurmountable. There are few possible measures that could be taken to improve the situation. In this study two such measures are investigated;

- i) Capturing underutilized public spaces (i.e. streets and open spaces) in order to maximize the benefits out of land and existing service networks. (See Chapter Two).
- ii) Developing land planning indices and guidelines tailored to the limited resources available for housing in this context. (See Chapter Three).

Both measures are directed towards improving the land utilization pattern in Greater Khartoum. They seek to rationalize the use of land by limiting unjustified sprawl, and inducing the range of population densities that ensures economic servicing of urban land.

These two measures are not inclusive. In fact land utilization is the most crucial aspect of a complex housing process. In effect, the present study needs to be supplemented by further research on other aspects such as housing finance, building materials and construction techniques, appropriate infrastructure provision, etc.

The main premise of the approach investigated in this study is that rational land utilization eliminates unjustified waste and produces more manageable and serviceable housing developments.

This approach is rather simple (not simplistic). It requires neither additional investments, nor new bureaucratic set ups. It resembles a "least effort" approach that reduces the task of public agencies to merely supplying serviced land, and requires them to be more rational in allocating this valuable resource.

The second measure --viz. the land planning guidelines-- suggests elements of a framework for land utilization that enable the housing agency to control land prices and to preempt "illegal" land developments by subdividing large areas of lands at minimum initial services when needed. Thus subsequent phases of development can be undertaken in a more orderly and less costly manner. The subsequent parts of this study elaborates on these two approaches to the problem.

CHAPTER TWO  
A STRATEGY FOR REMEDIAL ACTION IN  
EXISTING RESIDENTIAL AREAS

CASE STUDY: AL-DEUM EAST

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## I. INTRODUCTION

This chapter illustrates a strategy for remedial action in existing residential areas which are wasteful in their land utilization. Further evaluation of a case study, al-Deum East, is undertaken to identify the extent of the "problem" and the possible tracks for intervention. The strategy is illustrated in terms of its objectives, implications, and implementation process.

*Al-Deum East* represents an interesting case that merits further evaluation for the following considerations.

- 1) It is a typical example of third-class areas supposedly accessible to the majority of middle- and low-income groups in Greater Khartoum. Furthermore, it has the plot sizes and population densities that are most likely to prevail in the future. Therefore a detailed evaluation will shed some light on the kind of issues that one has to deal with in planning residential areas in the future.
- 2) It has the highest percentage of land wasted in the form of excessive public land (52%), consequently, the lowest percentage of private land (39%).
- 3) It has the longest circulation network (281 m/ha). Therefore, the most costly services and utilities networks.
- 4) It covers a larger area (285 hectares), therefore any remedial action will have a larger impact.



## II. FURTHER EVALUATION

For further evaluation, land utilization in a typical segment in al-Deum will be compared to land utilization in a reference layout that has the same design parameters, and a more cost-effective utilization of land.

### 1. EXISTING LAYOUT

A 400x400 m segment representative of the land utilization pattern in the area was selected (Fig 2.1). This is a workable size which could house up to 3500 persons using the same plot size, plot coverage and a more efficient land utilization. It is, therefore, a size of a small "neighborhood" that could support a school, shopping facilities, playgrounds, etc., all within walking distances from the dwellings.

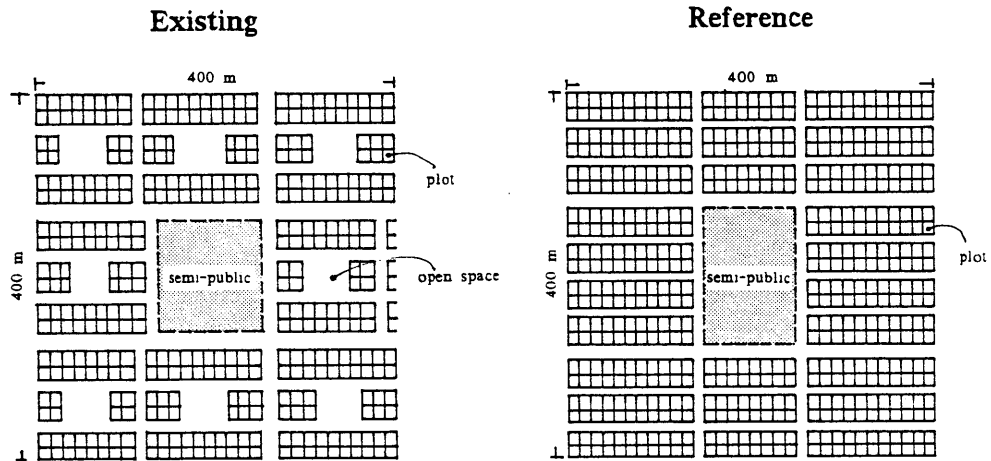
Land utilization percentages (public/private land percentages) for this segment was then calculated. Since the small open spaces within the residential clusters are publicly owned and can be unrestrictedly used by everybody, they were calculated, together with the streets as public land; the large open space was calculated as semi-public land for communal facilities; and all residential plots were calculated as private land.

The circulation network length per area served was calculated by simply adding the street lengths together and dividing by 16 hectares, the area of the segment. Only one-half the length of the peripheral streets was counted because they serve the adjoining areas as well.

### 2. REFERENCE LAYOUT

For comparison, an equivalent 400x400 m reference layout was developed by optimizing the semi-public land and the circulation network (Fig 2.1). The bias of this layout is towards minimizing the land under public agencies' responsibility (i.e. public spaces). This is necessitated by the fact that public agencies are generally crippled by insufficient financial and technical resources. Therefore devoting more land for private uses will serve the dual purpose of creating more housing, and of reducing the burdensome responsibilities of public agencies.

Fig 2.1: Comparison between Existing and Reference Layouts.



*Land Utilization*

total area	16 ha	(100%)	16 ha	(100%)
public areas	7.0 ha	(43.7%)	4.5 ha	(28%)
private areas	7.5 ha	(46.9%)	9.9ha	(62%)
semi-public areas	1.5 ha	(9.4%)	1.6 ha	(10%)

*Circulation Network*

total length of streets	5360 meters	4888meters
unit circulation length	335 m/ha	308m/ha

*Residential Plots*

plot number	372 plots	496 plots
average area	200 sq.m. (13.3x15 m)	200 sq.m. (13.3x15 m)

*Population Density*

total population	2418 person (6.5 p/family)	3224 person (6.5 p/family)
gross density	151 p/ha	202 p/ha
net density	323 p/ha	325 p/ha

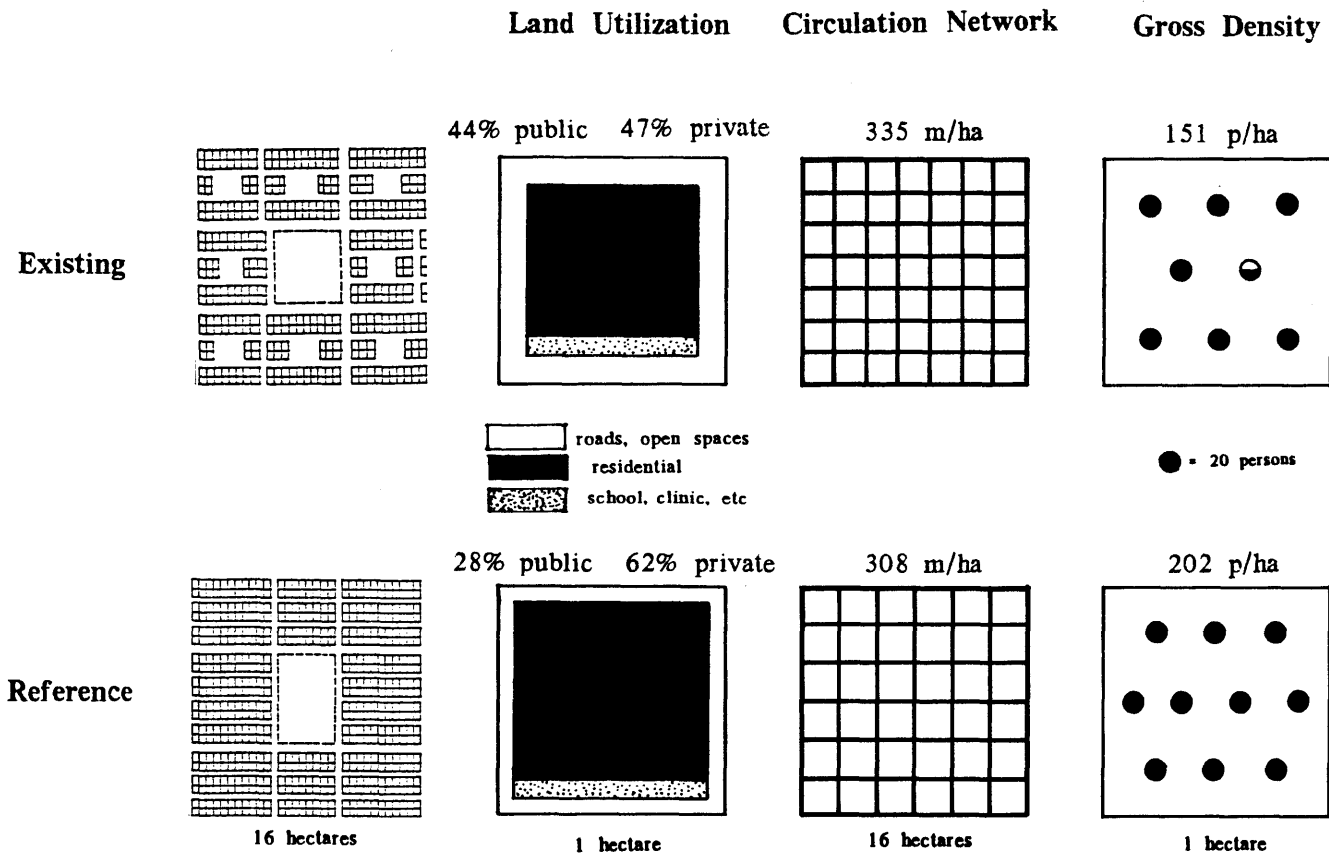


Fig 2.2: Graphic Comparison between Existing and Reference Layouts.

The same plot size and proportions (15x13.3 m.), and the same population density (325 p/ha) were used in the reference layout to give comparable results. Interior streets were taken as 10 m., and main streets as 15 m. in width. Compared to 12, and 20 m., respectively, in the existing layout.

An optimum amount of land for communal facilities for this area and density was determined to be 9-10%.<sup>1</sup> This compares favorably with areas for semi-public uses found in consolidated neighborhoods such as al-Mahdiyya al-Hara 2. Accordingly, communal facilities, including open spaces, can be incorporated within the larger open space which constitutes 9.4% of the total area of the segment. (For al-Deum as a whole, a more precise determination of the overall need for communal facilities and open spaces will indicate the amount of redundancy in these large open spaces). Accordingly, all the smaller open spaces are redundant and can be eliminated without affecting the required percentage of semi-public areas. The area gained by their elimination was used in the reference layout to expand the private spaces.

The reference layout is optimum in its land utilization and circulation network for this population density and plot proportions (1:1). Any change in either of these parameters will affect the reference layout. For the higher is the density, the more land is needed for communal facilities; and the more rectangular are the lots the shorter is the circulation network.

### 3. COMPARISON AND CONCLUSIONS

Comparison of the two layouts was done in purely geometric terms without considering other qualitative aspects. The geometric pattern, obviously, have an immediate impact on the overall cost of the development. Also, by virtue of its relative permanence, the geometric pattern will continue to impact the overall performance of the residential area long after other aspects have changed.

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<sup>1</sup> According to the indices developed in Chapter Three an optimum area for communal facilities for this area and population density is 14-15% of the total area. However, since the segment is part of a larger consolidated area many communal facilities in the vicinity are also used by people residing within the boundaries of the segment. Hence the area for communal facilities could be reduced to 9-10%.

The comparison between the two layouts in terms of their land utilization and circulation networks shown in Fig 2.2. indicates the following.

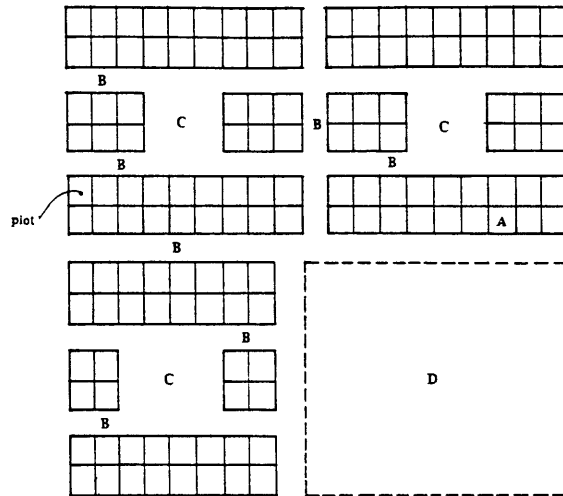
- 1) The percentage of private land has increased from 47% in the existing layout to 62% in the reference layout producing 33% more plots.
- 2) The percentage of public land has decreased from 44% in the existing layout to 28% in the reference layout.
- 3) The total circulation network has been reduced by 9%. This reduction is not substantial because of the 1:1 plot proportions. It will be illustrated later in this study that appreciable reductions in the circulation and utilities networks could have been achieved by varying the plot proportions to more rectangular proportions (e.g. 1:2, 1:3, etc.).

The comparison also indicates that there is room for improving the land utilization in the existing layout. Although the gridiron pattern and the circulation network are extremely difficult to change, some improvement can be achieved by converting segments of the existing streets into private and semi-private spaces. On the other hand, substantial improvement can be achieved by filling all or parts of the redundant open spaces with residential plots and other compatible uses.

### III. A STRATEGY FOR REMEDIAL ACTION

By virtue of their excessive size and number, the small open spaces within the residential clusters (type (C) in Fig 2.3) seem to be the most appropriate area where remedial action can be most effective. The logical steps for such intervention entails: a) identifying the existing sizes and utilizations of these open spaces; b) assessing the "real" need for open spaces at this level; c) identifying alternative land use options for the redundant area and the implications of each option; and d) devising a viable implementation strategy.

Fig 2.3: Open Space Utilization in al-Deum



Space	User-Groups	Activity	Time
A	M 2-6 yrs.	playing	○ ●
	F 2-70 yrs.	chatting, playing, etc.	○ ● ●
B	M 6-11 yrs.	soccer, etc.	○ ●
	M 15-70 yrs.	outdoor sitting	● ●
	M/F 7-60 yrs.	parties, ceremonies, etc.	● ●
C	M 11-16 yrs.	soccer, volleyball, etc.	○ ●
	M/F 10-60 yrs.	parties, ceremonies, etc.	● ●
	M 15-70 yrs.	collective praying	●
D	M 16-30 yrs.	sports, etc.	●
	M/F 10-60 yrs.	communal events	● ●

KEY: ○ morning      ● afternoon      ● night  
M: males      F: females

## 1. TYPE AND UTILIZATION OF OPEN SPACES IN AL-DEUM EAST

Open spaces within al-Deum East can be grouped into four categories (Fig 2.3); open spaces within each residential plot (type A); lanes and residential streets (type B); small open spaces for every 40-52 families (type C); and large open spaces (type D).

Cursory site observations indicate that the most common utilizations of type (C) open spaces are:

- 1) Playgrounds for 11-16 years old boys (mainly for soccer and volleyball games). 5-11 years old boys usually play inside or in close proximity of their homes (i.e. in open spaces type A and B); more mature men play in the larger open spaces outside the residential quarters (i.e. type D).
- 2) Areas for informal leisure gatherings for men. More typically though, such gatherings are performed either on the street immediately in front of the house, or in front of "corner" shops.
- 3) For ceremonial gatherings, where a 15-30 sq.m. structure of steel pipes and canvas is temporarily erected for the reception of guests. However, only families that are close enough to the open space usually use it for this purpose. The portion of the street directly in front of the house is a more convenient alternative for other families.
- 4) In very few cases a 15-20 sq.m. room has been erected as a prayer space (*zawiah*) or for a cooperative shop.
- 5) Some spaces are used for night and dawn prayers by elderly men who cannot walk to the mosque.. A prayer mat has to be brought in and out from adjacent houses each time prayers are performed.
- 6) Due to the inability of public agencies to provide periodic cleaning, some spaces have become dumping grounds for old cars, solid waste, etc.

## 2. EXISTING VS. APPROPRIATE SIZE OF TYPE (C) OPEN SPACES

From the previous exploration of the different uses of type (C) open spaces, it is evident that youngsters playing is the main function that govern the size of the open space. The other functions are less frequent such that open spaces designed as play areas could be transformed to accommodate other functions. The question then is what size of open space will accommodate these functions?

The population pyramid for Khartoum derived from the 1973 census indicates that boys within the 11-16 years age-group constitute 5%-6% of the population.<sup>1</sup> Therefore in an average cluster of 48 families in al-Deum, the number of children in this age-group will be around 20 children. In an extreme case when all of them participate at the same time in, say, a soccer game, a three-team tournament is likely to be organized. Judging by direct observation, 600-700 sq.m. will be a reasonable size for a play area to accommodate this number of children for this type of game. This size could easily accommodate a standard 18x9 volleyball field, or any ceremonial gathering. If a 25 sq.m. shelter is added to this space as a prayer/coop space, an optimum area for such open space will be 625-725 sq.m.

At present open spaces type (C) in al-Deum are either 2160 or 2860 sq.m. This represents a redundancy of 1430-2130 sq.m. of valuable urban land in each cluster already served with services and utilities. Around 120 of such spaces exist in al-Deum alone and innumerable similar spaces exist in other neighborhoods. This state of affairs partly explains the inflated sprawl of Greater Khartoum, a prominent feature of housing in the city.

## 3. A PROPOSAL FOR INFILL HOUSING

The high need for additional dwelling units in Greater Khartoum and the availability of yet enough reserved land for communal facilities in al-Deum, suggest that these redundant open spaces be subdivided into residential plots. The following exploration illustrates the viability of this proposal.

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<sup>1</sup> El-Bushra, E., *An Atlas of Khartoum Conurbation*. Khartoum University Press, 1976, p 82



**a) Objectives**

1. To provide additional residential plots, earnestly needed in Greater Khartoum.
2. To increase dwellers control over the direct dwelling environment by creating controllable semi-private spaces collectively managed by the families flanking them.
3. To enforce the sense of community by bringing people together to negotiate the number and layout of the additional housing units to be plugged into their clusters; hence increasing the chances of local acceptance and participation in the proposal.
4. To reduce the amount of redundant open spaces under public control; hence reducing the burdensome obligations of crippled public agencies.
5. To amend the layout of clusters such that through traffic within the residential quarters is eliminated. In effect main streets which act as conduits for through traffic are differentiated from residential streets which give direct access to more private areas.

**b) Layouts**

As stated above, amendment of cluster layouts, including the incorporation of additional units, should be determined by the residents of each cluster. However, the following guidelines are provided as minimum rules.

1. Entrances to the interior of the cluster should be restricted to three meters so as to discourage through vehicular traffic. The resulting saving in land could be sold/leased out to the adjoining families. A two-meter right-of-way over existing water pipes should always be maintained for easy access by the operating agency. The implications of this requirement on the allocation of the recaptured areas could be worked out between families.
2. If a continuous passage through the cluster is locally undesirable, a wall or a gate could be erected to block the passage, thus enhancing the private nature of interior spaces. Already established pedestrian routes should be preserved as far as possible.

3. For a more cost-effective layout, additional plots could have an average frontage of 10-12 meters, and a depth that vary between 20-25 meters.

**c) Implementation Strategy**

The implementation strategy suggested for this proposal has three components:

**1. Community Participation.**

This infill housing proposal is not only a physical intervention, it's underlying objective is to increase community participation in the control of neighborhoods. It is believed that operations such as solid waste collection and disposal, minor maintenance of infrastructure, landscaping and beautification of residential quarters could be handled more efficiently by the residents.

To achieve this underlying goal, it is imperative to involve the residents in the process from its inception. Decisions pertaining to the subdivision of open spaces in each cluster should be taken collectively by the residents with the help of a professional who advises them on technical issues such as the capacity of the existing infrastructure, right-of-way, etc.

To speed up and enrich the decision-making process, few preliminary layouts could be prepared beforehand by the Housing Department for review by the residents. (Few alternative layouts are depicted in Fig 2.4. to simulate scenarios that might result from this process). It is hoped that the monotony created by the existing repetitive physical pattern and by lack of effective local control of neighborhoods will be reduced by the variety of configurations that results from this process.

Although this process is elaborate and tedious when compared to the centralized decision-making process currently adopted, it is nevertheless worthwhile because it ensures that community energies will be channelled in upgrading and maintaining their neighborhoods, whereas the limited resources of public agencies can be focused in expanding and improving services in the whole city.

**2. Plot Allocation.**

Additional plots could be leased out to people from the waiting lists of the Lands Department. However, priority should be given to eligible families who are currently residing within the same area (preferably within the same cluster). This will comply

with the natural tendency of people to agglomerate close to their relatives and old neighbors.<sup>1</sup>

In order to enforce local control of the dwelling environments, semi-private areas could be leased out to the residents of each cluster at marginal charges that cover the administrative costs incurred. The legal aspects of this collective form of ownership, which is new to the context of Greater Khartoum, has to be worked out beforehand to eliminate any territorial ambiguities that might result in conflicts or negligence.

### 3. Finance.

Part of the revenue generated from the sale/lease of the recaptured land could be used in augmenting the services in al-Deum. The remainder could be added to the funds allocated by the city for provision and improvement of services in other areas.

## IV. CONCLUSION

The infill housing proposal illustrated in this section will provide an opportunity for the city to test the feasibility of capturing underutilized lands in other areas. Capitalizing on such redundant open spaces will make a substantial contribution to fulfilling the housing need in the city.

The next step is to capitalize on the "left over" spaces between existing neighborhoods before embarking to urbanize remote areas such as al-Shigla, Abu Adam, etc. designated for urbanization in the new housing plan. Such remote areas are extremely expensive to urbanize given the present meager financial resources available to the city. Therefore their urbanization should not be attempted before all vacant and underutilized lands have been exhausted. The guidelines for planning such "left over" spaces and new residential areas will be the subject of the next paper.

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<sup>1</sup> A social study of a squatter settlement east of al-Haj Yusuf, Khartoum North, revealed that squatters settle around relatives and old neighbors in their villages/towns such that in few years whole sections of villages are replicated in the squatter settlement. ( *al-Sahafa*, January 18, 1985)

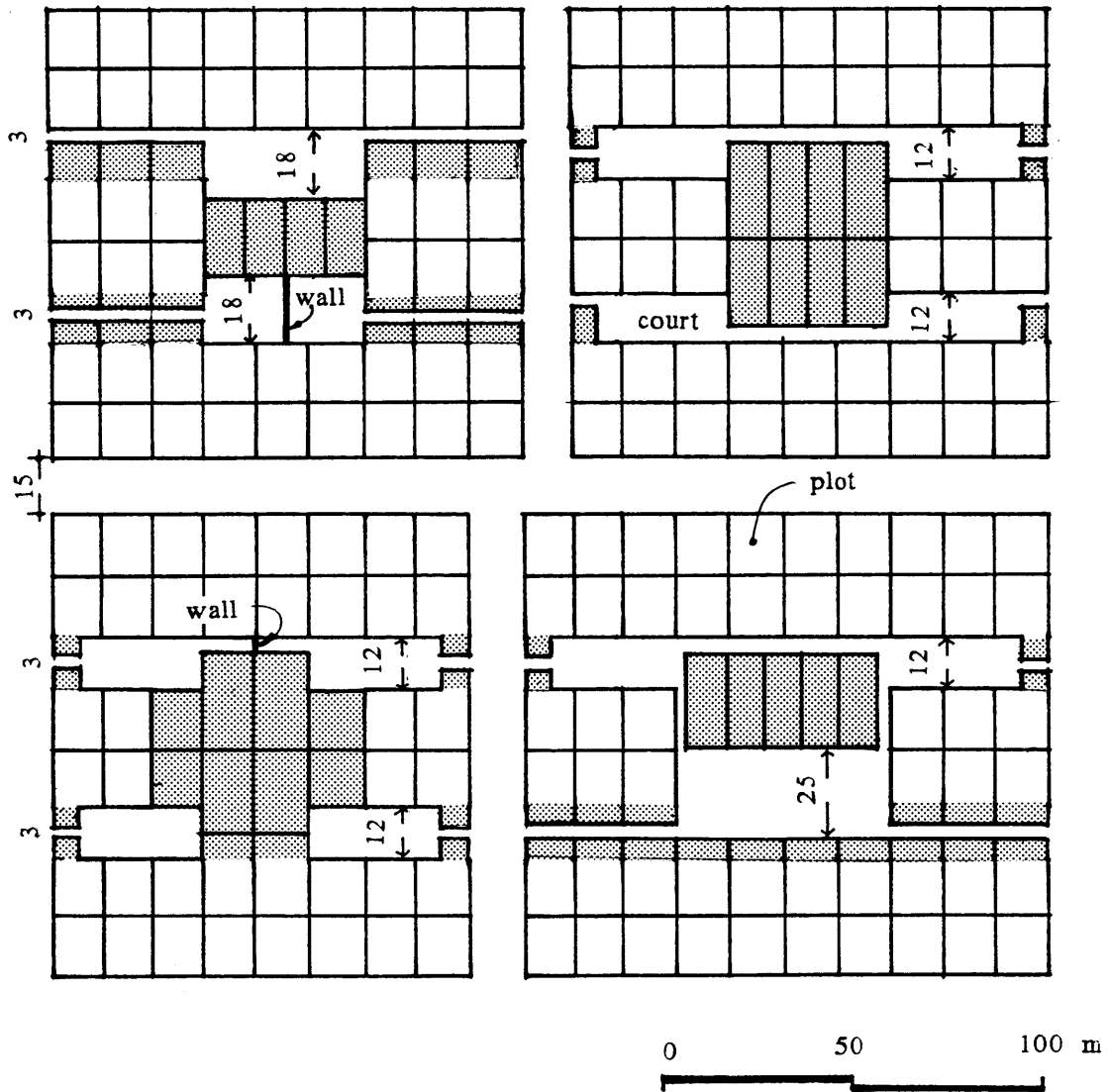


Fig 2.4: Alternative Layouts for Filling the "Voids" in al-Deum.  
 (shaded areas represent proposed additions)

CHAPTER THREE  
LAND PLANNING GUIDELINES FOR  
NEW RESIDENTIAL AREAS

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I. INTRODUCTION

This chapter presents a set of land planning guidelines and indices developed to guide the planning of new residential areas in Greater Khartoum. The indices should be viewed as reference quantities to be referred to in making decisions about appropriate space and facilities provision. They are neither "hard" standards nor requirements that have to be uniformly enforced across the board.

The indices and guidelines pertain to the following aspects.

- 1) Plot sizes and proportions.
- 2) Block sizes and configurations.
- 3) Circulation networks.
- 4) Open spaces.
- 5) Communal Facilities.

The chapter culminates with a reference table that relates the site area and the plot sizes adopted with the resultant population and plot numbers, population densities, and land utilization percentages. A model layout is appended to illustrate how the guidelines may be interpreted into a physical layout.

**Rationale**

In the absence of sufficient resources of any kind and at any level, the opportunity cost of using available resources becomes so high that any misappropriation is intolerable, and places a heavy burden on the society at large to replace it. In the housing field this is particularly true for land, an indispensable resource that exists in fixed, irreplaceable quantities. Planners and policy makers are faced with the challenge of rationalizing the use of land, and of ensuring an equitable access by all sectors of the population.

The preceding parts of this study have demonstrated how land, is underutilized and wasted in the Khartoum Conurbation due to an imbalance between the area provided for dwelling on one hand, and the area provided for circulation and communal facilities, on the other. This state of affairs is due to a large extent to:

- a) A lack of understanding of and agreement on what constitutes a "good" habitable environment. This is best illustrated by the obvious dichotomy between land utilization in extant traditional neighborhoods, and in contemporary ones. Contemporary neighborhoods, the products of planned public interventions, are characterized by wide roads, vast open spaces, and large areas for communal facilities. On the other hand, traditional built environments, the products of individual piecemeal interventions, are characterized by narrow streets, few open spaces, and relatively smaller areas for communal facilities.

It could be argued that the products of the latter process are more efficient in their land utilization, more adapted to the harsh climate, and more suited to the limited financial resources available to individuals and public agencies.

- b) A lack of land utilization norms and guidelines to direct the planning process of large-scale interventions. Such guidelines would ensure a more cost-effective utilization of land; and would cater for the socio-economic status and aspirations of the people for whom they are intended.
- c) Inflated projections of population densities that result in allocating vast areas for communal facilities and other future uses. Absence of periodic monitoring of residential growth impedes the assessment of these projections at a later stage and, consequently, the reallocation of reserved land.

It should be emphasized that efficient land utilization alone does not ensure the creation of cohesive environments for living. It's significance, however, stems from the fact that efficiency of utilization relieves the society of unjustified overburdens, and ensures that land will not be haphazardly wasted. Other prerequisites for a cohesive living environment are a coherent relationship between the physical layout, the users, and the legal structure. The physical layout should facilitate clear definition of spaces and territories as domains of control, and consequently provide physical elements and configurations that facilitate the confinement and adaptability of the space for its

intended use. Users of the space and other concerned parties should be conscious about their responsibilities and liabilities towards the use and control of their domains, and should be provided with the legal measures that facilitate this control.

### **Objectives**

The objectives of land planning indices and guidelines are threefold:

First, to establish a framework for land subdivision that enables the housing agency to intervene promptly when demand exists. The agency should assume the responsibility of surveying the land and designating the various land uses. Subsequent provision and upgrading of services can thus be undertaken more efficiently. Since it lies within the domain of technicians, this physical intervention can be implemented quickly while other legal and financial aspects are being settled.

Second, to provide functional guides pertaining to the size and location of special elements, such as schools, playgrounds, parks, etc.

Third, to provide indices of land utilization appropriate for each population density and site area. These could serve as benchmarks against which alternative layouts are evaluated.

### **Approach and Method**

Land planning guidelines should not be universal. They should, rather, be tailored to the physical environment and the cultural milieu that dictate the pattern of living and space utilization. Since socio-economic circumstances differ from one country to another, blind transfer of norms and guidelines either vertically or horizontally between countries is inappropriate, and often very harmful.

The set of guidelines developed here are derived mainly from functional requirements and from local practice through the evaluation of extant neighborhoods. Thus, they are a codification of a long tradition of housing in Greater Khartoum modified by problems gaining more prominence (e.g. the rising costs of urban services). The overriding concern here is to strike a balance between efficiency issues and the social and human aspects of habitation.

The indices suggested in the following sections are not requirements that have to be rigorously satisfied. They are, rather, functional guides to be referred to while decisions about appropriate provisions are being made. As far as possible a *range* of quantities is suggested. This leaves room for designers to apply their own judgement to satisfy the specific requirements of the site in question. Excessive variations from the indices should be justifiable.

It is imperative that these indices and guidelines are *temporal* in nature. The impacts of the guidelines has to be assessed periodically and any necessary adjustments has to be made so as to cope with changes in the socio-economic and technological levels. "They should be tools, kept in constant repair; not works of art that must not be touched".<sup>1</sup>

## II. THE INDICES AND GUIDELINES

### 1. PLOT SIZES

Plot sizes in Greater Khartoum have received a great deal of controversy and attention by many planners and scholars. Unanimously they have concluded that the adopted *minimum* plot sizes (300, 400, and 800 sq.m. for third-, second-, and first-class areas respectively) are excessively larger than what is actually needed for habitation; and excessively costly for the city to provide at the current subsidized prices. A succession of recommendations to reduce plot sizes were made; some based on family income;<sup>2</sup> others based on the family size within one income group;<sup>3</sup> others combining both the

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<sup>1</sup> Mabogunje et. al., *SCOPE 11, Shelter Provision in Developing Countries, the Influence of Standards and Criteria*, John Wiley and Sons, 1976, p 81.

<sup>2</sup> Doxiadis Associates, *Khartoum, a Long-Term Program and Master Plan for the Town, 1960* cited in Hafazalla, A/H. A. *Housing and its Division into Different Classes*. Unpublished M.Sc. Diss. University of Khartoum, 1983. See also Doxiadis Associates, *"The Size and Shape of Urban Plots"*, prepared for the Government of Sudan, Ministry of Local Government. *Ekistics*, vol 9:54, April 1960.

<sup>3</sup> Elias, B.O., *Space Standards in Low-Cost Housing Areas*. Unpublished Ph.D. Diss. University of Edingburgh, 1970 cited in Hafazalla, A/H. A. *op. cit.*



family income and family size;<sup>1</sup> and finally the recommendations of the Housing National Committee, MCPW, to restrict the *maximum* plot size to 200 sq.m. in third- and fourth-class areas, and to 300 sq.m. in first- and second-class areas.<sup>2</sup>

Whatever reasons might have impeded the implementation of previous recommendations, the consensus among them regarding the reduction of plot sizes is strikingly evident. There are reasons however, to believe that new recommendations have more chances of success. First, there is the growing momentum for administrative and legislative changes that followed the change of political structure in April 1985; and second, the increased public awareness of the problems created by urban sprawl.

*Recommendations*

Although the Committee's recommendations regarding plot sizes might seem reasonable, they fail to provide options of smaller and larger plots for families that might prefer to have them. Although standard plots are easy to subdivide and manage, they don't match the heterogeneity of family sizes and incomes. It seems more logical to have an assortment of plot sizes that cater for a wider spectrum of family incomes and sizes.

Alternatively, it is recommended that the following model for plot sizes be adopted.

	1st & 2nd-class (sq.m.)	3rd & 4th-class (sq.m.)	Plot Frontage (m.)
small plots	240	210	10, 12
average plots	300	240	10, 12,
large plots	360	300	10, 12, 15

*Table 3.1: Recommended Plot Sizes*

<sup>1</sup> Department of Housing, Ministry of People's Local Government *op. cit.* Table 8.

<sup>2</sup> Housing National Committee, MCPW. *op. cit.* Table 3.6.1

The selection of these sizes was made to allow for options of 10-, 12-, and 15-meter plot frontages. Thus more than six plot options of varying sizes and proportions are made available in each class area. Larger plots may be provided for commercial uses and should be charged at the market rates.

Precedents for "small" plots already exist in the Conurbation. The average plot size in al-Deum East, Khartoum, for instance, is 200 sq.m. whereas the average family size is 6.5 (slightly higher than the city average of 6.3 person/family). Another precedent is al-Sha'biyya, Khartoum North, where the average plot size is 280 sq.m. for an average family size of 7.7.<sup>1</sup>

## 2. PLOT PROPORTIONS

Plot proportions directly affect the efficiency of land subdivision and the circulation and utilities networks needed to serve each plot. In general, rectangular plots are more cost-effective than squarish ones. However, there should be a compromise between cost-effectiveness and the cultural perception of a home. If it is socially unacceptable to have "narrow" plots (e.g., less than 10 m in width) it is advisable not to impose them in pursuit of cost-effectiveness.

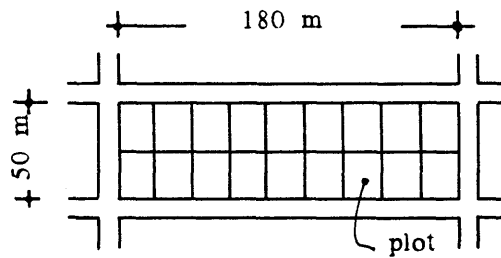
### Plot Frontage

The plot frontage is the most crucial parameter in the urban layout. Consider for instance, a block of 180x50 meters surrounded by 10-meter roads on four sides (Fig 3.1).

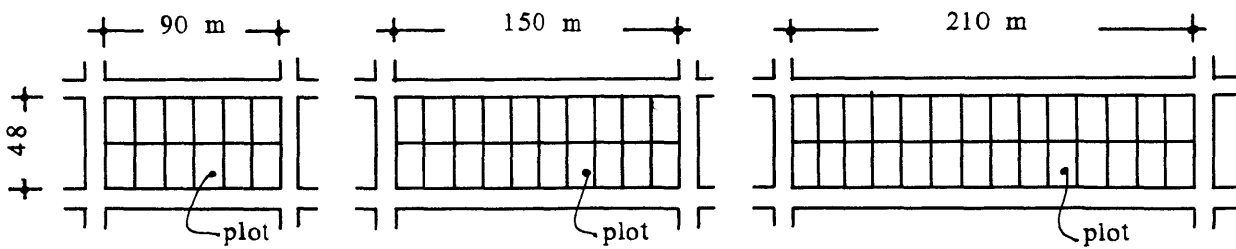
If the block is subdivided into equal plots using 10, 12, 15, 20, 25, and 30 meter plot frontages (W); and the same plot depth (D) of 25 meters, the resultant plot numbers unit circulation length (UCL) per plot will be as tabulated in Table 3.2.

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<sup>1</sup> Government of the Sudan, Department of Statistics, *Preliminary Results of the Third Population Census, 1983*, October 1983



*Fig 3.1: A 180x50 m Urban Block.*



*Fig 3.2: Three Urban Blocks.*

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frontage (W)	10	12	15	20	25	30
depth (D)	25	25	25	25	25	25
area (sq.m.)	250	300	375	500	625	750
W/D	0.4	0.5	0.6	0.8	1.0	1.2
plots (no.)	36	30	24	18	14	12
UCL (m/plot)	6.9	8.3	10.4	13.8	17.9	20.8

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*Table 3.2: Effect of Varying the Plot Proportions*

### Corollaries

The table asserts the following rudimentary rules.

- a) The smaller is the plot frontage, the larger is the number of plots obtained.
- b) The smaller is the frontage/depth ratio (W/D), the smaller is the unit circulation length needed to serve each plot.

### Recommendations

- a) An average plot frontage of 12 meters is recommended for all class areas. This is a reasonable width that facilitates provision of at least two separate courtyards for outdoor sleeping (a customary requirement in Sudanese houses).
- b) A minimum of 10 meter frontages could be used for interior and smaller plots without sacrificing too much of the functional requirements. 15 meters could be adopted as a maximum frontage for plots with a higher commercial potential, such as corner plots and plots flanking major streets.
- c) Plot pricing and the initial cost of services per plot could be based on the plot frontage and the plot area rather than on the area alone. Therefore for the same plot area the narrower is the frontage the cheaper is the plot. Narrower plots thus become more affordable and desirable. Hopefully, more cost-effective land subdivisions will result from adopting such "narrow" plots.

- d) Building regulations that postulate open spaces all around the built up area inside the plot should be amended to permit utilization of boundary walls as space enclosures. This is more in accordance with the way of building in traditional neighborhoods influenced by local customs and Islamic law. Considerable savings in land and construction costs could be achieved this way. The decision of which portion of a shared wall might be used by a neighbor should be left entirely to the concerned families to settle, rather than being prescribed in the building regulations.

### 3. BLOCK SIZE

The size and shape of the block have considerable bearing on the cost-effectiveness of the urban layout. Consider for instance, three blocks of dimensions 90x48 m., 150x48 m., and 210x48 m., surrounded on all sides by 10-meter roads (Fig 3.2). If each block is subdivided using equal plots of 15x24 m., the unit circulation length (UCL) per plot will be as tabulated in Table 3.3.

block length (m.)	90	150	180
block width (m.)	48	48	48
plots (no.)	12	20	28
UCL/plot (m.)	13.2	10.9	9.9
UCL/ha (m.)	272	234	214

*Table 3.3: Effect of Varying the Block Length*

#### Corollaries

The table asserts the following rudimentary rules.

- a) The longer is the block, the smaller is the circulation per plot ratio. Hence less streets and utilities networks are required to serve each plot. The same is also true if the block length is kept constant and the block width is varied --the wider is the block, the less network is needed per plot.

- b) Generally speaking, the larger is the block, the more cost-effective is the urban layout. (Compare for instance, the UCL for al-Riyadh and al-Deum shown in Fig 1.4).

#### *Recommendations*

- a) The choice of block dimensions should be a compromise between efficiency and convenience of pedestrian circulation within the site. From the point of view of the pedestrian, smaller blocks allow for more "short-cuts" and convenience of maneuver.
- b) It is recommended that the block length be within the 150–200 meter range. For an average block of 200x50 m, the walking distance between the farthest houses will not be more than four minutes assuming an average speed of four km/hr.

### **3. BLOCK CONFIGURATION**

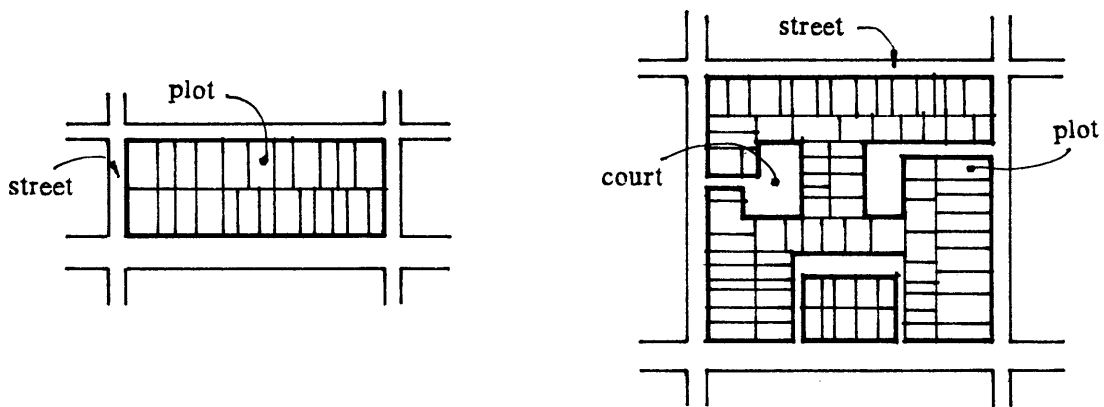
Generically, blocks can be grouped into two categories; a) gridiron blocks; and b) grid blocks. Gridiron blocks facilitate unrestricted traffic through the site, whereas grid blocks facilitate limited traffic within the block. (Fig. 3.3)

From the preceding exploration of block dimensions and their impact on the UCL per plot, grid blocks are more cost-effective than gridiron blocks because they have less street network per plot. Furthermore they facilitate more control of the direct dwelling environment by the adjoining families since they exclude unwanted traffic and trespassers.

#### *Recommendations*

- a) It is recommended that grid blocks be adopted as a module for land subdivision. Access to the block interior should allow for limited vehicular access. The interior of the block could be widened to create a "court" that facilitates communal interaction. Functions directly related to the dwellings (e.g. children playing, outdoor sitting, parties, etc.) can take place on the "court".

Fig 3.3: Grid vs. Gridiron Blocks



*Gridiron Blocks*

- . unrestricted traffic around the block precludes residents' control of residential quarters.
- . more streets per unit of private area.

*Grid Blocks*

- . limited traffic within the block facilitates residents' control of residential quarters.
- . less streets per unit of private area.

## 5. CIRCULATION NETWORK

The circulation network is the most important element in the urban layout. Decisions pertaining to the circulation network determine the land values, the layout and cost of utilities, the points of interest, the transportation routes, etc. It is also one of the components on which land is usually wasted. This is particularly true in Greater Khartoum where streets range in width from 10 to 40 meters despite the low car ownership and the harsh climatic conditions.

The circulation network in a residential extension will be dictated considerably by the network in the surrounding areas. Whereas in a new outlying area it can be independently designed. The following considerations should be kept in mind when designing the circulation network.

- a) The network should be simple enough to facilitate orientation within the site.
- b) It should have a clear hierarchical order with few thoroughfares as centers of attraction and commercial activities, and more frequent minor streets and pedestrian walkways.
- c) The distinction between "lines of transit" (i.e. conduits of through traffic within the site), and "lines of access" (i.e. access routes to residential quarters) should be carefully considered in order to restrict unwanted vehicular traffic within the residential estates.

Primarily, the circulation space is public property (although some streets could be privately owned). The responsibility of upkeeping streets and public walkways resides with public agencies. In order to preserve land and to reduce development and maintenance costs, *it is advisable to limit the percentage of land devoted to circulation in normal site conditions to 20%-25% of the total area.* If the site is swampy or hilly the percentage could be increased accordingly.

There are four levels of hierarchy of circulation routes that vary in function, width, and construction: a) Major streets; b) Minor streets; c) Pedestrian walkways; and d) Residential courts (Fig 3.4).



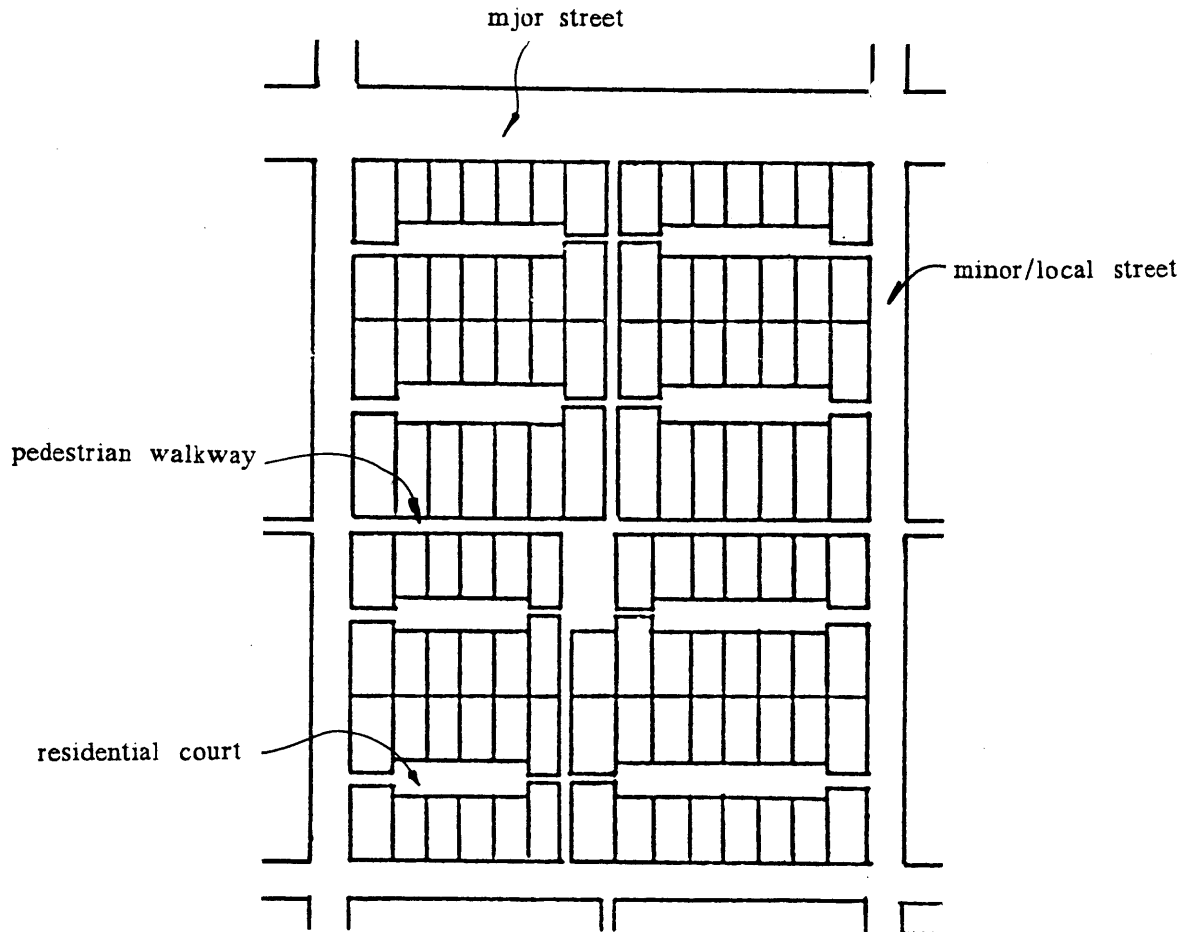


Fig 3.4: Types of Circulation Routes.

### 5.1 Major Streets

- a) Vehicles dominate the traffic in these streets, which also accommodate main utilities lines and storm water trenches. Spacing of major streets could be within the 400–500 meters range.
- b) Being the major conduits for fast, heavy traffic, major streets could have a maximum of six lanes (two for moving cars and a third for car parking each way). The right-of-way, therefore, could range from 20.00 to 22.00 meters. (Fig. 3.5)

### 5.2 Minor/Local Streets

- a) Facilitate both pedestrian and vehicular traffic within the site and accommodate secondary utilities networks and storm water trenches. For convenience of circulation, local streets could be spaced at 200–250 meters.
- b) Since car ownership is extremely low in Greater Khartoum, minor streets could have a maximum of two traffic lanes (one each way), and a third one for car parking on one side of the street. Accordingly the right-of-way could vary from 11.00 to 12.50 meters. (Fig. 3.6)

### 5.3 Pedestrian walkways

- a) Facilitate pedestrian traffic within the site, and limited access for service and emergency vehicles. Since vehicular traffic is subordinate, walkways need not be straight. They could even be spotted with some trees, benches, etc.
- b) Width of walkways could range from a minimum of 2.70 m. to a maximum of 5.00 m. (Fig 3.7). As evident in the old parts of Omdurman, this range is not only adequate for accommodating the prevalent patterns of circulation, but also allows buildings to cast their shadows on each other and on the walkway.

### 5.4 Residential Courts

- a) These are more private in nature. Collectively controlled by the families adjoining them, they could be restricted mainly to pedestrian and local vehicular traffic.

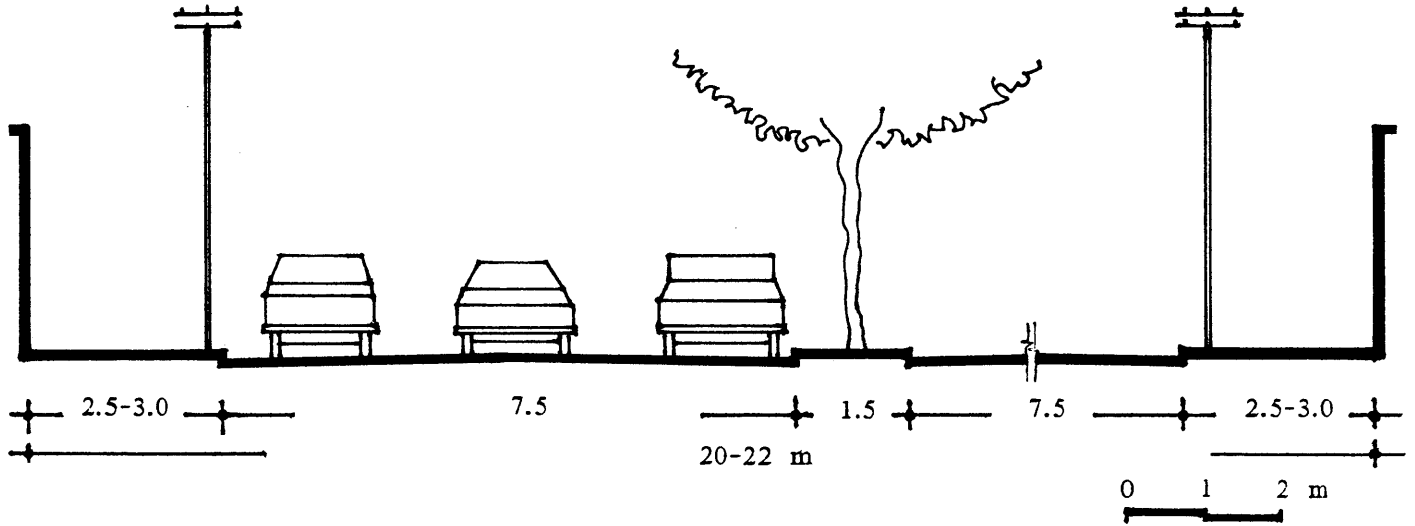


Fig 3.5: Major Streets.

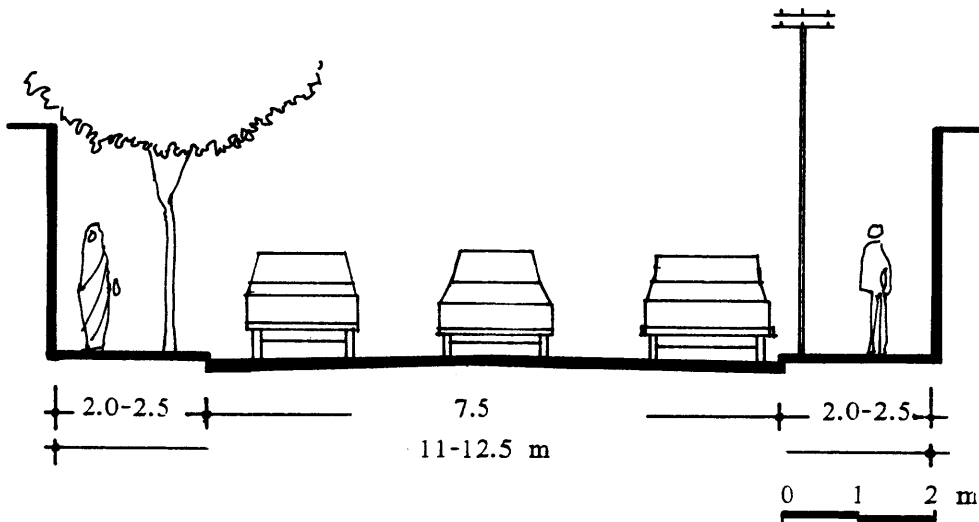


Fig 3.6: Minor/Local Streets.

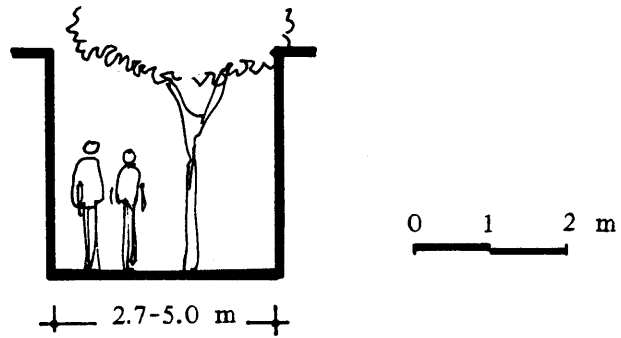
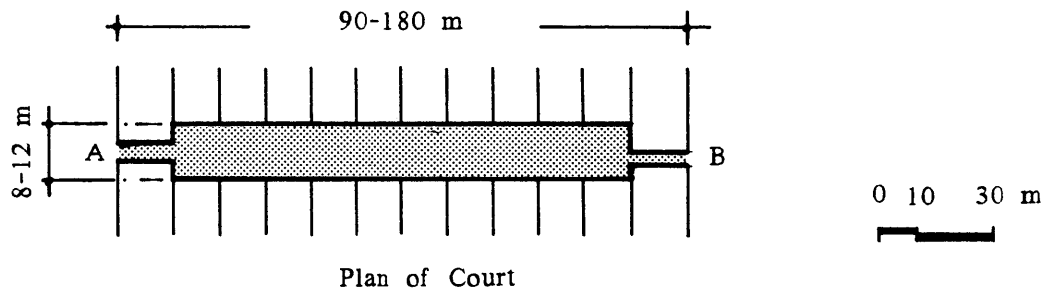
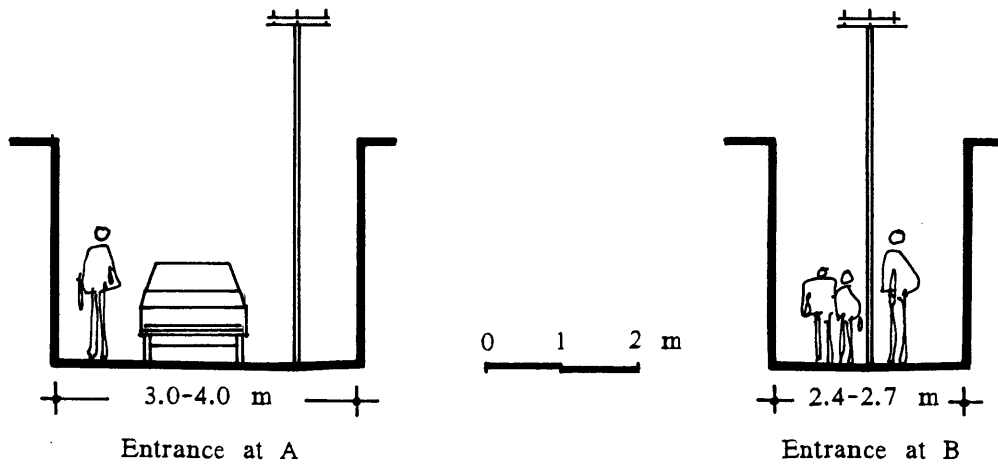


Fig 3.7: Pedestrian Walkways.



Plan of Court



Entrance at A

Entrance at B

Fig 3.8: Residential Courts.

They could, as well, be used for children playing, outdoor sitting, car parking, etc.

- b) Residential courts resemble dead-end streets prevalent in traditional settlements (e.g. villages and the older parts of Omdurman). Henceforth, they could be deliberately adopted as a physical pattern that enhances the residents' control of the direct residential environment. Involving the residents in the upkeep and maintenance of their courts will reduce some of the burden of public agencies.
- c) Courts could have various shapes. Their length however, could be within the 90–180 meter range in order to accommodate a reasonable number of support families (e.g., 15–30 families). The width however, could be restricted to 8–12 meters.
- d) Entry and exit to the court should be so designed that through vehicular traffic is impeded. Four meters could be adopted as a maximum width for an entrance on one side, while the other side could be totally blocked, or have a 2.40–2.70 m. pedestrian entrance. (Fig. 3.8)

## 6. OPEN SPACES

Open spaces in urban residential areas provide relief from the monotony of densely built-upon spaces, and provide visual and social amenities for the community. Potential uses of open spaces range from passive recreation (e.g. strolling, outdoor sitting, etc.); to active recreation (e.g. sports, children playing, etc.); as well as being venues for individuals and the community at large.

Open spaces should be related in size to the size of the population they serve. In densely-populated areas, for instance, more open spaces are needed to serve the community, and vice versa.

The ownership and responsibility of maintaining open spaces should be a joint one between the community and the public agencies of the city. Delegation of responsibilities should be clear enough to guarantee continued upkeep of open spaces.

In Greater Khartoum, open spaces are usually underutilized and often misused either because they are too large to be controlled and maintained, or too fragmented to be

of any use. Invariably, the responsibility of maintaining open spaces is left to the city and only very minimal effort is exerted by the community. With crippled public agencies, open spaces fall into neglect and become eyesores hazardous to the well-being of people.

Open spaces outside the residential plot could be categorized into three main categories; a) semi-private open spaces; b) sub-neighborhood open spaces; and c) central open spaces.

### 6.1 Semi-private Open Spaces "Courts"

- a) Courts facilitate grouping of families into small autonomous units of 15-30 families, and constitute the hub of communal interaction. They could be used for children playing within short proximity of their homes in a traffic-free environment, for ceremonial gatherings, casual sitting outs, etc.
- b) The range of dimensions and entry arrangements to the court are illustrated in Fig. 3.8. As an *approximate* guide, the size of court could be established at the rate of five to eight sq.m. per person<sup>1</sup> (i.e. 30-50 sq.m. per family).

### 6.2 Sub-neighborhood Open Spaces

- a) Medium-sized open spaces should be provided for a larger group of families (150-200 families). They form venues for youngsters playing, communal ceremonies and gatherings, and for various other forms of recreation.
- b) These spaces are semi-public in nature. Thus the responsibility of maintaining them should be shared between the community and the city. It would best be handled through communal self-help assisted by the city machinery.

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<sup>1</sup> These figures were derived from model courts developed to accommodate the functional requirements and range of activities usually performed in the court.

- c) A reasonable size that economizes urban land utilization and facilitates easy maintenance of such open spaces could be based on a rate of 1.50 sq.m. per person<sup>1</sup> (i.e. 10 sq.m. per family).

### 6.3 Main Open Spaces

- a) These are open spaces centrally located to serve the whole residential area. Economy of land utilization calls for a multi-use of these spaces. Accordingly they could be located near the school(s) and/or the marketplace to serve a multitude of functions and age-groups.
- b) The responsibility of maintaining these spaces should be a joint one between the community and the city in the same manner described for the sub-neighborhood open spaces.
- c) The size of the central open space could be a multiple of the size of a soccer field (the most popular sport in the region) at the rate of one soccer field for every 5000 people. (e.g. one field for 5,000 people, two for 7,500 and 10,000, and so on).

## 7. COMMUNAL FACILITIES

Communal facilities (namely educational, health, shopping, religious, and service facilities) are indispensable to any residential area. "Decisions on accessibility of communal facilities is often a compromise based on the tension between different considerations: the needs of the residents; the operating requirements of those who provide the facility; the public interest; and other benefits important for the housing environment".<sup>2</sup>

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<sup>1</sup> This figure was derived from the analysis in Chapter Two p 40, and from direct observation of similar spaces in Khartoum.

<sup>2</sup> Woodford, G. et. al. *The Value of Standards for the External Residential Environment*. Department of the Environment, U.K. Research Report No. 6, March 1977.

## 7.1 Educational Facilities

### a) Kindergartens

Kindergartens in Greater Khartoum are usually established through local initiatives. Accordingly, they are often incorporated within private houses, religious institutions (e.g. the neighborhood mosque), or the neighborhood club/community center. This tradition should be encouraged since both the community center and the mosque (with their vast open spaces and green areas) are underutilized during the day. Where these are non-existent in an area, some houses could always be transformed to accommodate kindergartens and day care centers.

### b) Primary Schools

Primary schools are very important elements in the residential area. If properly utilized, they can serve as centers for learning as well as for cultural and social activities of the community at large.

The number and size of primary schools to be provided in an area is dependent on the number of population that support them. The following planning indices were established based on the Ministry of Education guidelines, on direct observation, and on evaluation of a number of primary schools in the Conurbation.

- a) The maximum capacity of a classroom should be limited to 50 students.
- b) The maximum capacity of the school should be limited to 600 students (i.e. two streams, at six classrooms per stream)
- c) The average area per student is 10 sq.m. (i.e. 1.6 sq.m. per person)<sup>1</sup>
- d) Ideally, the maximum walking distance to the school from the house of the farthest user should be 500 m (i.e. a 7.5 minutes walking distance).
- e) The following table is an *approximate* guide for planning primary schools.

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<sup>1</sup> 16% of the population in Khartoum are children at the primary school age (El-Bushra, E. *op. cit.* p 82). It was assumed that 100% of them go to school.



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population (no.)	students (no.)	schools (no.)	stream/sch. (no.)	student/class (no.)	sch. area (sq.m.)
3,700	590	2	1	50	3000
7,500	1200	2	2	50	6000
10,000	1600	3	2	50	6000
15,000	2400	4	2	50	6000
20,000	3200	6	2	45	6000

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*Table 3.4: Approximate Planning Indices for Primary Schools*

### c) Intermediate Schools

Children within this age-group (i.e. 12-15 years) are more independent. They can walk/commute longer distances to the school. If the residential area is too small (i.e., less than 3500 people) and/or if there is a nearby school, the intermediate school need not be located within the same neighborhood.

Evaluation of intermediate schools in Greater Khartoum have resulted in the following general planning indices.

- a) The maximum capacity of a classroom should be limited to 40 students.
- b) The maximum capacity of the school should be limited to 360 students (i.e. three streams, at three classrooms per stream)
- c) The average area per student is 12.5 sq.m. (i.e. 0.6 sq.m. per person)<sup>1</sup>
- d) Ideally, the maximum travel distance to the school from the house of the farthest user should be 1000-1500 meters (i.e. 15-22 minutes walk).
- e) The following table is an *approximate* guide for planning intermediate schools.

---

<sup>1</sup> 6% of the population in Khartoum are children within this age-group (El-Bushra, E. *op. cit.* p 82). It was assumed that 85% of them go to school.

population (no.)	students (no.)	schools (no.)	stream/sch. (no.)	student/class (no.)	sch. area (sq.m.)
5,000	225	2	1	40	1500
10,000	510	2	2	40	3000
15,000	765	2	3	40	4500
20,000	1020	3	3	40	4500

*Table 3.5: Approximate Planning Indices for Intermediate Schools*

#### **d) Secondary Schools**

By virtue of their size and the age-group of their students (15–18 years), secondary schools serve a larger catchment area. Since their location depends on other external criteria, secondary schools are not essential elements in every neighborhood. They should be considered at a city-wide level rather than at the level of individual residential areas.

## **7.2. Shopping Facilities**

Within a residential area, shopping facilities can be of two categories; a) Shops for daily needs; and b) shops/markets for weekly/monthly needs.

#### **a) Shops for Daily Needs (Convenience Stores)**

These are usually privately established as family enterprises. The number, size, and location of such "corner" shops are totally dependent on the forces of supply and demand. Therefore, they need not be considered as independent elements at the planning stage. However, plots with a higher commercial potential (such as corner plots and plots fronting on major streets) should be slightly larger than average so as to accommodate potential commercial enterprises (shops, etc.).

### b) Neighborhood Markets

These incorporate shops and services less frequently needed (e.g. meat and vegetable shops, flour mills, barbers, tailors, etc.). The factors that affect the success of a neighborhood market includes; a) size and purchasing power of the support population; b) proximity to other shopping facilities; and c) accessibility.

Evaluation of existing neighborhood markets have resulted in 1.4 sq.m. as a *rudimentary* index for deciding on the size of the neighborhood market.

### 7.3 Community Center/Social Club

In every residential area the community center serves a wide spectrum of functions: it can be used as a kindergarten during the day; for adult education during the afternoons; as well as for cultural and recreational activities (exhibitions, public lectures, movies, etc.) during the evenings.

0.25 sq.m. per person could be used as an *approximate* guide for sizing the community center. For reasons of accessibility and convenience, more than one center could be provided if the residential area is too big.

### 7.4 Health Facilities

The provision of health facilities to residential areas is dependent on other external factors such as the overall capacity of the public health agencies to render health services to neighborhoods. In Greater Khartoum this capacity is rather limited at present such that few health facilities are shared by several neighborhoods. Nevertheless, it is recommended that a parcel of land be reserved in every residential area for a health facility of one sort or another depending on the size of the population.

As a *rudimentary* guide an 800-sq.m. plot could be allocated for a dispensary that serves 4000-5000 people (i.e. 0.12-0.15 sq.m. per person). For a population of 10,000-15,000 a 1500-1800 sq.m. plot could be allocated for a fully-fledged health center (incorporating general practitioners, a dentist, a lab, a dispensary, a family planning unit, etc.)

### 7.5 Religious Facilities

Places of worship could be provided in residential areas at the rate of 0.25 sq.m. per person (e.g. a 1200 sq.m. mosque for every 5000 persons). It is assumed that some prayer congregations will be held at the sub-neighborhood level in small prayer rooms (*zawiahs*), or in the open spaces provided at this level.

### 7.6 Reserve Areas

As the residential area consolidates and the community becomes more established it becomes extremely difficult to expropriate private land for public uses that might arise in the future. It is advisable, therefore, to reserve land at the planning stage to cater for this future uncertainty. If the need for future public spaces is carefully analyzed at the planning stage (based on reasonable population forecasts), the degree of uncertainty will be considerably reduced.

### SUMMARY OF AREAS FOR COMMUNAL FACILITIES NEEDED FOR SAMPLE POPULATION NUMBERS

The following table presents the areas needed for communal facilities for communities of 5,000, 7,500, 10,000, and 15,000 people. The figures could be used as quantitative guidelines at the planning stage of urban residential areas. The relevance and usefulness of the guidelines stem from the fact that they provide benchmarks to compare with. Albeit being *approximate*, they represent a systematic approach to residential land utilization. Hence they are more appropriate to work with than the inconsistent, outdated conventions currently utilized in Greater Khartoum. Through periodic evaluation and updating of these indices, and the aforementioned indices for plots and streets, a more rational and cost-effective land utilization in Greater Khartoum could be achieved.

Facility	sq.m/person	Population			
		5,000	7,500	10,000	15,000
		area in hectares			
Primary School	1.60	0.90	1.20	1.80	2.40
Intermediate School	0.60	0.30	0.60	0.60	0.90
Market	1.40	0.70	1.05	1.40	2.10
Community Center	0.25	0.12	0.18	0.24	0.36
Soccer Field	1.70	0.84	1.68	1.68	2.52
Open Spaces	1.50	0.75	1.13	1.50	2.25
Health	0.25	0.12	0.18	0.24	0.36
Religious	0.25	0.12	0.18	0.24	0.36
Reserve	0.60	0.30	0.45	0.60	0.90
Total	8.15	4.15	6.65	8.30	12.15

Table 3.6: Summary of Areas for Communal Facilities

Plot Area (sq.m.)	Site Area (Hectares)						Land Utilization (%)	Gross Density (p/Ha)
	10	25	50	75	100	150		
800	540 83	1370 210	2760 424	4130 636	5500 847 plots	8260 1270	68 3 25 4	55 private
600	700 108	1770 272	3550 545	5340 821	7120 1094	10670 1641	65 4 25 9	71 semi-private public
360	1080 166	2730 420	5460 840	8190 1260	10920 1680	16410 2524	60 6 25 9	109 semi-public
300	1280 196	3170 488	6330 974	9490 1459	12640 1944	18960 2917	59 6 25 10	127
240	1520 233	3760 578	7490 1153	11230 1728	14980 2304	22450 3453	56 7 25 12	150
210	1670 256	4140 636	8260 1270	12370 1903	16500 2538	24720 3803	53 8 25 14	165
180	1860 285	4600 709	9190 1413	13770 2118	18360 2824	27520 4233	51 9 25 15	184
150	2090 321	5190 799	10360 1593	15520 2387	20690 3183	31040 4774	48 10 25 17	208

Table 3.7: Population and Plot Numbers, Gross Density, and Land Utilization Indices Corresponding to Various Site and Plot Areas

**NOTES ON TABLE 3.7**

- a) The table was generated using the following fixed "variables".
- i) An average family size of 6.5 p/family.
  - ii) 25% of the total site area devoted to public land - i.e., streets and walkways.
  - iii) 8.5 sq.m./person devoted to semi-public areas - i.e., open spaces and communal facilities. (See Table 3.6).
- b) Eight plot sizes are used: the four plot sizes proposed in Table 3.1, two smaller plots of 150 and 180 sq.m., and two larger plots commonly used in Greater Khartoum (600, and 800 sq.m.).

**USE OF THE TABLE**

The table provides reference indices to be used in the planning of new residential areas. It can be used in many ways.

- a) Given a site area and a range of plot sizes, find the corresponding population and plot numbers, land utilization percentages and population densities.
- b) Given a site area and the total number of population to be accommodated, find the corresponding plot number and size, the land utilization percentages, and the population density.
- c) Given a range of plot sizes and population densities, find the site area required, and the corresponding number of plots and land utilization percentages.

**III. APPLICATION OF THE GUIDELINES IN  
PLANNING RESIDENTIAL AREAS: A MODEL LAYOUT**

The indices and guidelines proposed in the preceding sections were used to generate the model layout shown in Fig 3.9. In comparison to the five case studies presented in Fig 1.4 the model is more rational in its land utilization. This claim is substantiated by the following indicators.

- a) A higher percentage of private land (69% compared to an average of 54% indicated by the case studies); and a lower percentage of public land (20% compared to an average of 39% indicated by the case studies).
- c) A shorter circulation network (188 m/ha compared to an average of 215 m/ha indicated by the case studies).
- d) A higher population density (120 p/ha compared to an average of 90 p/ha indicated by the case studies).

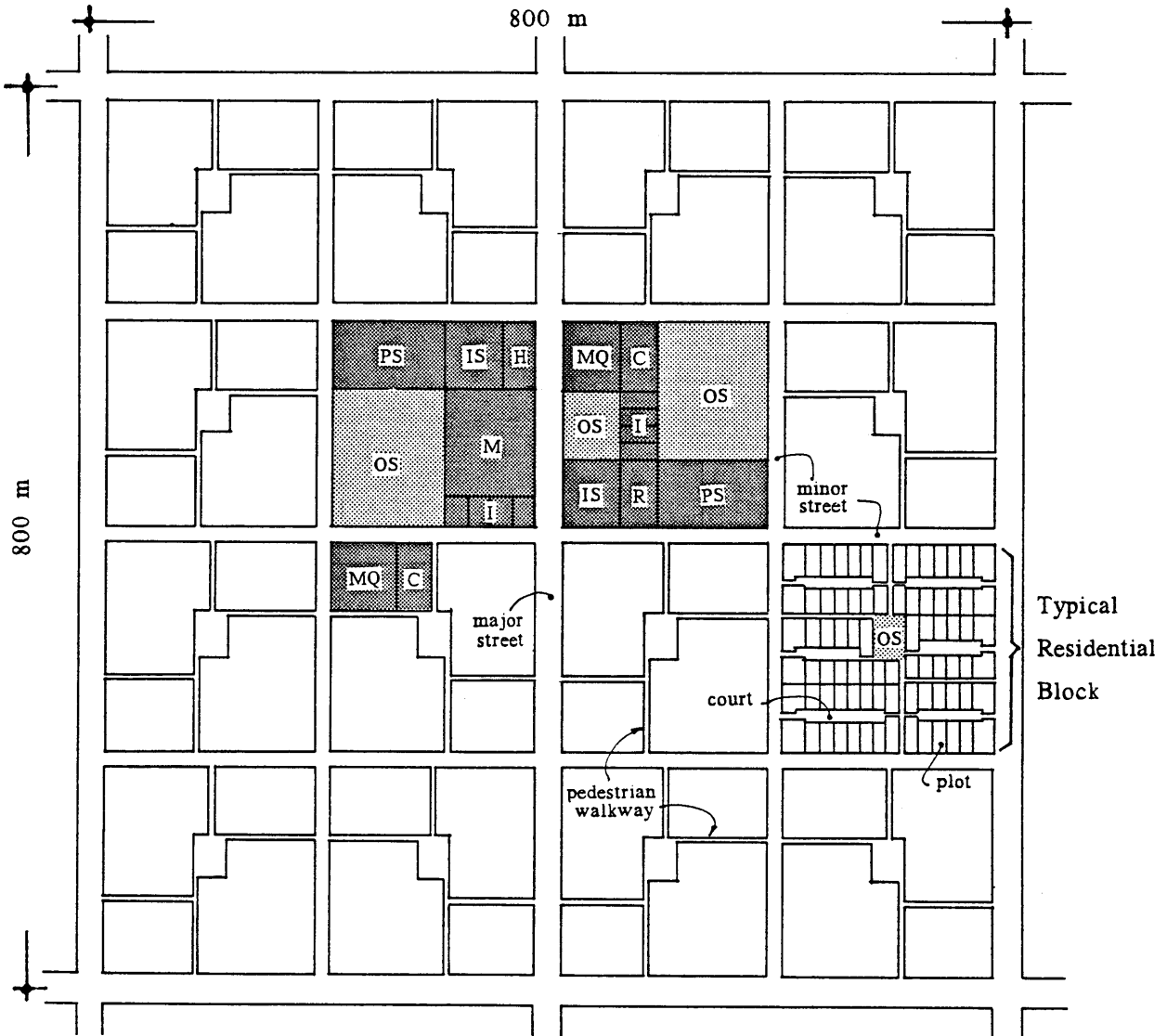
### STEPS FOR GENERATING THE MODEL LAYOUT

- a) An imaginary site equivalent in area to each case study was used. It was assumed that the site is flat and bound with major streets on four sides.
- b) A circulation grid composed of a major street and a network of minor streets was deployed. Minor streets were provided at 200-meter intervals, and major streets at 400-meter intervals.
- c) An average plot area of 240 sq.m. was selected. Larger plots were also provided and located on commercially valuable locations to cross-subsidize the development.
- d) Using table 3.7, for a site area of 64 hectares and an average plot area of 240 sq.m., the area for semi-public uses was found to be approximately 12% of the total area. Hence an equivalent portion of the site was allocated for open spaces and communal facilities using the proposed indices (i.e. section 6 onwards).
- e) The 200x200 m blocks bound by the minor streets were subdivided into residential quarters using a secondary network of pedestrian walkways. Each block was provided with a sub-neighborhood open space, and each 15-20 plots were grouped around a semi-private court.
- f) Having completed the layout, a cursory evaluation of its land utilization was undertaken using the last two columns of Table 3.7. If the layout indicates considerable deviations from the indices suggested, the land uses in the layout should be revised. This evaluation-redesign cycle is repeated as often as needed in order to satisfy as far as possible the proposed indices.



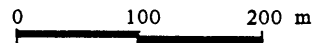
Fig 3.9: Model Layout for Residential Areas in Greater Khartoum

total population	7500	public	20%
gross density	120 p/ha	semi-public	12%
circulation network	188 m/ha	private	61%
		semi-private	7%



KEY:

- |    |  |    |                     |
|----|--|----|---------------------|
| OS | open space                                       | PS | primary school      |
| C  | community center                                 | IS | intermediate school |
| H  | health center                                    | M  | market              |
| R  | reserve  | MQ | mosque              |
| I  | high-intensity development, light industry, etc. |    |                     |



*Epilogue*

*Generating a cost-effective land utilization pattern in the manner illustrated in this chapter will satisfy the most crucial aspect of a rational housing process. Subsequently, other aspects and forces come into play, and that is another game....*

APPENDIX I  
**THE COUNTRY CONTEXT**

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### **1.1. LOCATION AND AREA**

The Republic of the Sudan lies between latitudes 4° and 22° north in northeast Africa. It borders on Egypt to the north, the Red Sea and Ethiopia to the east; Uganda, Kenya, and Zaire to the south; Central Africa, Chad, and Libya to the west (Fig I.1). It is the largest country in Africa with an area of more than 2.5 million sq.km. The country consists mainly of a plateau that slopes gently towards the north, spotted with the Red Sea Hills in the northeast, the Nuba Mountains and Jabal Marra in the west, and the Amatong Mountains in the south.

### **1.2. CLIMATE**

Tropical continental climates dominate most of the country. Three distinct climatic regions can be distinguished;

- a) The northern belt. Has a hot-dry climate. Mean maximum and minimum temperatures are 44°C and 25°C, respectively, in summer; 30°C and 10°C in winter. Annual rainfall varies from less than 50 mm in the far north to 100 in the other parts. Sandstorms are common on most parts of this region.
- b) The central belt. Also has a hot-dry climate with mean temperatures slightly less than the northern belt. Annual rainfall ranges between 500 and 800 mm.
- c) The southern belt. Has a warm-humid climate. Mean temperatures are lower than the northern belt. Annual rainfall exceeds 1000 mm in most parts.

### **1.3. POLITICAL HISTORY**

In prehistoric times strong kingdoms dominated most of northern Sudan. These were supplanted by two Christian kingdoms, Muquarra and Alawa, who ruled the northern and the central parts from 540 to 1540. A peaceful process of Islamization that took more than 1000 years had resulted in the emergence of two Muslim sultanates, the

Fung in the north and the centre, and the Fur in the west. Both sultanates survived for three centuries after which a Turco-Egyptian rule assisted by the British took over from 1820 to 1884. The national Mahdists revolted against, and defeated the colonial troops in 1884 and established a state that survived for 14 years. An Anglo-Egyptian "condominium" supplanted the Mahdiyya in 1898 and continued to rule till 1956 when the country gained its independence. A succession of national governments, both military and civilian, have ruled the country since then. In 1982 the country was legislatively and administratively decentralized into six regions, each with its own parliament and government, with a central government in Khartoum.

#### 1.4. POPULATION

The country is sparsely populated with a total population of 21 million people (1983). The natural rate of growth is 2.8%. More than half of the population is under 20 years of age and only 8% are over 50 years. The gross population density is 8 persons per sq.km.

**Ethnic Composition:** 50% Arabs in the north and the center; 11% Dinka in the south; 8% Nubians in the north; 6% Beja in the east; 25% others.

**Languages:** more than 100 languages and local dialects are spoken in the various regions of the country. Arabic is the native language of more than half of the population and the second language of most of the others. English is the principal language in the south and is still widely used by some institutions in the north.

**Religion:** 72% Muslim, 2% Christian, 26% pagans.

#### 1.5. URBANIZATION

About 25% of the country is urban. More than 30% of the urban population are concentrated in Greater Khartoum, the primate city. 10-15% of the rural population are nomads.

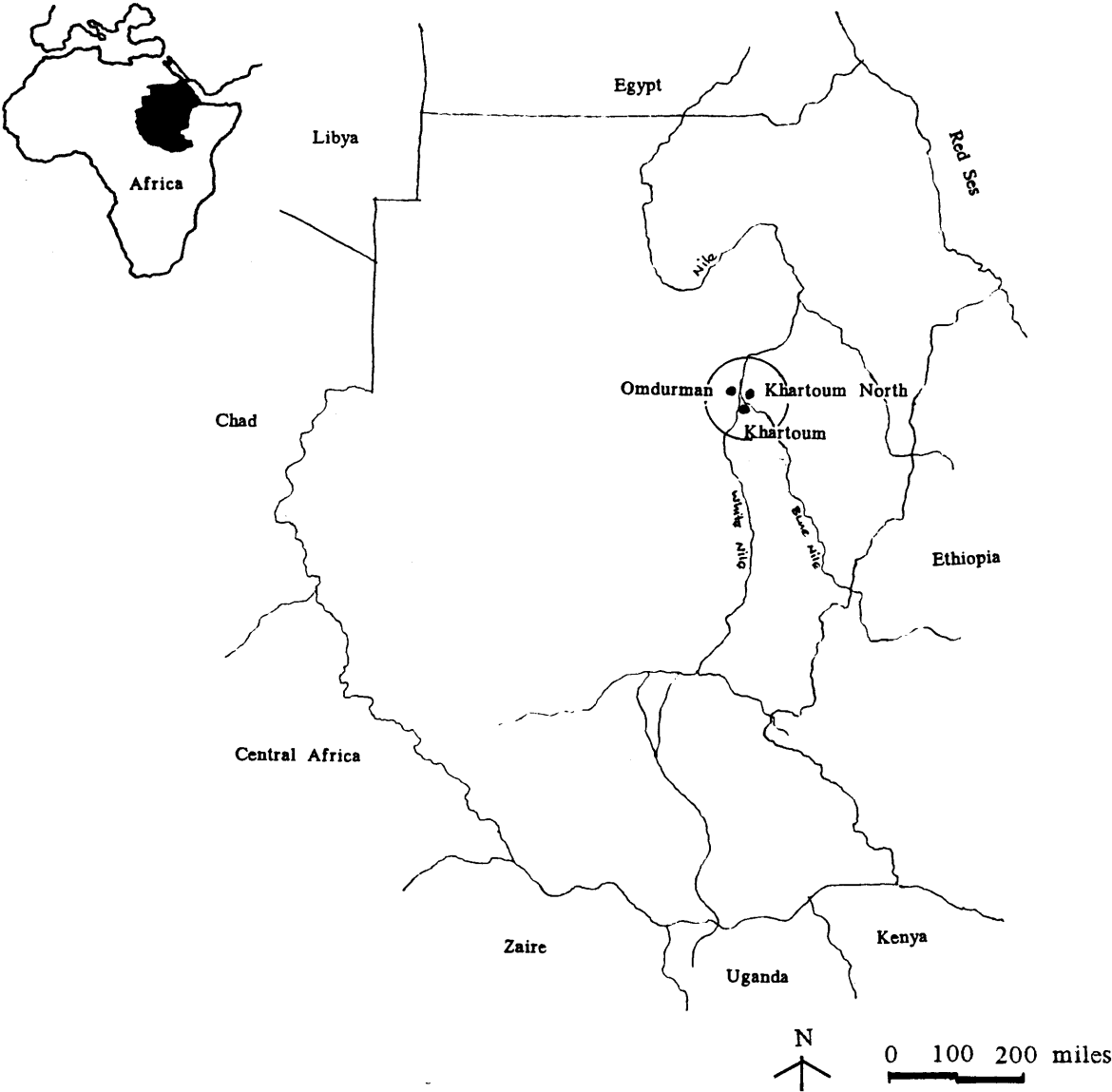


Fig 1.1: Map of the Sudan Showing Location of Greater Khartoum.

## 1.6. ECONOMY

Primarily a government-dominated mixed economy. Agriculture and livestock raising are the main economic activities of more than 80% of the population, and has produced about 95% of the exports in 1982. Cotton, sorghum, groundnuts, gum arabic, and sesame are the main products. Public enterprises, mainly foodstuffs and textiles, dominate the modern manufacturing activities. Major oil deposits were discovered in the early 80's and commercial exploitation is scheduled for the end of the decade.

The per capita GNP was estimated at US \$380 (1981).<sup>1</sup>

## 1.7. CURRENCY

The Sudanese pound (£S) comprises 100 piasters. Official rate of exchange is US \$1 equals £S1.30 (January 1984).

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<sup>1</sup> The World Bank. *World Development Report, 1983*. Oxford University Press, July 1983, Table 1.

APPENDIX II  
HISTORY OF URBANIZATION  
IN GREATER KHARTOUM

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The "Three Towns" Khartoum, Khartoum North, and Omdurman shifted from small settlements with rather simple physical and social structures by the early 19th century to become the major concentration of urban population in Sudan by the turn of the century. This rapid process of urbanization and the housing problems it created can be traced through four eras in the history of Sudan.

#### 1. THE TURCO-EGYPTIAN ERA (1820-1884)

When the confluence of the Blue and the White Niles was chosen as the seat of the Turco-Egyptian administration in 1830, the local building industry was relatively primitive, and most buildings were constructed of perishable materials. Masons and artisans were brought from Egypt to build the government buildings and to introduce the rudiments of brick baking and masonry construction to the natives of Khartoum. The Governor encouraged the residents to use the permanent building materials provided by his administration.

The population of Khartoum was estimated by European travelers at 30,000 to 60,000 people,<sup>1</sup> comprising three distinct groups: Europeans; Turks, Egyptians and Syrians; and Sudanese. This distinction was also reflected in the layout of the town which had three parts; a) *Hai al-Hakimdariyya*, incorporating the Governor's palace, government buildings, and residences of senior officials; b) *Hai al-Masjid*, incorporating the main mosque, the Arabic market, the European market, and housing for some native Sudanese eventually taken over by wealthy merchants and expatriate officials pushing the natives to the outskirts; and c) other peripheral neighborhoods to the south and west housing native Sudanese.<sup>2</sup>

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<sup>1</sup> Abu Salim, M. I. *Tarikh al-Khurtoum*. Beirut: Dar al-Jeel Press, 1979. (Arabic) p 61

<sup>2</sup> *Ibid.* pp 33-39.

## 2. THE MAHDIYYA (1884-1898)

When Khartoum fell into the hands of the Mahdists in January 1885, "the Dervishes occupied the city, but very soon the Khalifa feeling it impossible to supervise two towns, ordered its evacuation [in August 1886], the destruction of the buildings, and the removal of the [building] materials to Omdurman."<sup>1</sup>

During the Mahdiyya Omdurman witnessed an exodus of people from different parts of the country who joined the Mahdi and his successor, the Khalifa, increasing its population to 150,000 people by 1886.<sup>2</sup> Several neighborhoods were informally developed in Omdurman to accommodate these migrants according to their tribal and military affiliations.

Since the prevailing ideology at that time was to live a humble life with minimum material possessions in anticipation of a better life in the hereafter, no great attention was paid to the physical environment. Streets were drab and winding, lined up with buildings constructed out of mud, straw, and animal skin. Large plots (some more than 1000 sq.m. in area) were acquired to accommodate big extended families. In contrast there were few open spaces in the town. The standard of sanitation and hygiene was extremely poor in some parts of the town.

These features still characterize most of the old neighborhoods of Omdurman today, albeit being replanned and upgraded several times.

## 3. THE ANGLO-EGYPTIAN "CONDOMINIUM" (1898-1955)

When the Anglo-Egyptian forces defeated the Khalifa's army and captured Omdurman in 1898, the first task of its commander, Lord Kitchener, was to rebuild Khartoum in an European model to be the capital of the new administration. The ruins of the

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<sup>1</sup> McLean W. H., "The Planning of Khartoum and Omdurman in the Earliest Period of British Rule". In Valdo Pons ed., *Urbanization and Urban Life in the Sudan*. Dept. of Sociology and Social Anthropology, University of Hull, UK, 1980, p 134.

<sup>2</sup> El-Bushra E. *op. cit.* pp 31-36



Turco-Egyptian town were scrapped and Khartoum was given a fresh start.<sup>1</sup> The town, which became the first planned town in Sudan, was subdivided using a gridiron pattern of streets with a series of diagonal streets to facilitate communication and control of its different parts. It comprised four main quarters:<sup>2</sup>

- a) the area between the Blue Nile and the Khedive Avenue (Gama'a Avenue) was designated for government buildings, the Governor's Palace, and residences for senior government officials.
- b) the area between the Khedive Avenue and Abbas Pasha Square (United Nations Square) extending west of Victoria Avenue (Qasr Avenue) to the Great Mosque, was designated as a commercial area.
- c) the area immediately to the south of Abbas Pasha Square and the Great Mosque west of Victoria Avenue was allocated for small workshops and the Arabic Market.
- d) the surrounding area bounded by the line of the old fortification was subdivided into residential quarters for wealthy merchants and expatriate government employees. Natives of Sudan, however, were confined to the outskirts of this area as well as to Omdurman and Khartoum North.

Built and maintained by the government, the houses of senior officials were single-family houses with luxurious space and construction standards. Other civil servants were provided with loans to build and maintain their houses. The whole settlement enjoyed a full range of services including paved streets, piped water, electricity, covered drains, and sewerage in some parts.

Meanwhile, Omdurman and Khartoum North continued to grow informally with minimal directives from the Governor who used to inspect them regularly to make sure that everything was in order under his control.

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<sup>1</sup> Stevenson, R. "Khartoum During the Turco-Egyptian Occupation". In Valdo Pons, *op. cit.* p 98.

<sup>2</sup> Abu Salim, M. I. *op. cit.* p 136

The creation of services and light industries in Khartoum attracted many people from the hinterland to it. These migrants settled to the south of Khartoum in a settlement called al-Deim. The congestion and appalling conditions in al-Deim, together with the rapid growth of Khartoum proper necessitated the creation of a commission in 1947 to deal with these problems.

The task undertaken by the commission was converting al-Deim into residential areas for the well-to-do people (Khartoum 2 and Khartoum 3). Residents of the "Old" Deim were relocated further to the south and to the west in the "New" Deims (al-Deum).<sup>1</sup>

A government decree enacted in 1906 categorized residential areas into first-, second-, and third-class areas. Each area had different plot sizes, different levels of services, and different standards of construction. This classification system persists till now in all urban areas of Sudan with various impacts on the socio-physical conditions of the city.

### 3. POST INDEPENDENCE, 1956-PRESENT

The years that followed the declaration of independence in January 1956 witnessed an influx of people from all over the country to the "Three Towns" where an industrial and service base was being created. The population of the "Three Towns" grew from 26,000 in 1956 to 800,000 in 1973, to 1.3 million in 1983 (63% increase in the last decade). This resulted in an acute shortage of housing manifested in soaring rents, high land prices, shortages in building materials and labor, as well as in large areas of squatter settlements. Several long term measures were taken to remedy this state of affairs:

- a) The Town and Country Planning Act was enacted in 1956 (complemented later on by another act in 1961) to regulate growth and land use in urban areas.
- b) Master plans for Greater Khartoum and Port Sudan were prepared in 1960.

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<sup>1</sup> Arthur, A. "Slum Clearance in Khartoum". *Journal of African Administration*, vol. 6, no. 2, April 1954, p 73.

- c) The Sudanese Estates Bank was established in 1966 to provide housing loans for eligible citizens.
- d) The Regional Plan for Greater Khartoum was prepared in 1974.
- e) The three plans for national economic and social development formulated between 1956 and 1983 addressed the housing problem with various degrees of emphasis and included several housing programs (Appendix III).

Being the primate city in Sudan, Greater Khartoum continues to expand in all directions to accommodate more and more people. Nowadays, it covers an area of approximately 300 sq. km. housing more than 1.3 million people.

APPENDIX III  
HOUSING IN THE NATIONAL  
DEVELOPMENT PLANS

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## 1. THE TEN-YEAR PLAN, 1960/61-1970/71<sup>1</sup>

The Ten-Year Plan for Economic and Social Development was the first plan in the history of Sudan. The main characteristics of the plan were as follows.

### 1.1 General Objective

The main objective of this plan was to achieve economic growth. Consequently, 73.5% of the investment was directed towards the direct productive sectors, and only 26.5% for the service sector including housing.

### 1.2 Investment

Investment in housing amounted to £S72 million (i.e., 1.5% of the GDP). The share of the public sector in this investment amounted to £S42 million (i.e., 20.5%).<sup>2</sup>

### 1.3 Housing Program

The housing program had the following characteristics;

- a) Leasing serviced plots to eligible applicants in urban areas;
- b) Construction of 1000 "economical" houses to be distributed to workers and low-income employees on a hire-purchase basis; and
- c) Construction of urban dwelling units to be leased out to government employees.

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<sup>1</sup> Department of Housing Services and Engineering Affairs, Ministry of Peoples Local Government, *National Report on Human Settlements, the Democratic Republic of the Sudan*. Prepared for the UN Habitat Conference, 1976. pp 10-12. See also Housing National Committee, *op. cit.*, pp 9-13.

<sup>2</sup> The exchange rate for this period was US \$1 = £S0.35.

#### 1.4 Implementation and Impact

- a) The total number of plots and houses distributed during this period was 70,000 units. Among the various schemes implemented during this period were New Halfa, al-Amarat First- and Second-class areas, and the town of al-Mahdiyya.
- b) Minimum plot areas adopted were 300-400 sq.m. in third-class areas, 600 sq.m. in second-class areas, and 800 sq.m. in first-class areas.
- c) The extravagant space and services standards adopted were not suited to the financial resources available; consequently, it was possible to extend services to less than 43% of the plots distributed.
- d) Residential densities became as low as 76 person/hectare in third-class areas and 38 person/hectare in first- and second-class areas. In comparison, densities in urban areas in Egypt were 350-570 person/hectare; 120-240 person/hectare in Ethiopia, Libya and Uganda.

## 2. THE FIVE-YEAR PLAN, 1970/71-1975/76<sup>1</sup>

In May 1969 the Ten-Year Plan was suspended. Instead, a five-year plan was announced in July 1970 to cover the period from 1970/71 to 1975/76. The main features of this plan were as follows.

### 2.1 General Objective

Increasing productivity and achieving economic growth were the main objectives of this plan. Accordingly, all the social and service sectors including housing received a smaller share in the GDP formation.

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<sup>1</sup> Department of Housing Services and Engineering Affairs. *op. cit.* pp 12-14. See also Housing National Committee. *op. cit.*, pp 13-14.

## 2.2 Investment

The total investment in housing during this period amounted to £S130.9 million, of which the public sector share was £S18.2 million (i.e., 14%).

## 2.3 Housing Program

- a) The Plan did not stipulate specific quantitative and qualitative targets to be achieved within the five years of its duration. Moreover, most of the public investment in housing was devoted to servicing the plots distributed during the previous plan.
- b) The Plan perpetuated the policy of leasing serviced plots at the same space standards previously adopted.

## 2.4 Implementation and Impact

- a) The total number of units distributed within this plan did not exceed 4000 units.
- b) Approximately 20% of the units surveyed in 1973 in the "Three Towns" didn't have any form of services.
- c) Since housing production was far too short than the actual demand in urban areas squatter settlements grew rapidly such that more than 30% of Greater Khartoum's inhabitants in 1973 were living in squatter areas.

## 3. EXTENSION OF THE FIVE-YEAR PLAN

The Five-Year Plan was extended in 1975 to include the fiscal year 1976/77. A one-year housing plan was formulated to cover this period and to rectify the problems carried over from the previous plans. The main features of this action plan were.<sup>1</sup>

- a) The provision of 28,000 leasehold serviced plots in 13 urban areas.

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<sup>1</sup> Housing National Committee. *op. cit.*, pp 15-17.

- b) Construction of 600 "economical" houses to be leased out to workers on a hire-purchase basis.
- c) Upgrading of illegal settlements in Greater Khartoum and Port Sudan.
- d) Encouraging private investment in housing.

Due to financial difficulties and the weakness of the implementation agencies very little of this plan was actually implemented.

## 4. THE SIX-YEAR PLAN, 1976/77-1982/83<sup>1</sup>

### 4.1 General Objectives

Among other objectives, the Plan addressed the question of housing with greater concern. It stipulated "the provision of hygienic housing to all income groups in environments provided with the basic amenities" as a long term housing objective. Within this general objective however, priority was given to settlements of at least 20,000 inhabitants.

### 4.2 Investment

The total *planned* investment in housing was £S424.5 million. The public share in this investment was £S26.5 million (i.e., 6.3%).

### 4.3 Housing Program

- a) Provision of 129,000 serviced plots for all income groups with priority given to low-income groups.
- b) Construction of 5000 "economical" houses in five major cities to be distributed on a hire-purchase basis.
- c) Provision of 18,000 "investment" dwelling units by private investors.

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<sup>1</sup> Housing National Committee. *op. cit.*, pp 17-24.

- d) Upgrading 42,000 illegal housing units in Greater Khartoum and Port Sudan.
- e) Preparation of master plans for 13 towns.
- f) Preparation of detailed proposals for augmenting the physical infrastructure of Greater Khartoum.
- g) Increasing the Estates Bank's capital from £S15 million to £S40 million.

#### **4.4 Implementation and Impact**

Faced with severe financial difficulties, none of these ambitious projects was implemented. Moreover, the Plan was suspended in September 1979, and a short-term action plan was announced in November 1981. It called for halting investment in any new projects, and directing all efforts towards utilizing and rehabilitating the existing productive capacity. This plan was followed by similar action plans that have basically the same objective. The repercussions of ignoring the housing sector in these ad hoc action plans are illustrated in Chapter Two of the present study.



APPENDIX IV  
THE CASE STUDIES

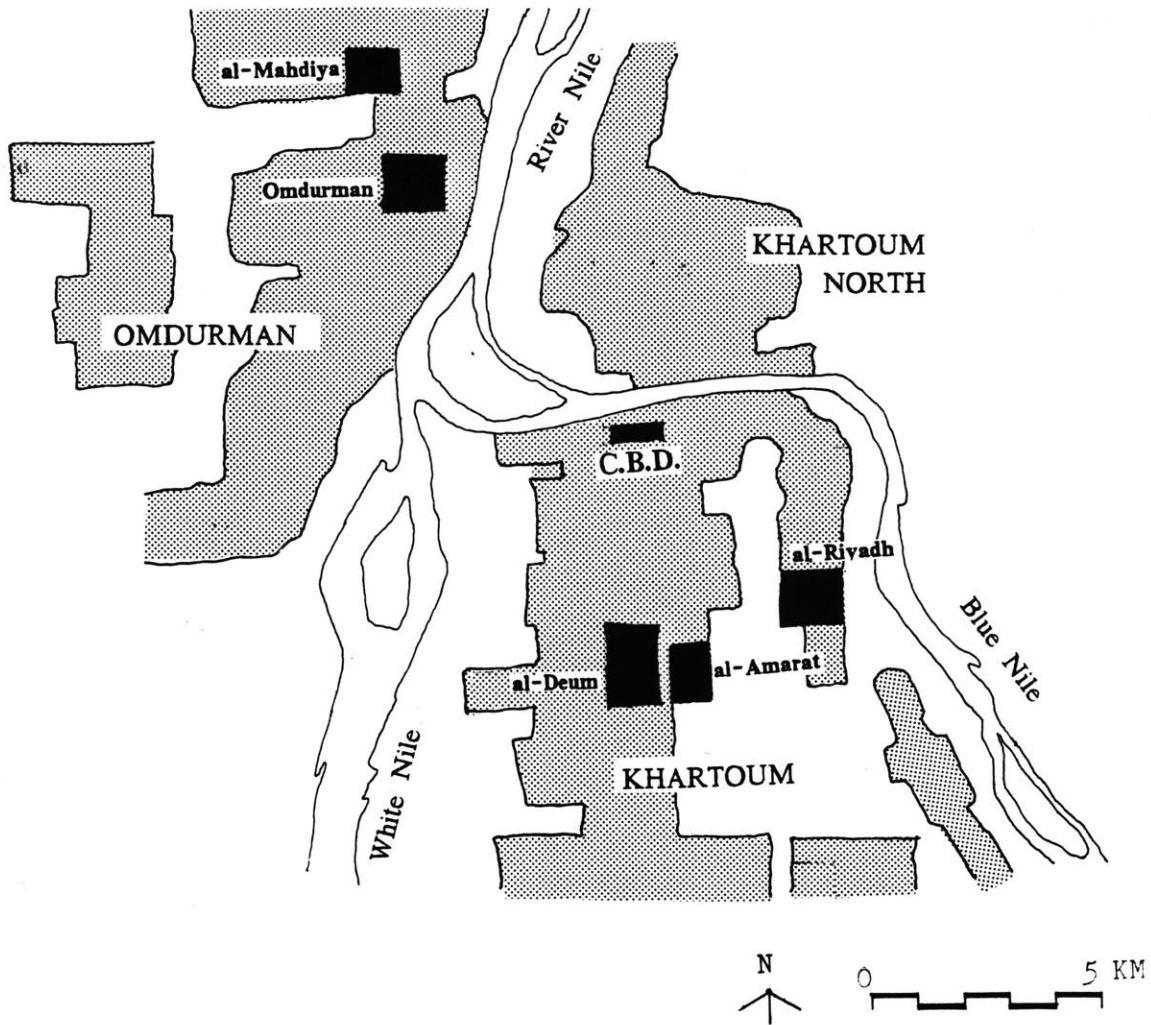


Fig IV.1: Location of the Case Studies within Greater Khartoum

## 1. AL-RIYADH FIRST-CLASS AREA

This area lies 7 km. to the south-east of the Central Business District of Khartoum. It is surrounded by Nasser third-class extension on the north, al-Grief West on the east, al-Tai'f first-class area on the south, and Khartoum international airport on the west.

It comprises 260 hectares of flat land that had been used for rain-fed cultivation prior to 1950. Between 1970 and 1976 the area was urbanized and subdivided into first- and second-class site and services residential areas (the second-class area comprises 30 hectares only). 20-25% of the plots are still undeveloped, as well as most of the areas designated for communal facilities. (Fig IV.2 and Photograph 9).

**Income Group:** High-income.

**Levels of Services:** Individual water and electricity connections, telephones, open run-off drainage ditches, major road compacted and paved with tarmac, others are compacted only.

**Communal Facilities:** Since the area is not fully developed yet, it has very few communal facilities. Apart from a private international school, it has no schools, recreation or health facilities (apart from few private clinics), and no proper shopping center. It has two mosques, and open spaces of varying sizes and shapes.

**Plot Sizes:** Plots range between 1300 and 600 sq.m. in the first-class area, with an average plot area of 920 sq.m. And between 700 and 500 sq.m. in the second-class area.

**Dwelling Types:** Dwellings are built in either R.C. frames and baked-brick infill walls, or baked-brick walls and corrugated iron or R.C. roofs. The area contains an assortment of dwelling types ranging from single-story single-family houses to 6-story apartment buildings. In the majority of cases vertical expansion to provide rental units seems to be an overriding concern. (Photographs 10, 11)



*Photo 9: Aerial View of Part of Al-Riyadh.*

*(Source: Sudan Survey Department, 1983).*

*Although the area was urbanized 10-15 years ago, plots and communal facilities are not yet fully developed.*

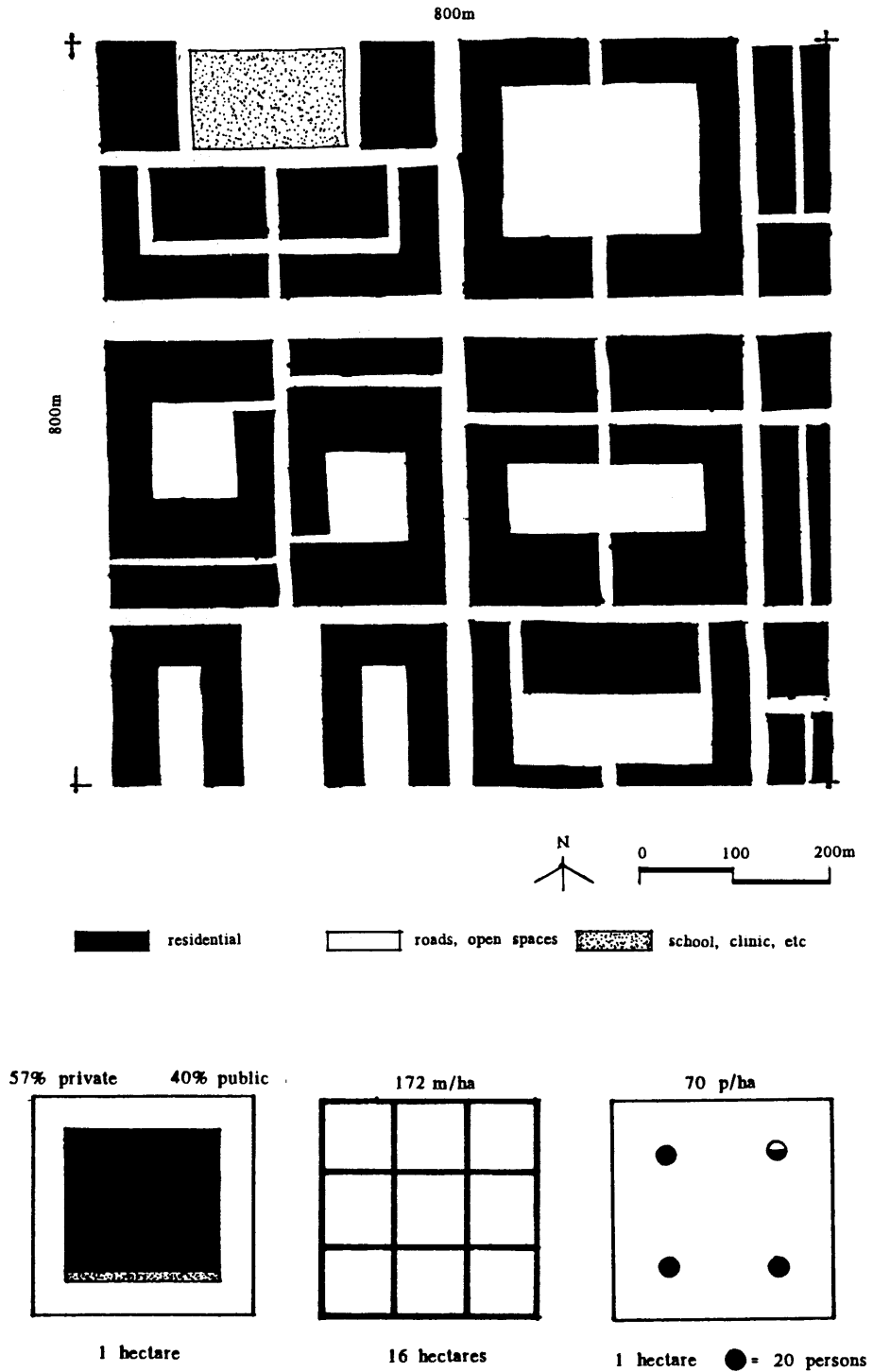


*Photo 10: Al-Riyadh. General View.*



*Photo 11: Al-Riyadh. Major Street.*

*Fig IV.2: Segment in Al-Riyadh and its Land Utilization Indices. Note in Particular the Low Density and the High Percentage of Public Land, i.e., Streets and Open Spaces.*



## 2. AL-AMARAT SECOND-CLASS AREA

This area lies 4 km. to the south-east of the Central Business District of Khartoum. It is bounded on the north by al-Amarat First-Class Area, on the east by Khartoum-Medani highway and the international airport, on the south by vacant land, and on the west by al-Deum East third class area.

It was developed as a second-class sites-and-services extension in the late 1950's and early 1960's. Most homeowners received loans from banks and/or government agencies to build their houses. The area is well developed, except for its southeast edge where some plots are not yet fully developed. (Fig. IV.3 and Photograph 12).

**Income Groups:** High- and upper-middle income.

**Levels of Services:** Individual water and electricity connections, street lighting, telephones, asphalt-paved roads, paved sidewalks, and permanently built and covered run-off drainage ditches.

**Communal Facilities:** Two schools and a third one under construction, a market, numerous private clinics, a church, a mosque (under construction), a central open space designated in the original plan for recreation facilities and apartment/office buildings with shopping facilities on the lower floors, and smaller dispersed open spaces.

**Plot Sizes:** The average plot size is 600 sq.m.

**Dwelling Types:** Dwellings are built in either R.C. frames and baked-brick infill walls, or baked-brick walls and R.C. or corrugated iron sheet roofs. The dwellings are mostly 2-3 story single-family houses, with some 4-5 story apartment buildings (Photographs 13, 14). Some houses were converted into offices rented out by foreign embassies and private institutions.



*Photo 12: Aerial View of Part of Al-Amarat.  
(Source: Sudan Survey Department, 1983).*



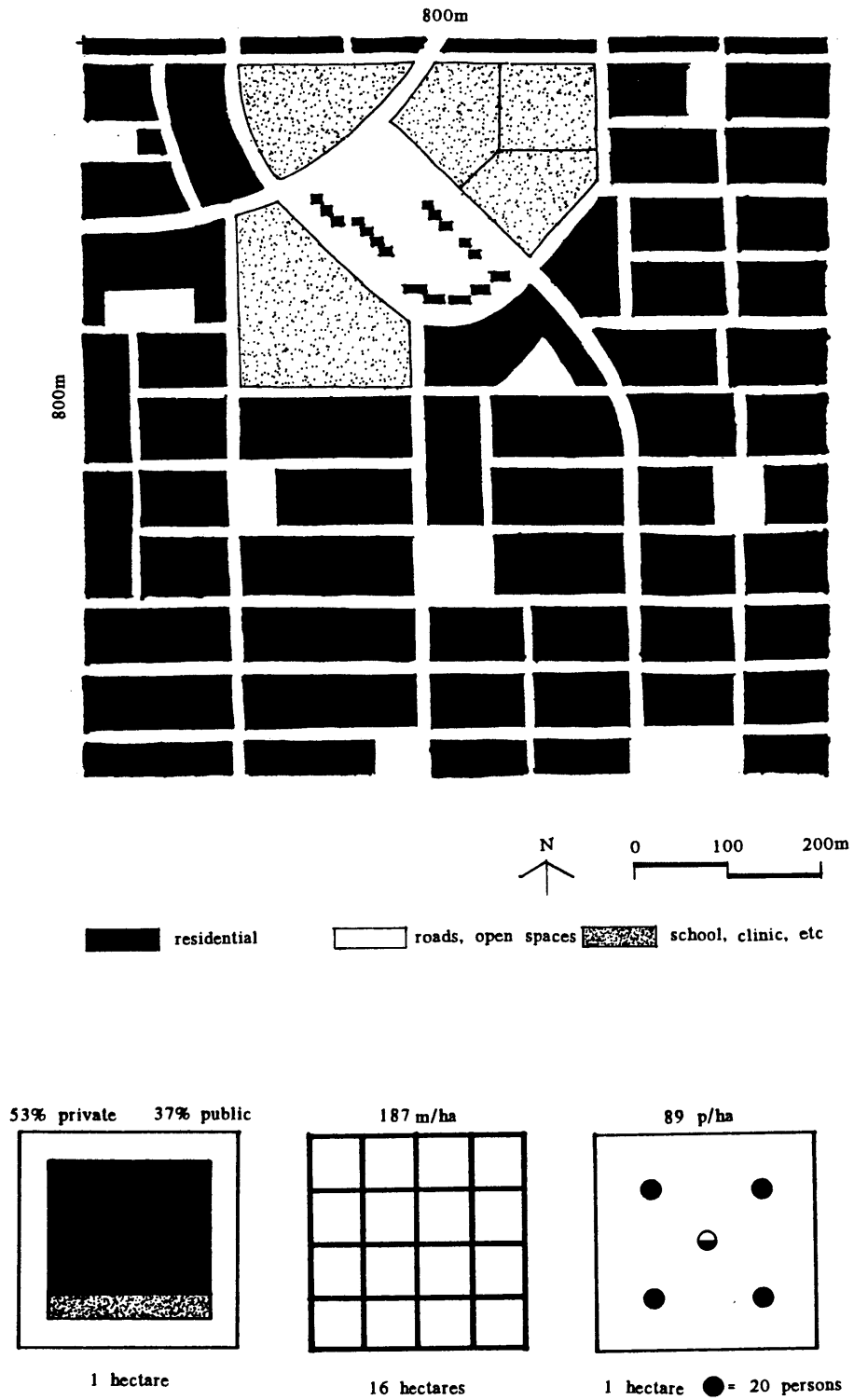
*Photo 13: Al-Amarat. Street View.*



*Photo 14: Al-Amarat. The Vastness of Open Spaces Precludes their Confinement to More Dwelling-Related Functions.*



Fig IV.3: Segment in Al-Amarat and its Land Utilization Indices.



### 3. AL-MAHDIYYA AL-HARA 2 THIRD-CLASS AREA

This area lies 10 km. to the north-west of Khartoum Central Business District. It is bounded on the north by al-Hara 5, on the east by a newly-developed first-class area, on the south by an open space and a cemetery, and by a major road and al-Hara 1 on the west.

It is one of six *harat* (neighborhoods) that form the town of al-Mahdiyya, which was realized as a northern extension of the old city of Omdurman in the late 1950's. It was developed as a third-class sites-and-services extension for middle and low-income people. The area is fairly developed with all the houses completed and inhabited for more than 20 years. It has a center that contains schools, a market and other communal facilities; and four sub-centers each composed of an open space and few shops. (Fig. IV.4 and Photograph 15)

**Income Groups:** Middle- and low-income.

**Levels of Services:** Individual water and electricity connections, street lighting, telephones, open run-off drainage ditches, and compacted major roads.

**Communal Facilities:** Two primary schools, one high school serving a larger region, a club, a mosque, a market, open spaces, and an area reserved for a health center.

**Plot Sizes:** Plots range between 500 and 600 sq.m.

**Dwelling Types:** Single-story single-family houses predominates. Most houses are built of baked-brick walls with either corrugated iron sheets or timber roofs. (Photograph 16, 17)



*Photo 15: Aerial View of Part of Al-Mahdiyya.  
(Source: Sudan Survey Department, 1983).  
Note the Multiplicity and Vastness of Open Spaces.*

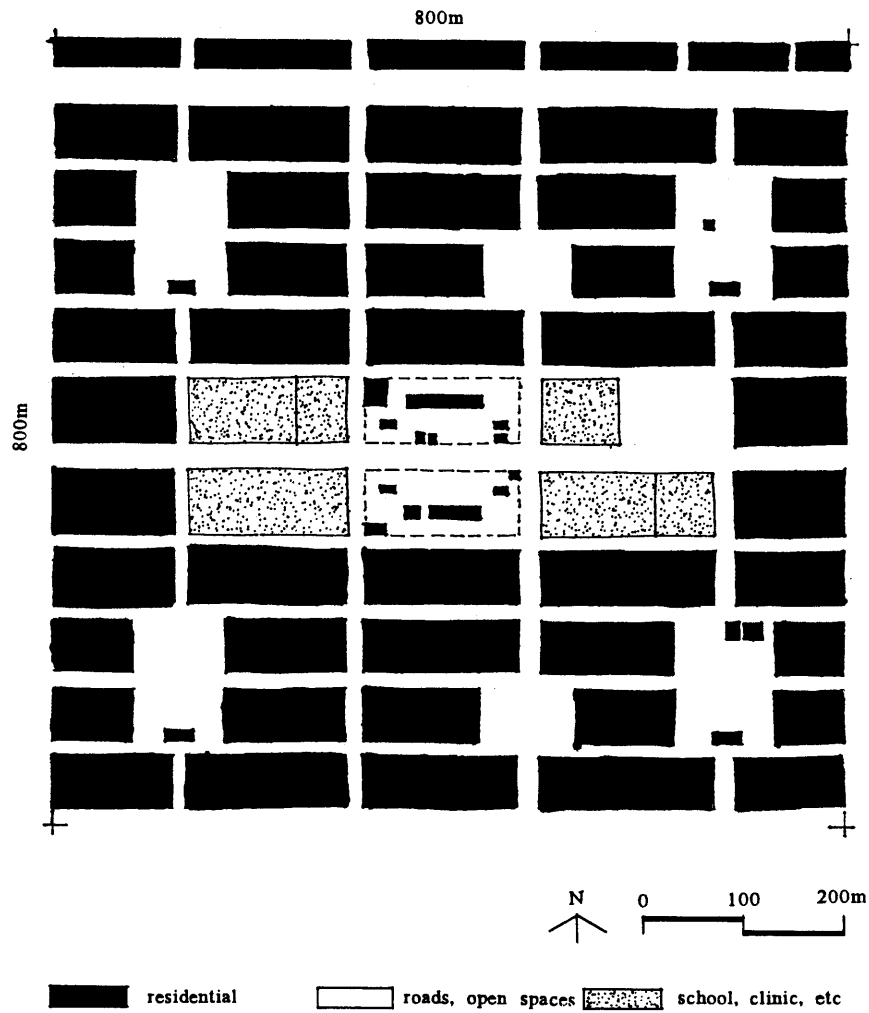


*Photo 16: Al-Mahdiyya. When Left Open, Main Drainage Ditches Form Physical Barriers Between Dwellings, and Act as Dumps.*

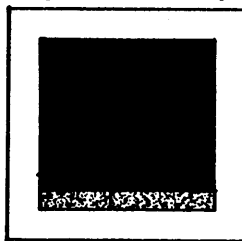


*Photo 17: Al-Mahdiyya. A Residential Street.*

Fig IV.4: Segment in Al-Mahdiyya and its Land Utilization Indices.

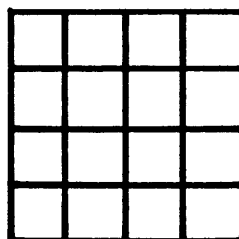


51% private 43% public



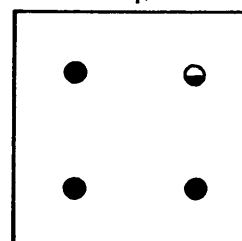
1 hectare

204 m/ha



16 hectares

70 p/ha



1 hectare ● = 20 persons

#### 4. AL-DEUM EAST THIRD-CLASS AREA

This area is located 4 km. to the south of Khartoum Central Business District. It is surrounded by Hai al-Zuhur to the north, al-Amarat First- and Second-Class areas to the east, Khartoum Polytechnic to the south, and al-Hilla al-Gadeeda to the west.

It was developed in the early 1950's to house low-income people who have been relocated from the area south of Khartoum railway station when this area was designated in 1949 as first- and second-class extensions of the colonial city.<sup>1</sup> Each 40-52 houses form a "cluster" with a 2100-2500 sq.m. open space. Larger open spaces and communal facilities are dispersed within the area (Fig IV.5 and Photograph 18).

**Income Groups:** Low- and lower-middle income.

**Levels of Services:** Individual water and electricity connections, open run-off drainage ditches, and untreated road surfaces.

**Communal Facilities:** Primary, intermediate and high schools, mosques, market, fire-wood market, health center, and numerous open spaces.

**Plot Sizes:** Most plots are 200 sq.m. in area.

**Dwelling Types:** Predominantly single-story houses built of mud- and/or baked-brick walls, and corrugated iron sheets or "traditional" timber roofs (Photographs 19, 20). There are few multi-story buildings along the main asphalt roads on the eastern and western edges, and apartment blocks at the south-east corner.

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<sup>1</sup> Abu Salim, M. I. *op. cit.* p 162.



*Photo 18: Aerial View of Part of Al-Deum.*

*(Source: Sudan Survey Department, 1983).*

*Note in Particular the Excessive Width of Streets and the  
Multiplicity of open spaces.*



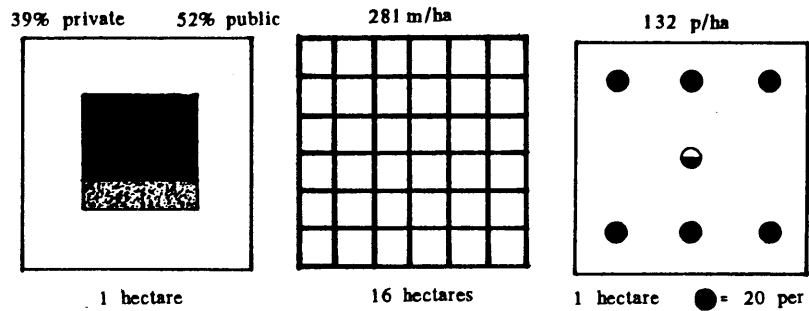
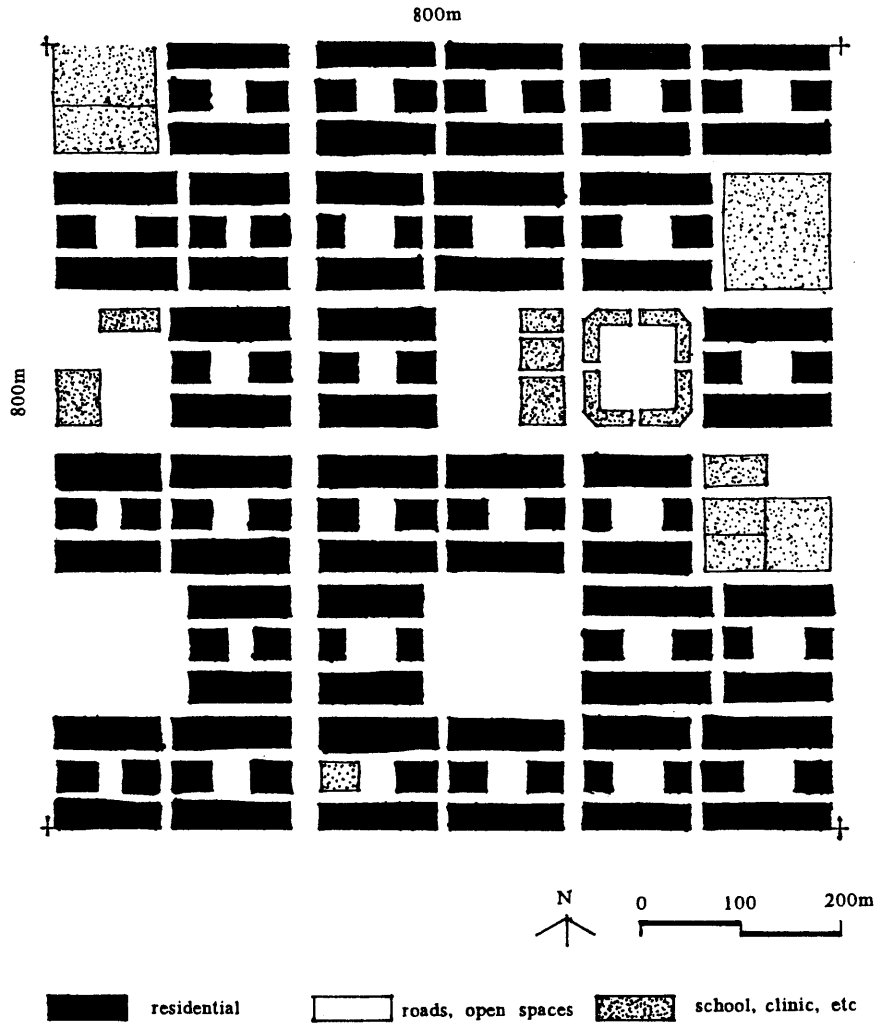
*Photo 19: Al-Deum. A Residential Street.*



*Photo 20: Al-Deum. One of the Rare Cases Where a Structure has been Erected in One of its Numerous Open Spaces.*



*Fig IV.5: Segment in Al-Deum and its Land Utilization Indices. Note the High Percentage of Public Land and the Long Circulation Network. This is the Only Case Which Shows a Relatively High Population Density.*



## 5. OLD OMDURMAN THIRD-CLASS AREA

This part of Old Omdurman lies six km. to the northeast of Khartoum's Central Business District. It includes parts of Wadnubawi, Bait al-Mal, Al-Rikabbiyya, Hai al-Kashif, and Abdalla Khalil.

Intensive urbanization in this area began in the 1880's when Omdurman was made the capital of the Mahdiyya state. The development progressed in a piecemeal manner with no definite plan and minimal restrictions on land acquisition. Plots of 1000-2000 sq.m. are not uncommon in the area (Fig IV.6 and Photograph 21).

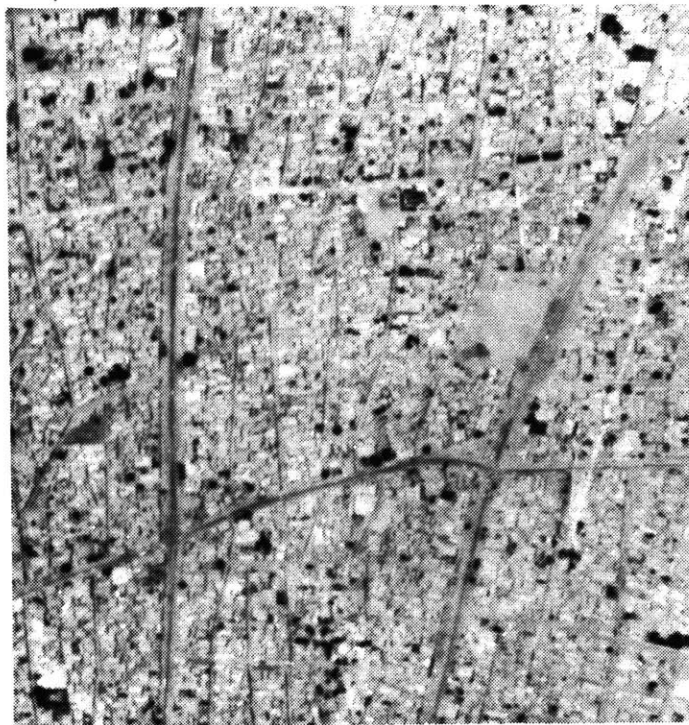
**Income Groups:** Mainly middle- and low-income.

**Level of Services:** Individual water and electricity connections, open run-off drainage ditches, street lighting, paving on major roads only.

**Communal Facilities:** Two schools, two mosques, an old cemetery, and two open spaces.

**Plot Sizes:** 500-2000 sq.m., with an average area of 700 sq.m.

**Dwelling Types:** Mainly single-story houses housing extended families. Mud- and/or backed-bricks are the main building materials for walls, as are corrugated iron sheets and timber for roofs. Many houses have been upgraded and subdivided into smaller multi-family dwellings (Photographs 22, 23).



*Photo 21: Aerial View of Part of Omdurman.  
(Source: Sudan Survey Department, 1983).*

*Note the Dense Land Utilization and the Irregularity of the Street Network.*

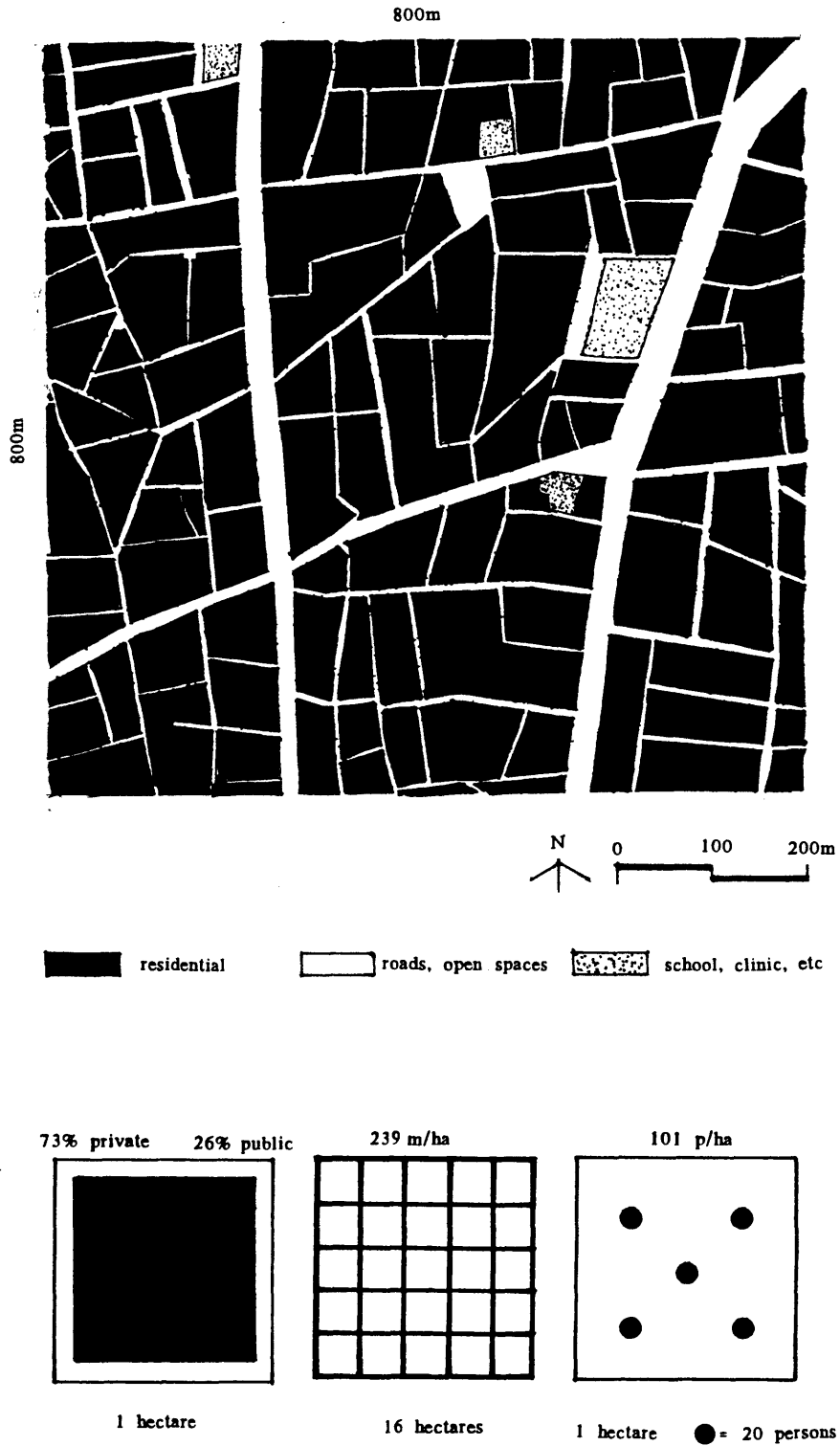


*Photo 22: Compared to the Previous Cases, the Street Width in Old Omdurman is More Adapted to its Utilization and to the Harsh Climate.*



*Photo 23: Omdurman. A Street View.*

*Fig IV.6: Segment in Omdurman and its Land Utilization Indices.  
Note the High Percentage of Private Land and  
the Long Circulation Network.*



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