URBAN DWELLING ENVIRONMENTS IN RAPIDLY GROWING CITIES

Case Study: Khamis Mushait, Saudi Arabia

BY

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B.Arch., Riyadh University

(1977)

SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE

DEGREE OF

MASTER OF ARCHITECTURE IN ADVANCED STUDIES

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

May, 1979

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Submitted to the Department of Architecture
on May 11, 1979, in partial fulfillment of the requirements
for the degree of Master of Architecture in Advanced Studies

ABSTRACT

This study presents three dwelling environments in the city of Khamis Mushait, Saudi Arabia. It provides a reference for the understanding of the low/middle/income housing and its environment. It offers a reference base for tackling realistically low/middle income housing and its services and infrastructure. It can orient decision makers in optimizing the allocation of financial resources in housing, housing improvement and urban developments.

Finally, it assists in formulating and evaluating housing policies by illustrating, analyzing, evaluating and comparing the present physical structure of the housing systems and land utilization and especially in physical planning aspects.

Thesis Supervisor: .....
Horacio Caminos
Title: Professor of Architecture

ACKNOWLEDGEMENTS

The author wishes to acknowledge the support, guidance and cooperation of Professor Horacio Caminos, whose direction was invaluable for the preparation of this work. The author is also indebted to Mr. Reinhard Goethert for his personal assistance.

The author is also indebted to Riyadh University, Saudi Arabia, for its scholarship award which assisted him in carrying out his higher studies at the Massachusetts Institute of Technology.

The author gratefully acknowledges the information and assistance received from the following institutions/officials in Saudi Arabia: Ministry of Municipal and Rural Affairs, Ministry of Petroleum and Mineral Resources; Department of Aerial Photognometry, Ministry of Information, Ministry of planning, Department of General Statistics of Ministry of Finance and National Economy, Principality of A'sir, Ministry of Public Work and Housing, and the Saudi Arabia Educational Mission to the U.S.A. and to Mr. Ebrahiem Al-Dahan, Dr. Abdullah Al-Shuibi, Mr. Suliman Al-Rubiesh, and to Mr. Abdul Aziz Ibn Melha.

Finally many thanks to Ivonne Downing La Riva for her help in drawing and typing, Fouad Tashkandi, and to all who directly or indirectly contributed to this work whose names were not mentioned.

F.K.T. Cambridge, May 1979.

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PREFACE

CONTENT: This is a study on residential land utilization and identification of dwelling environments for the low/middle income groups based on field surveys and evaluation of three existing localities selected from the Southern Region's largest city. The case studies provide first hand material with which basic patterns can be identified in different aspects of the housing environment in the context of rapid urbanization in Saudi Arabia.

OBJECTIVES: a) To illustrate, analyze, evaluate and compare the present physical structure of housing systems and land utilization in Khamis Mushait, in relation to social, economical, and cultural conditions. b) To stimulate the formulation of more realistic and effective policies concerning utilities/ services and facilities regarding low/middle income housing. c) To add updated information, data and guidelines for planners, architects, policy makers, students as well for the firms for a clearer understanding of the user and his dwelling environment in the country.

APLICATION: This research offers a reference for understanding and dealing realistically with low/middle income housing, by taking advantage of existing housing and its service infrastructure. It can orient decision makers in optimizing the allocation of financial resources in housing, housing improvements and urban development.

DATA: This study is derived from field research carried out by the author during the summer 1977-1978 and during under graduate studies in Riyadh University 1971-1976; complemented by maps, aerial photographs and bibliographic materials. The case studies analysis is based on a methodology developed in the Urban Settlement Design in Developing Countries, directed by Professor Horacio Caminos at the Massachusetts Institute of Technology. This study is the third of its kind undertaken in the same program related to the housing situation in the country following a study in Riyadh in 1975 and in Jeddah in 1977.

CONTENTS

INTRODUCTION

The Urban Dwelling Environments in Rapidly Growing Cities is intended as a contribution toward a better understanding of the relationship between people and their dwelling places in the context of rapid social changes. Rapid population growth, accelerating industrialization, depletion of nonrenewable resources, wide-spread malnutrition, rapid urbanization, housing shortages, increased control of land use, over extended urban services, buildings designed by government agencies, and implementation of urban developments by large scale organization are becoming a common indication of the environment condition today and are apparent in all regions of the world. These problems are further aggravated because economical and political systems are unstable, and social well being is a privilege of a minority usually in power, the low and very low income sectors of the population are the most affected by the urbanization process. They constitute the largest majority of the population, particularly in the so-called developing countries, and they have the most urgent needs in terms of food, health care, education and shelter.

Cities are rapidly growing in size and population, along with the social, political and economical institutions that produce and maintain them; the area for personal and local control is diminishing; the conflict between environment and human needs is growing. Without adequate knowledge of the determining factors, planning of the environment is becoming increasingly superficial, irrelevant and, in short, impotent to deal with the environmental problems of poverty and wealth.

The population will tend to increase in the near future which demands more and better dwelling environments. Radically new forms for cities are being proposed within economics that, in theory at least would lower their costs. If investment priorities significantly change in the coming years, or if modes of communication continue to change as rapidly as they have in the past, the form of future dwelling environments may be as different for the wealthy as for the poor.

As a result of the tremendous growth of the Saudi Arabia's economy, cities are growing radpidly, causing critical problems in terms of housing and its related infrastructure, especially for the low-income population. Land speculation, lack of infrastructure, and misuse of land are common problems.

To ease the pressure on public utilities and municipal services in urban areas, the government of Saudi Arabia has been pursuing the implementation of the Second Development Plan (1975-1980). Various new Ministeries were created: in 1975 the Ministry of Housing and Public Works, in 1975 the Ministry of Municipal and Rural Affairs. Other institutions have also been created including the Real Estate Development Fund which grants interest-free and subsidized long-term loans; and the Saudi Real Estate company.

Khamis Mushait, the largest city in the Southern region, is an example of a rapidly urbanizing area, where the living conditions and the physical environments are rapidly deteriorating for the majority of the population.

As a result, most of the residents of the city live in old or substandard housing with limited services.

Khamis Mushait is becoming a receiving place for the rural migrants who are seeking employment opportunities, and is experiencing rapid changes particularly in urbanization. These changes are in the physical structure as well as in the socio-economic structure of the community. These changes have taken place because of a high and rapid growth of the country's oil revenue, rapid growth of the population, increase number of vehicles and the introduction of new technologies. The consequences of these changes are: high demand for facilities and utilities/services; deterioration of traditional settlements, changing of traditional patterns, increase of land value, demand on building materials/ labour and construction industry, increase of social stratification, and decline of agricultural land.

Three existing settlements are analized which represent the prevailing housing systems at the time of the survey:

TRADITIONAL SETTLEMENT: It is the origin of the city, its offers direct pedestrian access to market, employment, family and related to climate/cultural/social values with an unequaled vitality. They are rich in social interaction and participation. However, they tend to lack of proper sewage disposal, and refuse collection services. Hence people are moving out to the new areas, leaving it for the low income groups and for the new comers.

In recent years, this pattern has been changing because of the introduction of vehicles. Islam emphasizes community relationship which is reflected on the land, creating an identical pattern. The houses provide privacy and protect their dwellers from the eyes of the outsiders. These requirements lead to the development of a double circulation system and separation of the house into family and guests section, private and public respectively. This settlement is tending to diminish as a result of deterioration, demolishing, and replacement by new concrete buildings. It has very good land utilization and an acceptable population density.

NEW PLANNED SETTLEMENT: A stereo-type pattern with better services but it requires vehicle use. This area is developed in the same pattern of the economically-developed countries without much consideration to the local cultural and physical characteristics. Thus the privacy was not stressed in the planning and design of residential areas. It has poor land utilization resulting in a higher public cost disproportionate to population served.

SQUATTER SETTLEMENT: This is a consequence of the struggle for shelter, it is the only alternative of the rural migrant/nomadic settlers who come to the city looking for job opportunities. Land is occupied, subdivided, and soon covered with shelters, built by the occupants solely with their own effort and resources. Dwellings are made of wood frame covered with corrugated metal sheets. It cost is around U.S. $ 1500, and it takes from one week to ten days to be completed. Utilities

and services are neither provided nor anticipated initially. This has become a critical matter. Unplanned urban sprawl and inefficient use of the land have made the provision of utilities and services both difficult and uneconomical. This settlement has the highest lenght of circulation and much public land.

As a matter of fact, the provision of refuse collection is becoming critical, with the existing land-subdivision - resulting in high circulation inefficiency -, the problem will aggravate. Furthermore, it will increase implementation, maintenance and operation costs of water supply, sewage disposal, street lighting, street paving and electricity.

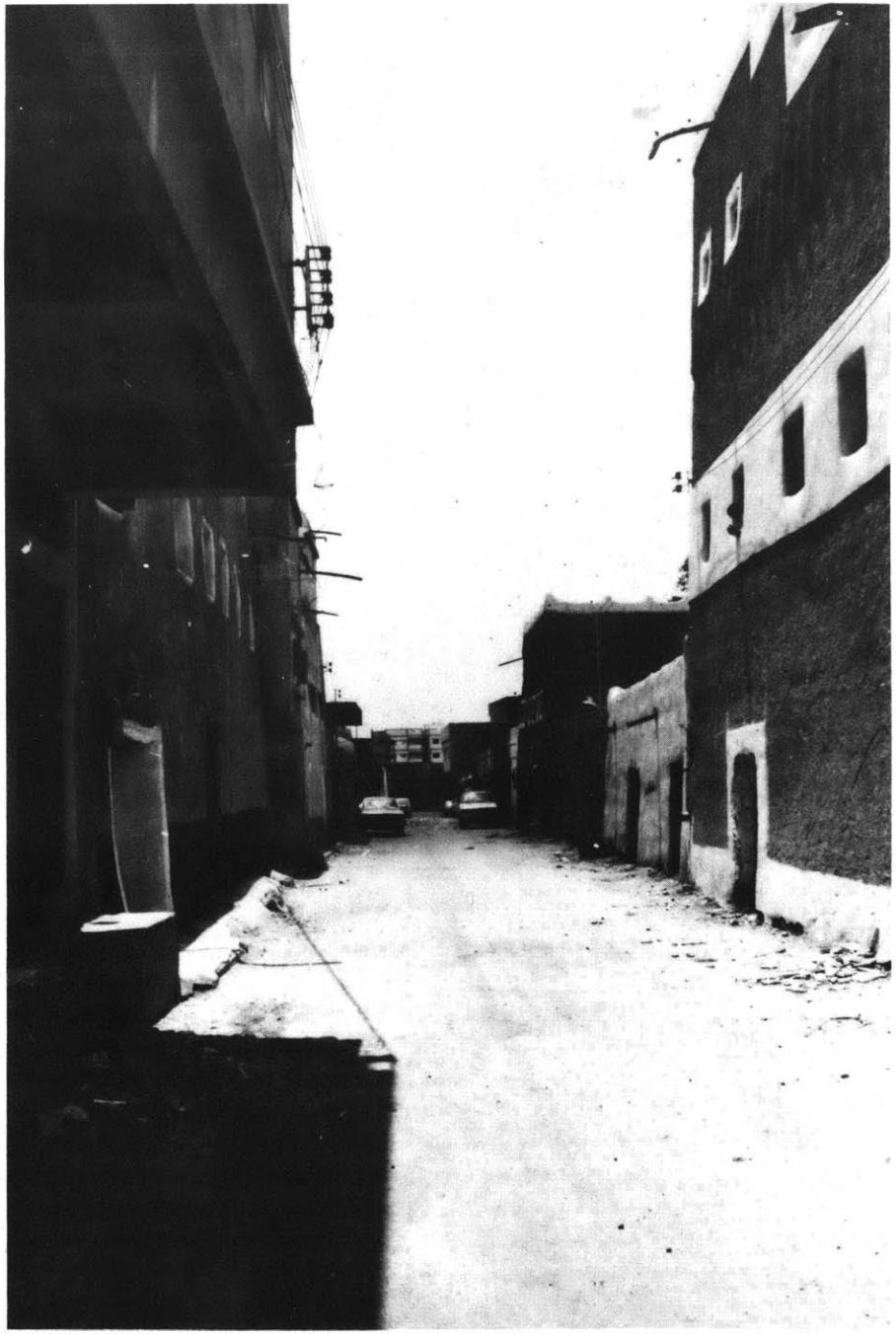
It is clear that technical and professional services and contributions in physical development are badly needed not only in the provision of shelter but also in the crucial areas of land utilization, land distribution and provision, maintenance, and operation of utilities and services.

Eighty per cent or more of the housing in the city is provided by private and popular sectors. The rest is built by interest-free loans. A proposition for 5000 dwelling units is being proposed for the low/middle income population in the area.

In the housing process changes should take place: FROM the provision of luxurios dwellings, at exuberant prices, TOWARD the provision of land and services. FROM government efforts spread over small scale problems of dwellings, TOWARD government efforts concentrated on the basic large scale problems of land and infrastructure. FROM erradication and renewal of "inadequate" dwellings, TOWARD evaluation and upgrading of "inadequate" dwellings.

Attention should be directed toward improving the actual low/middle income housing systems, as well as the traditional one.

It should be clearly understood that the attempt of this study/research is to serve as reference and alternative set of guidelines for those involved in planning of residential developments and formulation of housing policies. It is intended to provide a comparative framework for the analysis and evaluation of existing dwelling environments.

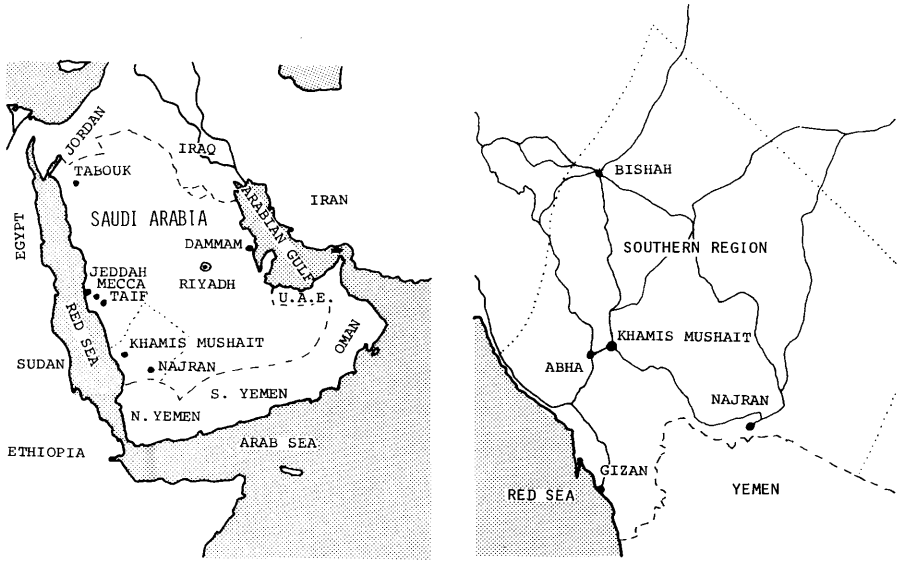


(left) AL-GHAMBER: Traditional row court houses using local materials related to climate conditions and social/cultural values. Note the T.V. antenna.
(right) AL-GHAMBER: Traditional row houses are hardly resisting the pressure of the new trends.

urban context

INTRODUCTION. The following section deals with an urban area/environment within which dwelling/land systems have been developed. The purposes of this section are: to give to the readers, no familiars with the context, a brief panoramical view of it and to provide points of reference and comparison with other urban contexts. It includes: primary information, history, economy, government, demography, socio-economy and housing. Plans are showing: urban topography and circulation, urban growth patterns, urban land use patterns and urban density patterns.

URBAN CONTEXT
Khamis Mushait



1. Khamis Mushait is the largest city in southern Saudi Arabia. It is the re-distribution center for goods trucked in from Jiddah and Riyadh. The city is situated in the geographical center of the southern region which is located in the valley of Bishah (wadi Bishah) at the junction of wadi Atwood. It lies on a flat plain and receives an ample water supply from the two valleys.

Average monthly relative humidity is 43%-80% with predominant winds from the southwest. The city's altitude is approximately 2,000 meters above sea level, providing it with an average high temerature of 33°C and a low of 4°C. Latitude is 18°81'N: Longitude 42°43'E. Rain falls almost every month, predominantly in the spring and summer. The average rainfall is approximately 300 mm per year.

2. Over time, individual settlements appeared along the "wadis". Until the beginning of the twentieth century, these settlements could be described as clusters of villages rather than urban areas. Most of these villages centered around the fortresslike residents of tribal chiefs. The Thursday weekly market (suq al-khamis) provided the primary means of exchanging goods and services. The mosques served not only as places of worship, but as educational and community centers as well. Settlements developed in the northeast corner between the two "wadis" with a slow growth toward the south.

3. Khamis Mushait functions as the leading commercial and manufacturing center of the southern region. It has gained even further importance as the site of a military base. The growth of the city's economic life has been extremly rapid. The economic structure

of Khamis Mushait is agricultural as well as urban and commercial. The 1975 master plan survey showed the following: agriculture; 33.3%, production, 31.5%; services, 7.7%; commercial sales, 8.1%; and teachers, 2.7%. The city imports commodities that are transported both from western and central regions and distributes goods to local residents as well as other major cities and towns in the southern region.

4. Khamis Mushait, formerly a part of the Abha Municipality, became a separate entity in 1970-71. Currently, it is dependent upon Abha administratively, where the town planning office for the region is located. The municipality purchases land from private individuals for both residential development and road construction. Following the acquisition of the land, the streets were constructed and the land was divided into 20 x 20 meter lots for both individual households and community service facilities.

5. During the past ten years, the population growth of Khamis Mushait has advanced rapidly. In 1974, it reached 48,000. The estimated population in 1977 was 60,000. The annual growth rate was 3.8% (estimated in 1974 by Tange and URTEC) and 7% (estimated in 1977 by Scan Plan Sweco).

A sex distribution study carried out by the government in 1974, showed an imbalance, indicating a high proportion of men who were attracted to the city for work. The diagrams showed a high percentage of population under age 20 (50%). This is probably due to the large size of families (6.2 persons per family). This implies that the number of families in 1977 was 9,500. According to the 1974 census, gross density was 67 persons per hectare; net density was 257 p/ha.

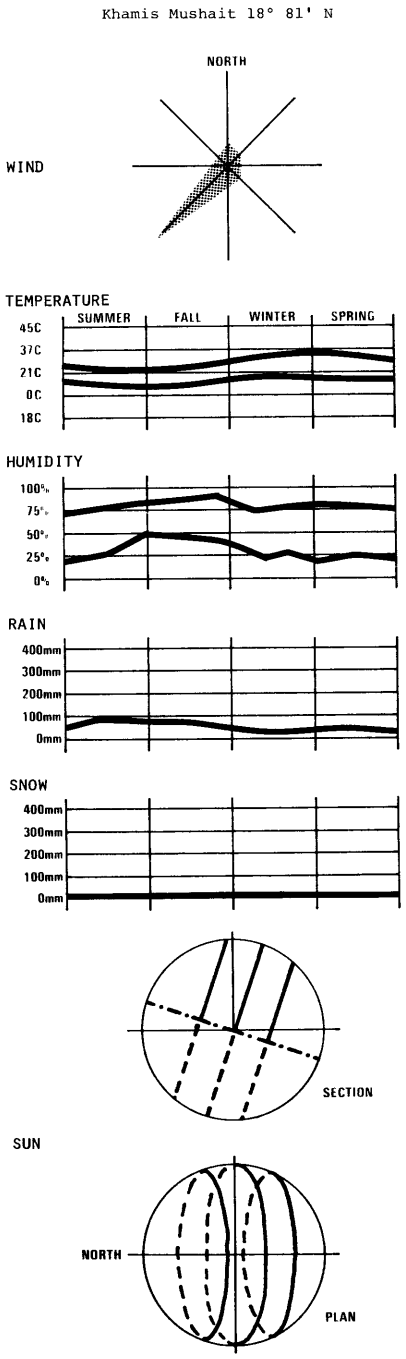
6. The majority of the population of these localities are Moslems. The Saudis comprise more than two-thirds, and the Yeminis constitute the largest foreign minority.

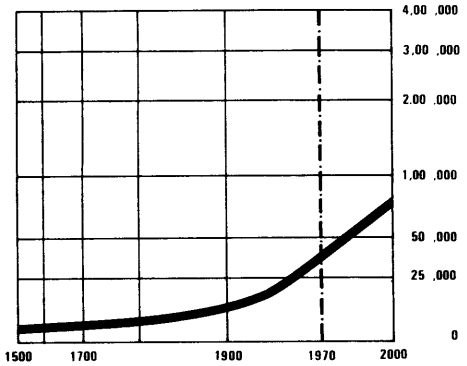
Islam has a strong effect on many aspects of urban living. Privacy is an important cultural value. It is reflected in the design of individual houses as well as in their physical layout. All living spaces, including courtyards, are enclosed by walls. This also affects the socio-economic structure of the

community where the rich and poor live next to each other, each within their own walls. The community, thus created, is reinforced by the presence of a mosque where people gather to pray five times a day. The larger community is reinforced once a week in the Friday prayer at the "Jamià" (mosque).

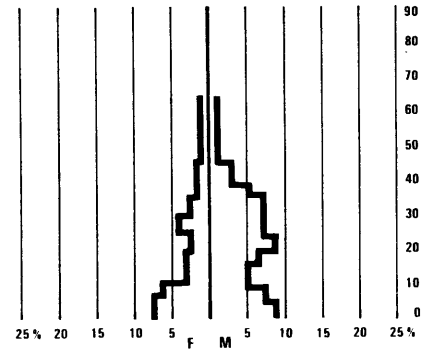
7. The low-income population is faced with the difficulty of finding housing accommodation that offers a reasonable standard of living at an affordable price. Land is in great demand as witnessed by the large number of squatters and temporary settlements east of wadi Bishah. Many areas near the center remain underdeveloped.

A general observation relating to the privacy of the dwellings is that two reception areas are required, one for family use, the other for public use. Most of the rooms are multi-purpose. Houses are one to four floors high; those in the squatter settlements are small one-story structures.

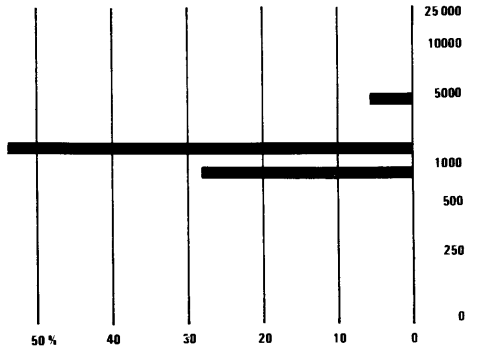




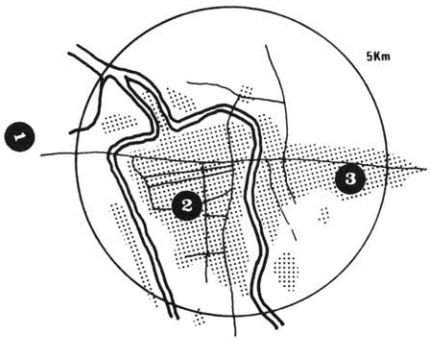
URBAN POPULATION GROWTH
horizontal: dates vertical: population
Source: Ministry of Finance and National Economy



URBAN POPULATION DISTRIBUTION
horizontal: percentages vertical: ages
males: M females: F
Source: Department of General Statistics, 1974 General Census, Ministry of Finance and National Economy

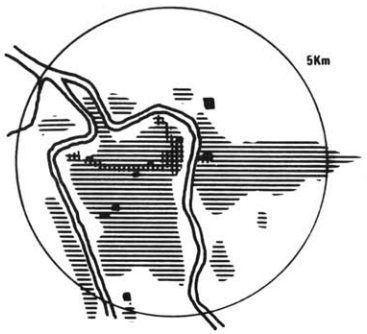


URBAN ANNUAL INCOME DISTRIBUTION
horizontal: percentages vertical: dollars
Source: Master Plan Reports: Kenzo Tange & URTEC



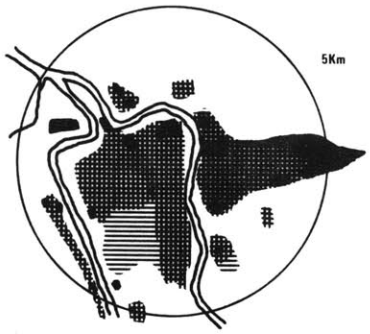
URBAN TOPOGRAPHY AND CIRCULATION

URBAN TOPOGRAPHY AND CIRCULATION: Khamis Mushait was established at the junction of major roads in the southwestern region on a flat plain, bounded by two valleys; wadi Bishah to the northeast and wadi Atwod to the southwest. It lies on the edge of the Asir range and on the western fringe of the highland plateau. Development covers an area of roughly 3.5 km from the north to the south and approximately 5 km from the east to the west. It is accessible to Abha in the west, Najran in the south, and Bishah in the north.



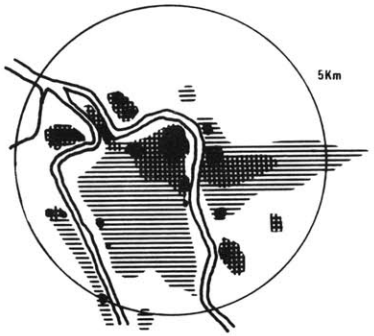
URBAN LAND USE PATTERN

URBAN LAND USE PATTERN: Old residential areas are found along the "wadis", while new development is in the south and east. The old settlements consist mainly of mud houses. Apartment blocks are scattered throughout the urban area; commercial development is along the Abha-Al-Khamis Road, the city center, and the road from the center to Bishah which passes the Al-Gharabah mosque. The industrial area is located to the west along the Abha Al-Khamis Road and to the northeas corner. Agricultural areas are found along both sides of the "wadis"



URBAN INCOME PATTERN

URBAN INCOME PATTERN: The new low-income sector is concentrated east of wadi Bishah. The separation of socio-economic groups did not exist, due to the fact that the Islamic community has integrated the various income groups. As matter of fact the existing traditional settlements united different income residents. Rapid growth of the population and the high demand for the urban lands, resulted in urban income pattern.



URBAN GROWTH PATTERN

URBAN GROWTH PATTERN: The area began as a cluster of villages. The name is derived from the Mushait clan of the Rashid section of Shahran. Most of the Khamis Mushait settlements are clustered around the villages of Addarb and Al-Ghamer in the northeas corner between two "wadis". During the 1950's, the growth was to the south and the west.

With the establishment of a military base, an airport, roads, and commercial activities, Khamis Mushait has developed into a major center for migration, since it has the highest concentration of employment opportunities in the region.

KEY

A Airport

Primary Road

Railroad

Rapid Transit

Built-up Area

1 AL GHAMBER

2 AL KHUTTAH 2

3 AL ARGHAL

AREAS

RESIDENTIAL

COMMERCIAL

INDUSTRIAL

INCOMES

LOW

MEDIUM

HIGH

DATES

1930

1950

1978

0 5 10Km

1:125000

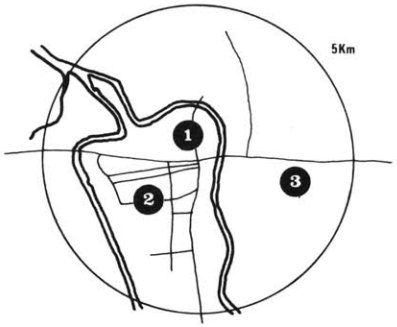
N

(left) A view toward the Friday mosque "Jamia'". This is one of the main commercial streets in the city.
(right) AL-GHAMBER: Contemporary imitation of the traditional houses using cement blocks. Main doors are directly opening to a secondary street, to solve this problem, for privacy purposes, bent entrances were developed.

case studies

INTRODUCTION. This section is concerning with the three selected case studies, which represent the prevailing housing systems at the time of the survey. The purposes of this section are: to illustrate dwelling/land systems in relation to community environment and to illustrate their extent, composition and layout. It also provides a comparative framework, reference for analysis of the existing dwelling environments. They are: Traditional Settlement (old), Planned Settlement and Unplanned Settlement (squatter).

CASE STUDIES



The following section presents case studies of selected dwelling situations in the *Khamis Mushait* urban area at the present time. The three examples were selected according to income group, housing facilities, and urban pattern. The first three maps show the locality of each area in terms of the plan, the land use, and circulation patterns connecting it to the city. Three scales are applied to each case study.

LOCALITY SEGMENT: All the localities differ in size and shape. A segment of 400 x 400 meters has been taken from each locality for comparison purposes.

LOCAL BLOCK: Within each locality segment, a typical residential block has been selected to allow a comparison of land utilization (spatial patterns, percentages, densities, and circulation distances). The block is bounded on all sides by circulation; so that the ratio of circulation to area served may be compared.

DWELLING UNIT: This is defined as a typical self-contained unit for an individual, a family, or a group in each locality segment.

1 - AL GHAMBER

TRADITIONAL SETTLEMENT(OLD)

A traditional settlement. Private, low/middle income residents. Traditional row/grouped houses and new apartment buildings. Acceptable density, large blocks and good land utilization. Located in the northeast corner of the city.

2 - AL KHUTTAH AL THANEIAH

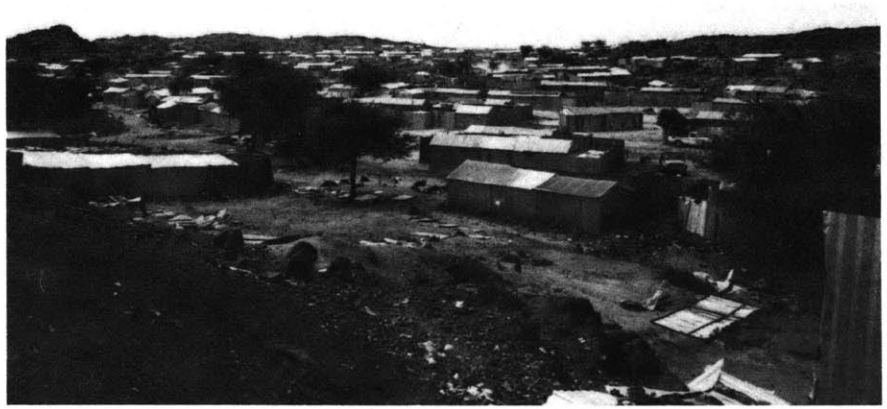
PLANNED SETTLEMENT

A planned settlement. Private, upper income residents. Row and detached houses/apartment buildings. Low density, small blocks and high percentage of public land. Located in the south of the city.

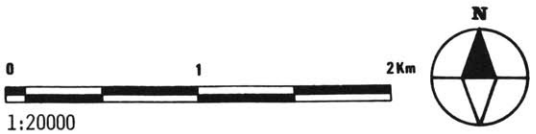
3 - AL ARGHAL

UNPLANNED SETTLEMENT (SQUATTER)

A squatter settlement. Private, low/ income residents. Row/grouped shanties. Acceptable density and high percentage of unused land, and high circulation lengths. Located to the east of Wadi Bishah.



LOCALITIES PLAN



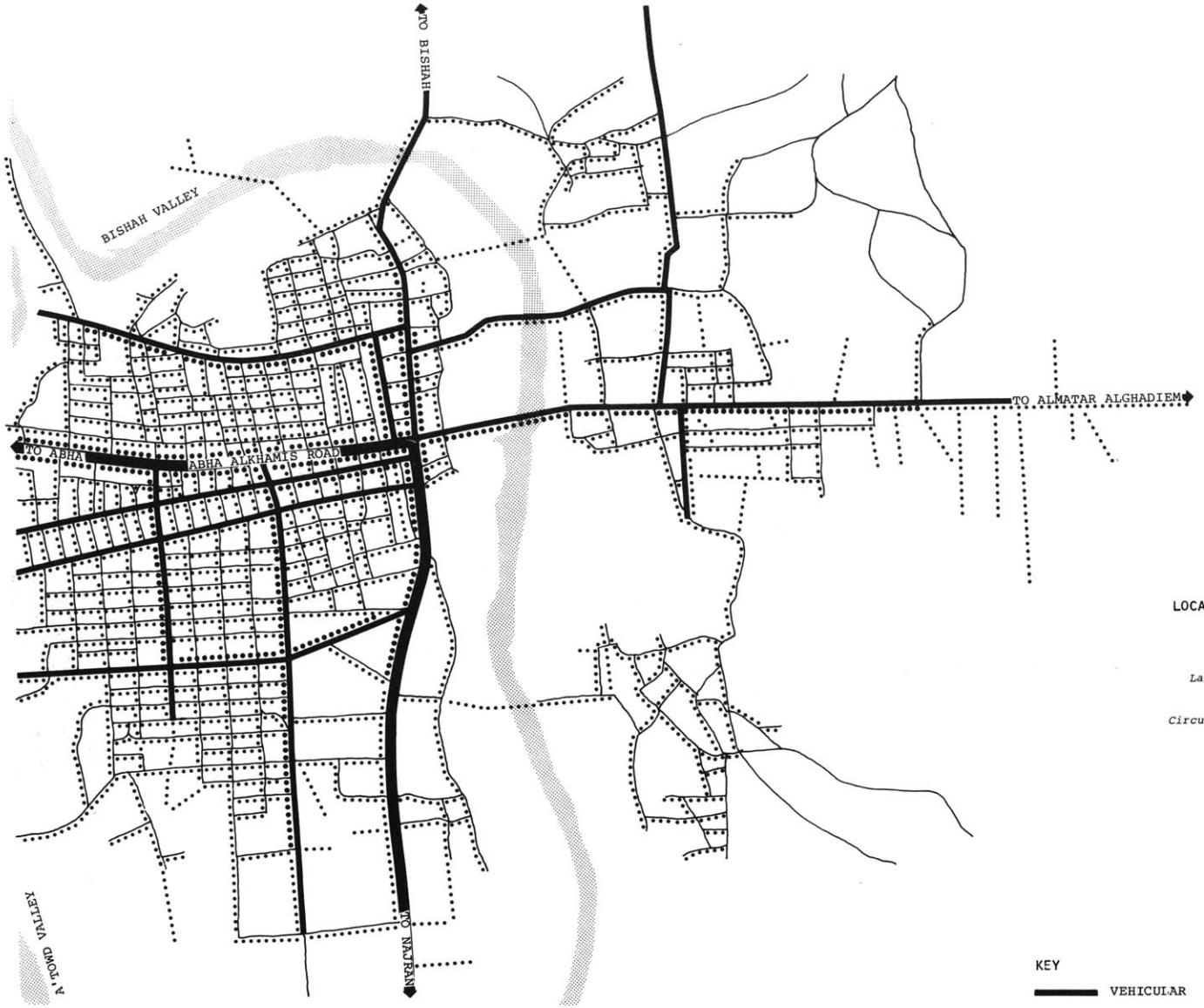
LAYOUT: It is easy to define the traditional settlements by their circulation pattern, land utilization, and types of dwellings. Narrow streets, large blocks and dead-end streets are the predominant features.

The planned/divided land settlements have a grid-iron pattern, with wide straight streets. The blocks are smaller than those in the traditional and squatter settlements where you find small lots and shaties grouped together creating cluster-like patterns.

LAND USE: Commercial activities are concentrated along the main road, the "Khamis Muchait-Abha Road". The main market area is located in the center of the city, north of Al-Jamia' (the Friday mosque). The parking area is located at the old marketplace of Addarb. The city, at the time of the survey, had 15 schools, 23 mosques, 2 hospitals, and various government facilities.

In the traditional settlement, a mosque serves a radius of approximately 100 meters while in the new settlements the radius is much larger. In the three case studies presented here, the schools lacked adequate playgrounds and open space. Furthermore, the schools are not properly located in terms of population density or physical planning.

LOCALITYIES LAND USE PATTERN



CIRCULATION PATTERN: Most of the streets are paved. The main streets are well lit. Congestion is created by the lack of public transportation and the increasing number of private vehicles which require more parking spaces. In addition, parking areas are very limited, causing further congestion on the side streets.

LOCALITIES SOURCES

Plan: *(accurate) Aerial Photographs, Survey Department, Ministry of Municipalities and Rural Affairs, 1974*

Land Use Pattern: *(accurate) Aerial Photograph Map, Survey Department, Ministry of Municipal and Rural Affairs, 1976*

Circulation Pattern: *(approximate) Field Survey, F. Tashkandi*

KEY

VEHICULAR

PEDESTRIAN

N

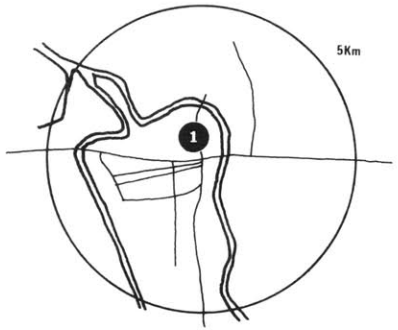
0 1 2Km

1:20000

LOCALITIES CIRCULATION PATTERN

1 AL GHAMBER
Kkamis Mushait

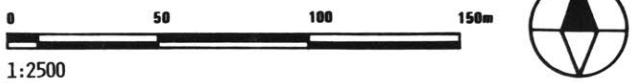
TRADITIONAL SETTLEMENT(OLD)



ORIGIN: Al-Ghamber is located in the northeast part of Khamis Mushait. It is one of the oldest villages situated along *"Wadi Bishah"* (Valley of Bisha). It is located on agricultural land and, along with 18 other villages, makes up the chainlike settlement of *Belah Shahran*. Historically, the area is known as *"Addarb"*, and it is where the Thursday market originally began. At this market, people from different tribes and settlements gathered and furthered their political, social, religious, economic and commercial interests. Due to several factors (namely, the valley, the flat topography, and a junction of major roads in the southwestern region), Khamis Mushait also became a military base, and, therefore, even more important.

LAYOUT: The layout is typically an accretion pattern. After the introduction of the automobile, this pattern has been changing and has taken essentially a straight grid form. The narrow streets have been widened to meet the new demand of the vehicular traffic. This process has destroyed many traditional homes. The oldest part of *"Addarb"* settlement and the weekly market have been replaced by a large commercial and parking area. Mosques are the main public elements and serve a radius of approximately 100 meters.

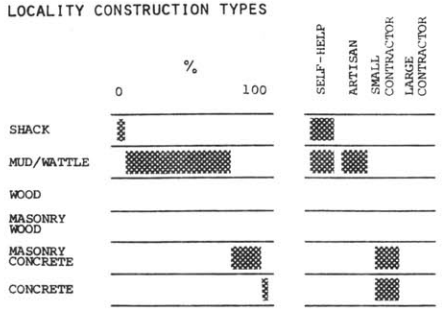
LOCALITY SEGMENT AIR PHOTOGRAPH



1:2500

LOCALITY SEGMENT PLAN

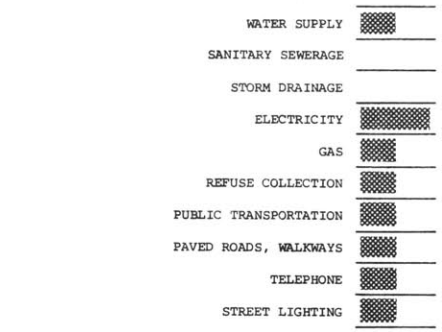
LOCALITY CONSTRUCTION TYPES



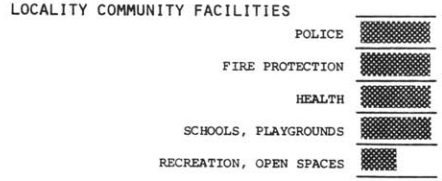
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

LOCALITY UTILITIES AND SERVICES



LOCALITY COMMUNITY FACILITIES



The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate

SELECTED BLOCK

LOCALITY BLOCK: The traditional pattern demonstrates good land utilization in terms of private (lots), semi-private (access to inner lots) and public (streets). Lot sizes vary, since the locality is inhabited by different income groups.

LOCALITY BLOCK LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	29	0.7	41
DWELLING UNITS	30	0.7	43
PEOPLE	202	0.7	289

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	0.15	17
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	0.52	77
SEMI-PRIVATE (cluster courts)	0.03	05
TOTAL	0.7	100

NETWORK EFFICIENCY

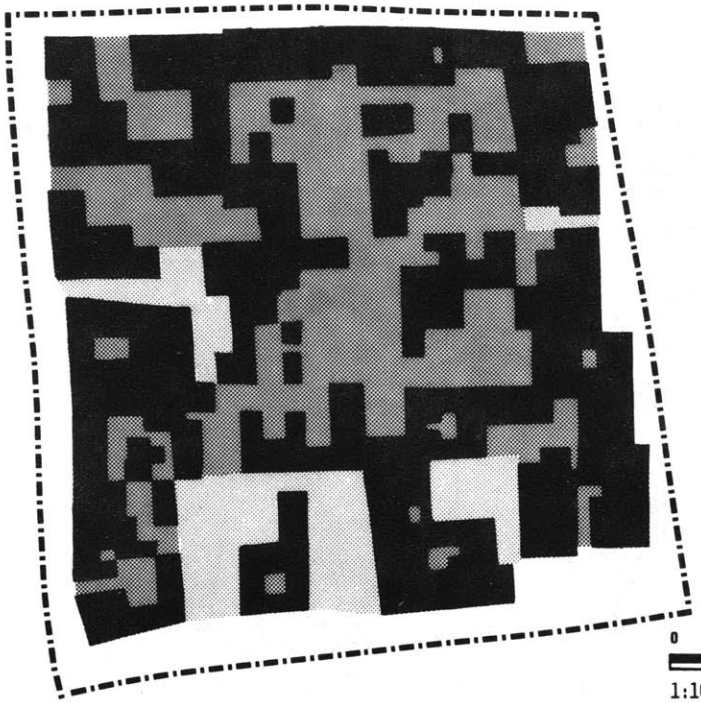
$$\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 243 \text{ m/Ha}$$

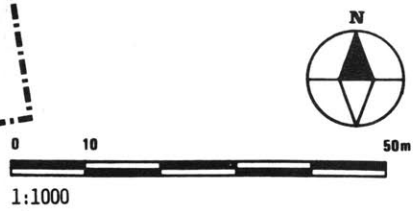
LOTS

Average area, dimensions = 233 m^2

1:1000

LOCALITY BLOCK PLAN

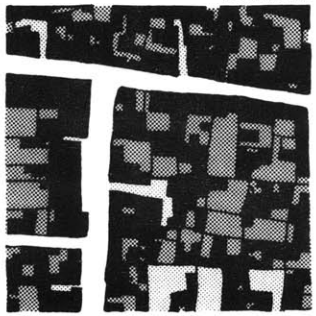




LOCALITY BLOCK LAND UTILIZATION

LAND UTILIZATION DIAGRAMS

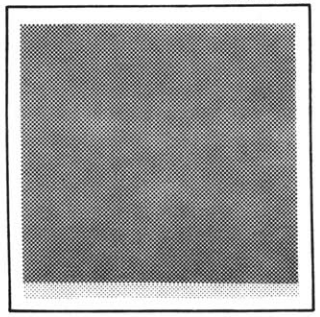
1 Hectare



PATTERN

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

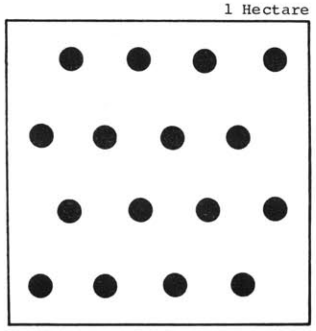
1 Hectare



PERCENTAGES

Streets/Walkways	18%
Playgrounds	00%
Cluster Courts	05%
Dwellings/Lots	77%

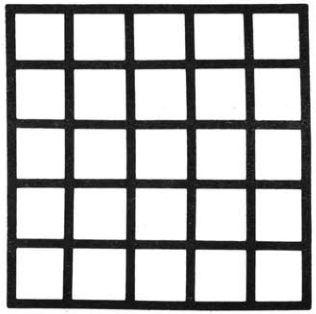
1 Hectare



DENSITY Persons/Hectare 289

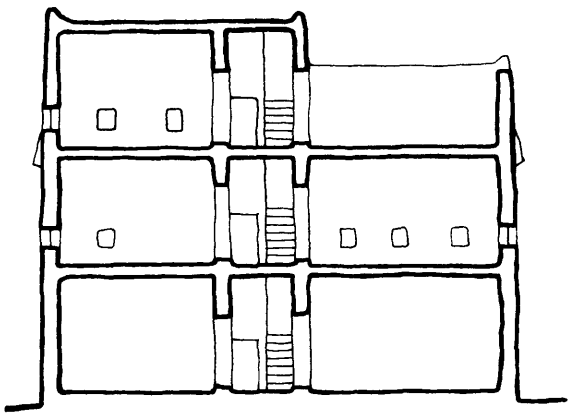
20 Persons

16 Hectares

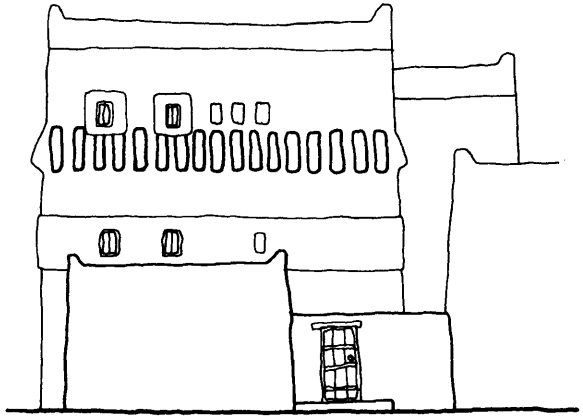


CIRCULATION EFFICIENCY 243

Meters/Hectare



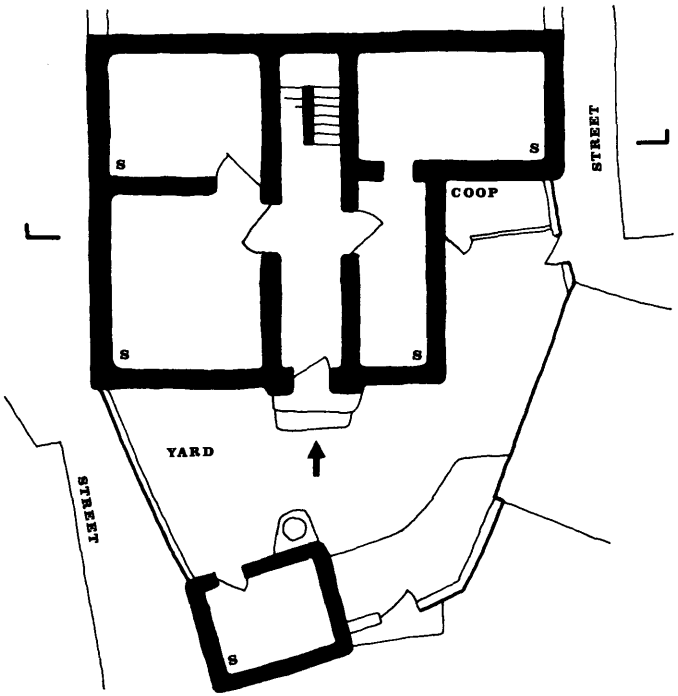
SECTION



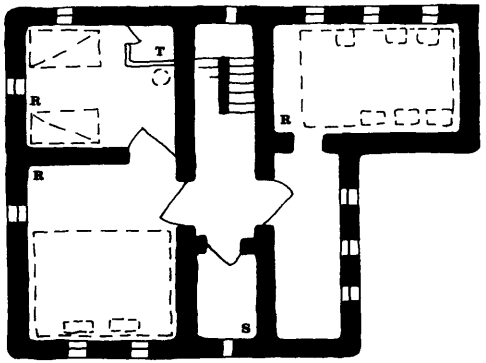
ELEVATION

DWELLINGS: According to Islamic tradition dwelling space is divided into separate areas for guests and family, public and private respectively. Two and three-story houses are more common than single-story homes. If a house has only one floor, the guest/family, public/private division is accomplished and reinforced by a courtyard. In a two-story dwelling, the public area is situated on the first floor, where guests are received. If an upper floor is added, the first floor becomes a storage area or place to keep the animals, and the second floor becomes public, leaving the upper story for private use.

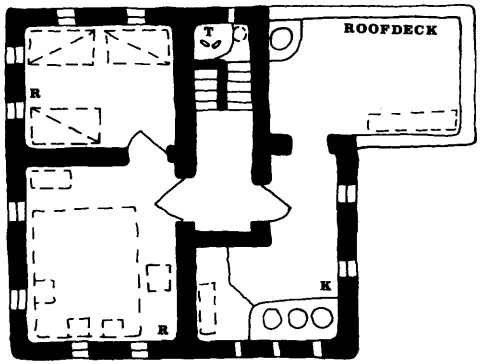
PHOTOGRAPHS, opposite page:
TRADITIONAL SETTLEMENT: (left) Children playing peacefully in the community open area surounded by two to three traditional houses.
(right) Three storey traditional house very well designed to meet the climatical and traditional requirements, roof deck widely used here facing south-east where the T.V. antenna is emerging.



GROUND FLOOR PLAN



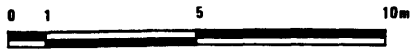
FIRST FLOOR PLAN



SECOND FLOOR PLAN

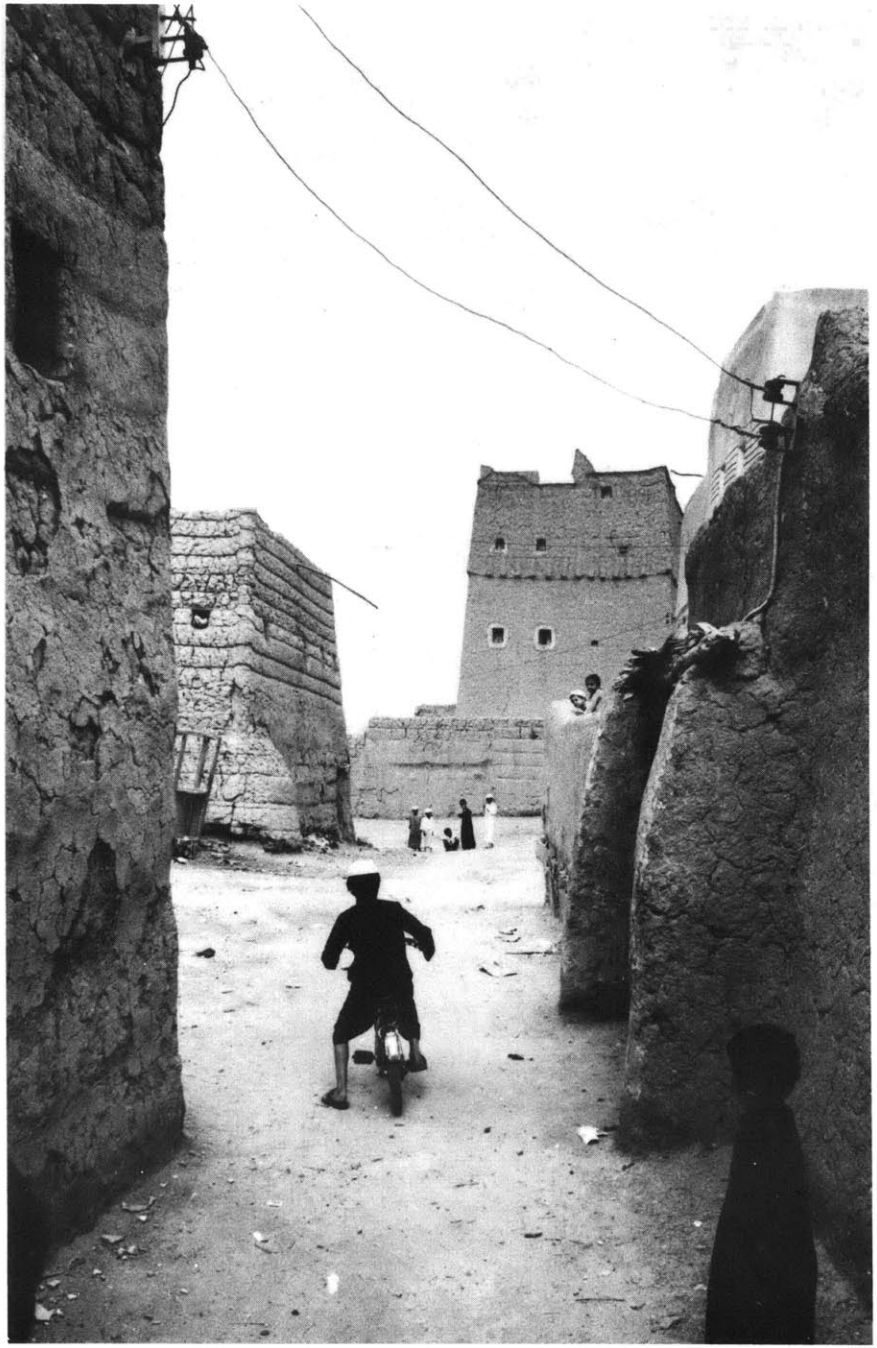
KEY

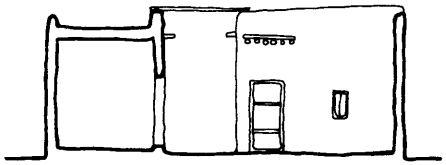
B Bedroom
G Guest room
R Room (multi-use)
S Storage
T Toilet



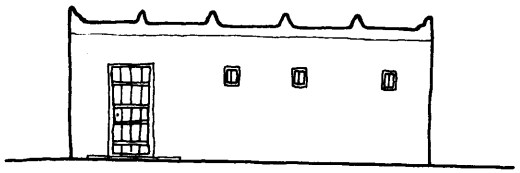
1:200

TYPICAL DWELLING

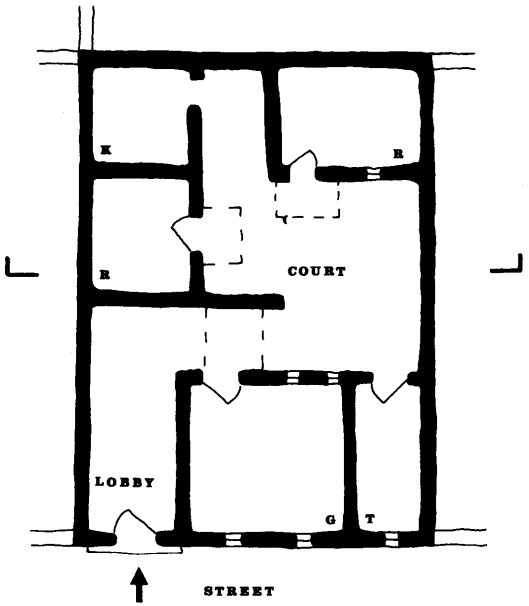




SECTION



ELEVATION



PLAN

KEY

B Bedroom
G Guest room
R Room (multi-use)
S Storage
T Toilet

CASE STUDY SOURCE

Segment Plan:	*(accurate) Aerial Photograph, Department of Aerial Photogn-ometry, Ministry of Petroleum and Minerals*
Block Plan:	*(accurate) IBID*
Block Land Utilization:	*(accurate) IBID*
Typical Dwelling:	*(approximate) Kenzo Tange & URTEC Existing Condition: Khamis Mushait, 1976* *(approximate) Farhat K. Tashkandi, Field Survey, Summer 1978*
Physical Data:	*(approximate) Farhat K. Tashkandi, Field Survey, Summer 1978*
Socio-Economic Data:	*(approximate) F.K.Tashkandi, Field Survey, Summer 1978*
Photographs:	*Farhat Khourshid Tashkandi, Field Survey, Summer 1978*
Other Information:	*F. K. Tashkandi, Architectural Department, College of Eng., Riyadh University, 1972-77*

0 1 5 10m

1:200

TYPICAL DWELLING

PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT	
type:	HOUSE
area (sq m):	122
tenure:	LEGAL RENTAL
LAND/LOT	
utilization:	PRIVATE
area (sq m):	122
tenure:	LEGAL OWNERSHIP
DWELLING	
location:	INNER RING
type:	ROW/GROUPED
number of floors:	1
utilization:	FAMILY
physical state:	FAIR
DWELLING DEVELOPMENT	
mode:	INCREMENTAL
developer:	PRIVATE
builder:	ARTISAN
construction type:	MUD-WATTLE
year of construction:	N.A.
MATERIALS	
foundation:	RUBBLE
floors:	EARTH
walls:	LAYERS OF MUD
roof:	WOOD/MUD
DWELLING FACILITIES	
wc:	1
shower:	-
kitchen:	1
rooms:	3
other:	LOBBY, COURT

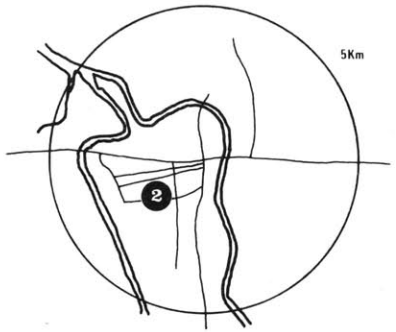
SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL	
user's ethnic origin:	SAUDI FROM RURAL
place of birth:	BADALAH
education level:	NONE
NUMBER OF USERS	
married:	2
single:	2
children:	8
total:	12
MIGRATION PATTERN	
number of moves:	1
rural - urban:	X
urban - urban:	-
urban - rural:	-
why came to urban area:	WORK (CARPENTER)
GENERAL: ECONOMIC	
user's income group:	MIDDLE
employment:	GOVERNMENT EMPLOEE
distance to work:	0.5 Km.
mode of travel:	WALKING
COSTS	
dwelling unit:	N.A.
land - market value:	U.S.$ 30,000
DWELLING UNIT PAYMENTS	
financing:	SELF-FINANCED
rent/mortgage:	N.A.
% income for rent/mortgage:	N.A.

PHOTOGRAPHS, opposite page:
AL-GHAMBER: (top) Traditional row houses, with courts and narrow streets,provide shaded areas. Note the T.V. antenna.
(left bottom) Semi private area provides indirect access to dwelling as well as play area for children.
(right bottom) A iew of the bent entrance and the wall which separates the private area (family) from the guest area. Doors and windows open to the court.

2 AL KHUTTAH AL THANEIAH Khamis Mushait

PLANNED SETTLEMENT

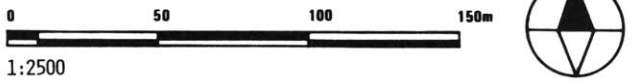


ORIGIN: Al-Khyttah Al-Thaniyah is located south of the Abha Al-Khamis road. It was developed in response to the demand for residential land when concrete construction was introduced to the area. It took on a grid-iron pattern to help meet the invasion of motor vehicles.

LAYOUT: The layout of the area is that of a grid-iron, developed in much the same fashion as in economically developed countries, without much consideration given to local cultural and physical characteristics. Blocks are smaller, divided into 20 x 20 meters, then into 20 x 10 meters and 10 x 10 meters for corner lots. Schools and mosques are scattered throughout this area without any proper allocation. Playgrounds and park areas are inadequate. The concept of a community does not really exist.

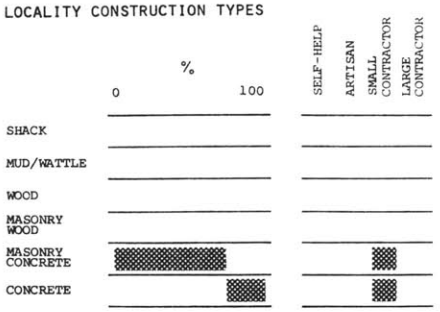
LAND USE: Two hospitals, several schools and mosques are predominant in this locality. The commercial street is in the centre. Along the Abha Al-Khamis road the population density is high with many multi-story apartment buildings. There is a high percentage of public land/streets with higher circulation efficiency. Street lighting, paved road, and sidewalks are adequate. Moreover, government projects for water supply and sewerage are under construction.

LOCALITY SEGMENT AIR PHOTOGRAPH



LOCALITY SEGMENT PLAN

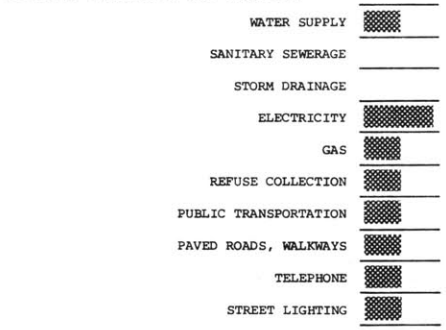
LOCALITY CONSTRUCTION TYPES



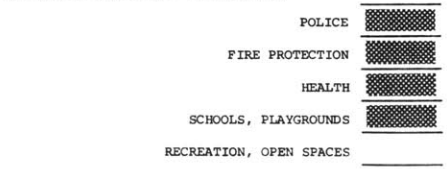
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

LOCALITY UTILITIES AND SERVICES



LOCALITY COMMUNITY FACILITIES

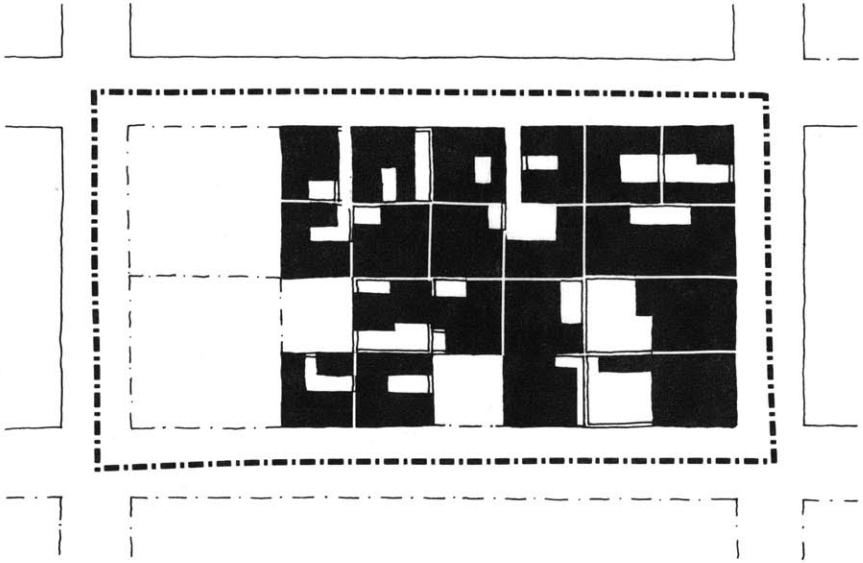


The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate

SELECTED BLOCK

LOCALITY BLOCK: Blocks are 80x40 sq.meters. Initially, they were designed to be 20x20 sq.m. At present, most of the lots are subdivided to 20x10 square meters by individuals. Those lots located on block corners have two approachs and they measure 10x10 square meters.



LOCALITY BLOCK LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	8	0.45	18
DWELLING UNITS	16	0.45	36
PEOPLE	95	0.45	211

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	0.13	29
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	0.32	71
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	0.45	100

NETWORK EFFICIENCY

$$\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 311 \text{ m/Ha}$$

LOTS

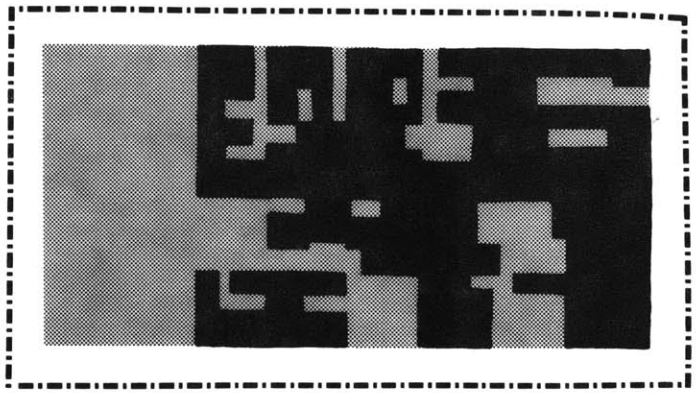
Average area, dimensions = 200 m^2

N

0 10 50m

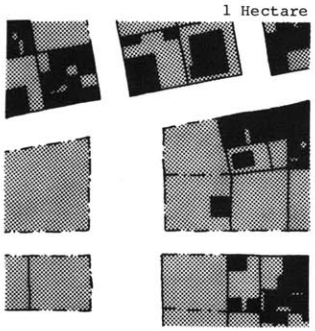
1:1000

LOCALITY BLOCK PLAN



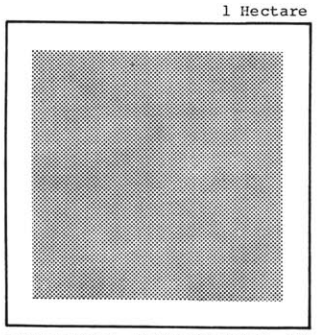
LOCALITY BLOCK LAND UTILIZATION

LAND UTILIZATION DIAGRAMS



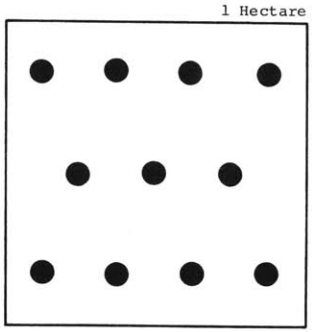
PATTERN

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



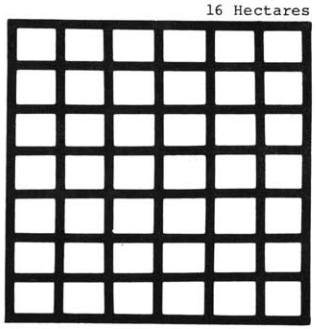
PERCENTAGES

Streets/Walkways	29%
Playgrounds	00%
Cluster Courts	00%
Dwellings/Lots	71%



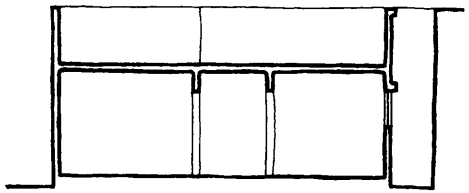
DENSITY Persons/Hectare 211

20 Persons

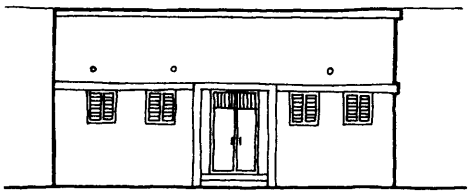


CIRCULATION EFFICIENCY 311

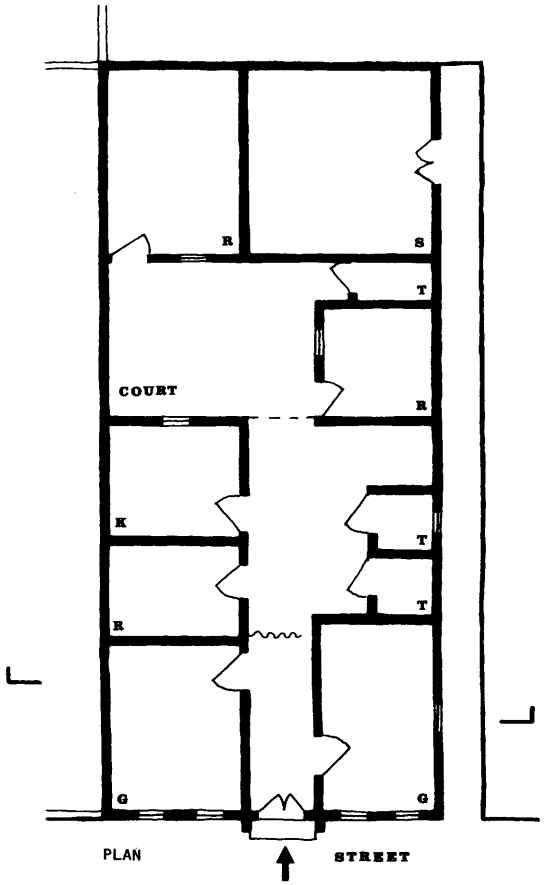
Meters/Hectare



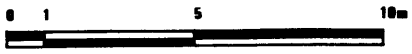
SECTION



ELEVATION



TYPICAL DWELLING



1:200

TYPICAL DWELLINGS: Row houses with court-yeards or back/front yards, two stories, and walk-up apartments are becoming popular in this area. They are made from new building materials, recently introduced (e.g., steel, concrete, and cement blocks). The public area (reception and guest rooms) always faces the street and is near the main entrance. The private area is further from the entrance.

KEY

B Bedroom
G Guest room
R Room (multi-use)
S Storage
T Toilet

CASE STUDY SOURCE

Segment Plan: *(accurate) Aerial Photograph, Department of Aerial Photogrometry, Ministry of Petroleum and Minerals, 1974*
Block Plan: *(accurate) IBID*
Block Land Utilization: *(accurate) IBID*
Typical Dwelling: *(approximate) Field Survey, Farhat Tashkandi Summer of 1978*
Physical Data: *(approximate) IBID*
Socio-Economic Data: *(approximate) IBID*
Photographs: *Farhat Tashkandi, 1978*
General Information: *Kenzo Tange & URTEC, SCAN PLAN SWECO's Khamis Mushit Reports*

PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT	
type:	HOUSE
area (sq m):	180
tenure:	LEGAL OWNERSHIP
LAND/LOT	
utilization:	PRIVATE
area (sq m):	200
tenure:	LEGAL OWNERSHIP
DWELLING	
location:	INNER RING
type:	ROW/GROUPED
number of floors:	1
utilization:	FAMILY
physical state:	GOOD
DWELLING DEVELOPMENT	
mode:	INSTANT
developer:	PRIVATE
builder:	SMALL CONTRACTOR
construction type:	MASONORY, CONCRETE
year of construction:	1970
MATERIALS	
foundation:	R. CONCRETE
floors:	MOSAIC TILES
walls:	CEMENT BRICKS
roof:	R. CONCRETE
DWELLING FACILITIES	
wc:	2
shower:	1
kitchen:	1
rooms:	5
other:	STORAGE, COURT

SOCIO-ECONOMIC DATA
(related to user)

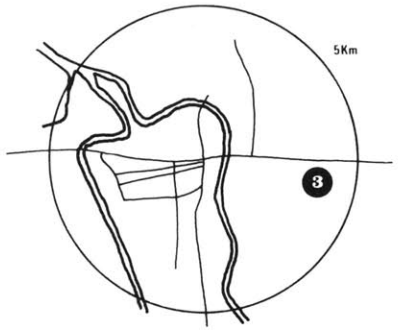
GENERAL: SOCIAL	
user's ethnic origin:	SAUDI FROM A'SIR
place of birth:	A'LKAM
education level:	HIGH SCHOOL
NUMBER OF USERS	
married:	2
single:	-
children:	3
total:	5
MIGRATION PATTERN	
number of moves:	2
rural - urban:	X
urban - urban:	X
urban - rural:	-
why came to urban area:	TRADE
GENERAL: ECONOMIC	
user's income group:	MIDDLE
employment:	TRADE
distance to work:	1.5 Km.
mode of travel:	PRIVATE CAR
COSTS	
dwelling unit:	U.S.$ 15,160
land - market value:	U.S.$ 27,270
DWELLING UNIT PAYMENTS	
financing:	SELF-FINANCED
rent/mortgage:	N.A.
% income for rent/mortgage:	N.A.

PHOTOGRAPHS, opposite page:
AL-KHUTTAH AL-THANEIAH: (top) Secondary street provides direct access to the lots.
(left bottom) Two types of dwellings; row houses and apartment buildings are dominating the area.
(right bottom) In some cases the user close the street using chains to provide a semi-public area.


TOYOTA

3 AL ARGHAL
Khamis Mushait

UNPLANNED SETTLEMENT (SQUATTER)

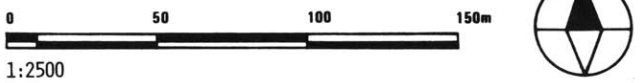


ORIGIN: Al-Arghal is located to the east of wadi Bishah, north and south of the Al-Matar Al-Ghamber Road. It was originally developed as an area for newcomers. Due to the opportunities for military employment and the city's economic activities, an itinerant population gradually invaded the land resulting in a large slum area.

LAYOUT: The layout is typically an accretion pattern. As a result of increasing use of vehicles, rectangular blocks are forming an initial stage of a grid pattern. This pattern is being developed in the same trend as the old traditional Islamic patterns were developed. Because the settlement is in the initial stage of evolution, high percentage of land has not being used/filled, causing high percentage of public land, and high circulation efficiency.

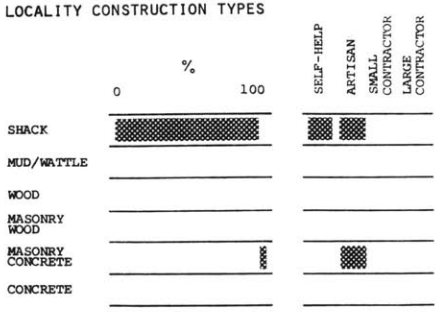
LAND USE: This is predominantly a residential area. Some land is used for worship, adjacent to the shanties. No other activities take place in this locality although there is a very high percentage of open area (public land).

LOCALITY SEGMENT AIR PHOTOGRAPH



LOCALITY SEGMENT PLAN

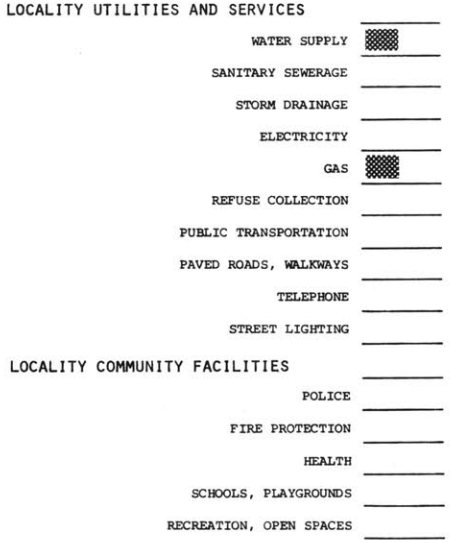
LOCALITY CONSTRUCTION TYPES



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

Quality of information: Approximate

LOCALITY UTILITIES AND SERVICES



The chart illustrates the approximate availability of utilities, services, and community facilities at three levels: NONE, LIMITED, ADEQUATE.

Quality of information: Approximate

SELECTED BLOCK

LOCALITY BLOCK: Row/grouped shanties (sandakah) have sprung up in this area in an accretion pattern. The blocks are smaller than those in the other localities. They are in process of saturation and will reach the same point as the traditional blocks. Some of the blocks are rectangular in shape because of vehicle circulation (streets implementation).

LOCALITY BLOCK LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	18	0.3	60
DWELLING UNITS	18	0.3	60
PEOPLE	85	0.3	283

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	0.1	60
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	0.2	40
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	0.3	100

NETWORK EFFICIENCY

$$\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 370 \text{ m/Ha}$$

LOTS

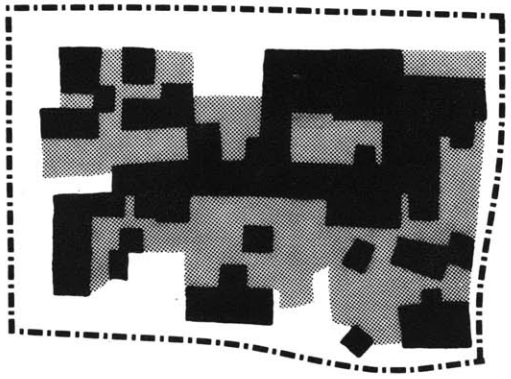
Average area, dimensions = 80 m^2

N

0 10 50m

1:1000

LOCALITY BLOCK PLAN



1:1000

LOCALITY BLOCK LAND UTILIZATION

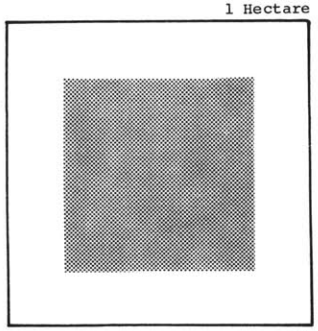
LAND UTILIZATION DIAGRAMS

1 Hectare

PATTERN

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

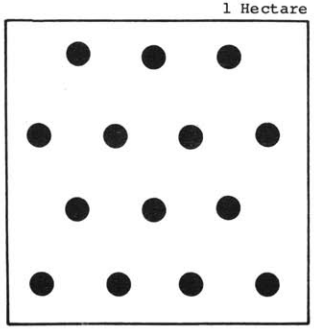
1 Hectare



PERCENTAGES

Streets/Walkways	40%
Playgrounds	00%
Cluster Courts	00%
Dwellings/Lots	60%

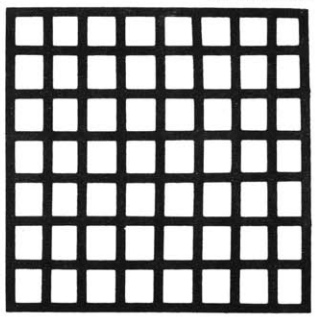
1 Hectare



DENSITY Persons/Hectare 283

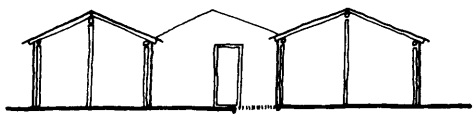
20 Persons

16 Hectares

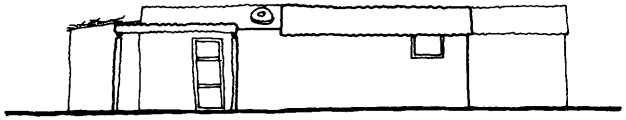


CIRCULATION EFFICIENCY 370

Meters/Hectare

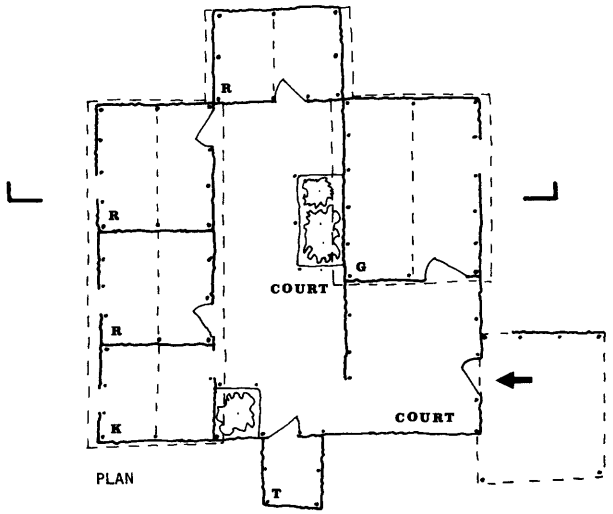


SECTION



ELEVATION

TYPICAL DWELLING: The shanties are made of corregated metal sheets, on wooden frames. They are examples of an adaptation of the traditional Moslem dwelling. Inner courts are maintained for privacy, separation of activities, lighting and ventilation. Rooms open onto the courts, occupying an average of 70-100 square meters.



PLAN

KEY

B Bedroom
G Guest room
R Room (multi-use)
S Storage
T Toilet

CASE STUDY SOURCE

Segment Plan:	*(accurate) Aerial Photograph, Department of Aerial Photognometry, Ministry of Petroleum and Minerals, 1974*
Block Plan:	*(accurate) IBID*
Block Land Utilization:	*(accurate) IBID*
Typical Dwelling:	*(approximate) Field Survey, Farhat Tashkandi Summer of 1978*
Physical Data:	*(approximate) IBID*
Socio-Economic Data:	*(approximate) IBID*
Photographs:	*Farhat Tashkandi, 1978*
General Information:	*Kenzo Tange & URTEC, 1976 and SCAN PLAN SWESCO, 1978*

0 1 5 10m

TYPICAL DWELLING 1:200

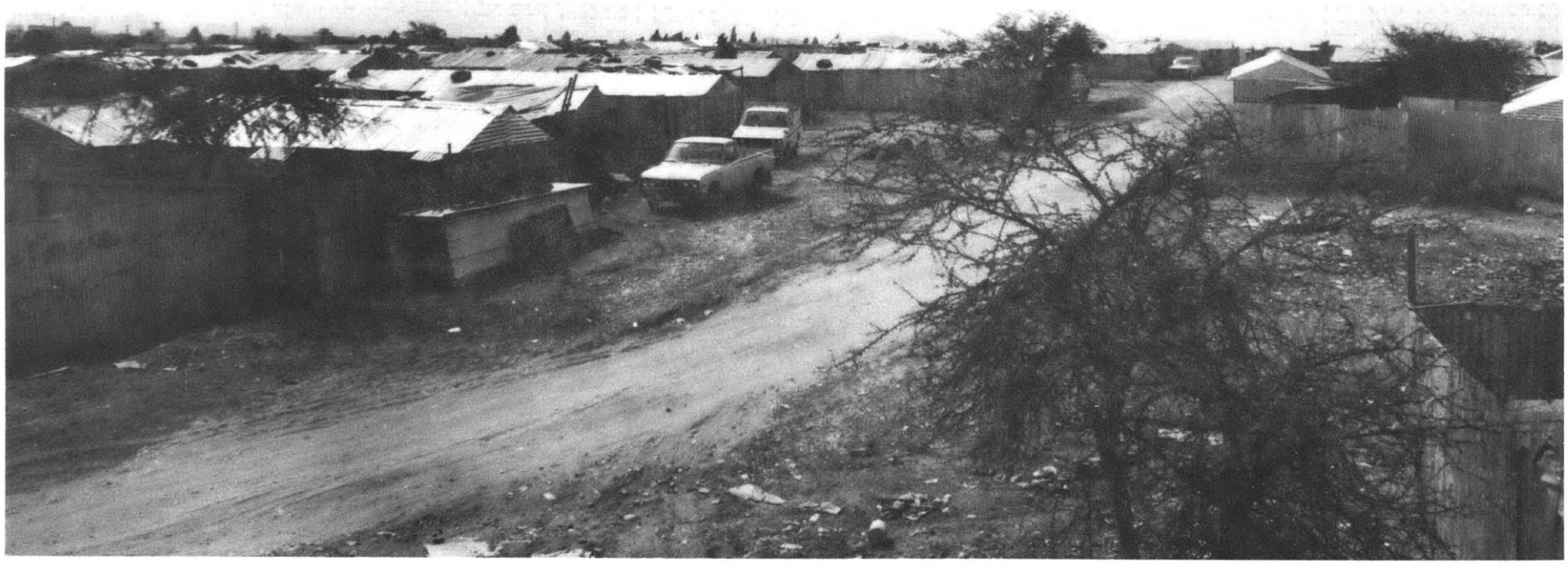
PHYSICAL DATA
(related to dwelling and land)

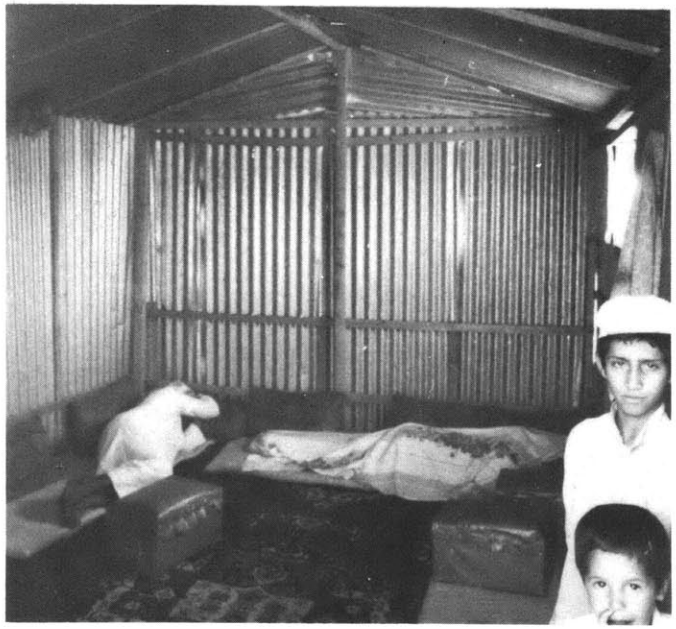
DWELLING UNIT	
type:	SHANTY
area (sq m):	100
tenure:	LEGAL OWNERSHIP
LAND/LOT	
utilization:	PRIVATE
area (sq m):	100
tenure:	EXTRA LEGAL
DWELLING	
location:	CITY PRIPHERY
type:	GROUPED/SEMI-DETACHED
number of floors:	1
utilization:	SINGLE FAMILY
physical state:	BAD
DWELLING DEVELOPMENT	
mode:	INCREMENTAL
developer:	POPULAR
builder:	ARTISAN/SELF-HELP
construction type:	SHACK
year of construction:	1976
MATERIALS	
foundation:	COMPACTED EARTH
floors:	COMPACTED EARTH
walls:	CORRUGATED SHEET METAL
roof:	CORRUGATED SHEET METAL
DWELLING FACILITIES	
wc:	1
shower:	-
kitchen:	1
rooms:	4
other:	COURT

SOCIO-ECONOMIC DATA
(related to user)

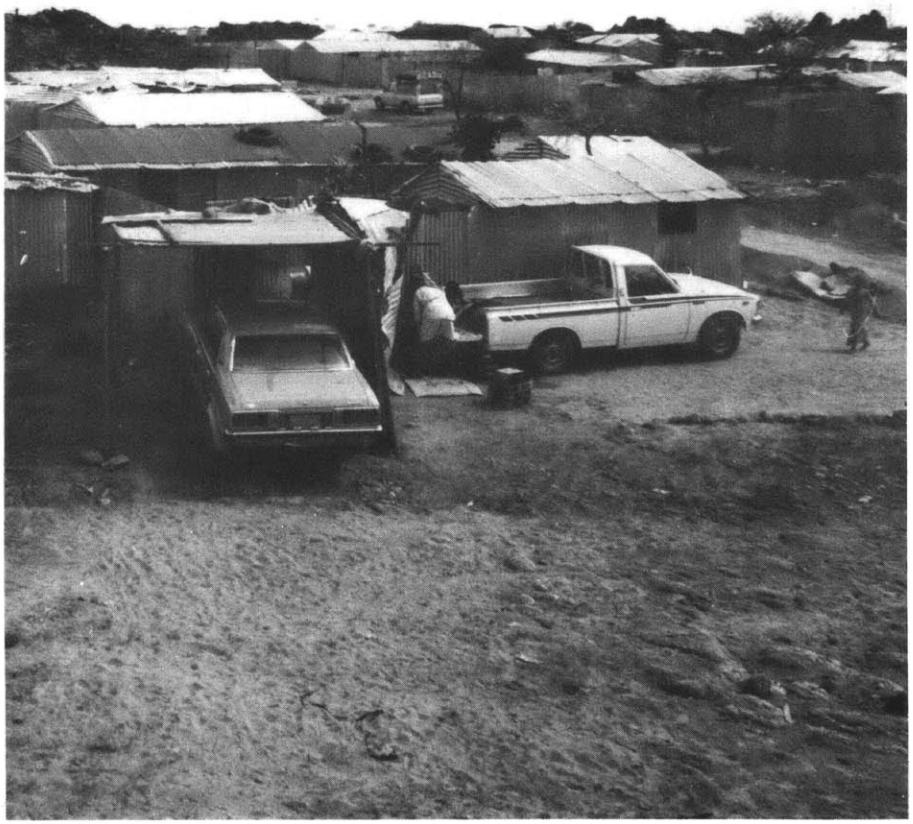
GENERAL: SOCIAL	
user's ethnic origin:	SAUDI FROM A'SIR
place of birth:	BELAD ZAHRAN
education level:	PRIMARY SCHOOL
NUMBER OF USERS	
married:	2
single:	-
children:	5
total:	7
MIGRATION PATTERN	
number of moves:	2
rural - urban:	X
urban - urban:	X
urban - rural:	-
why came to urban area:	MILITARY SERVICE
GENERAL: ECONOMIC	
user's income group:	LOW-MIDDLE
employment:	SOLDIER
distance to work:	25 Km.
mode of travel:	PRIVATE CAR
COSTS	
dwelling unit:	U.S.$ 1,800
land - market value:	N.A.(OPEN LAND)
DWELLING UNIT PAYMENTS	
financing:	SELF-FINANCING
rent/mortgage:	-
% income for rent/mortgage:	-

PHOTOGRAPHS, opposie
AL-ARGHAL AL-GHANOBI: (top) A major road provides access to shanties grouped together forming a cluster like a pattern.
(left bottom) A view of the guests room furnished with local traditional style.
(right bottom) Water supply is provided by the user himself using plastic storage carried on private trucks. The area defined at the front is used by the community as a praying place.





(left) A squatter settlement, to the north of Almatar Alkadiem road, is in its initial stage of development. (right) A squatter settlement, to the south of Almatar Alkadiem road. Water is provided to the settlement by the users in trucks/tankers.



evaluations

INTRODUCTION. Two types of evaluations are presented: dwelling time/process perspective and land utilization patterns, percentages, densities and circulation efficiency. It provides the formulation of housing polycies and guidelines for planning residential developments. Its purposes are: to permit the observation of uses, densities and trends as they change over time; to illustrate land utilization relationships within each case study environment and among different environments in term of patterns, percentages, densities and circulation efficiency.

DWELLING TIME/PROCESS PERSPECTIVE

The three case studies of Kamis Mushait urban area are presented as representative models of existing housing that illustrates different examples of land utilization.

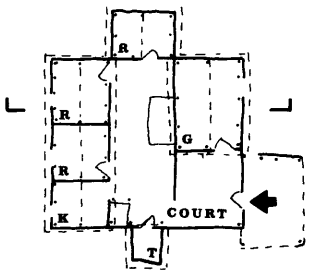
The three cases range from low to middle-income groups. On the chart, the dwelling types are arranged horizontally, according to income level, and related vertically to past, present, and future conditions. in order to present them in a broader time/process perspective, the chart permits the observation of uses, densities, and trends as they change over time.

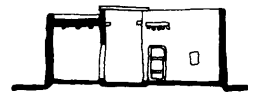
The existing housing models are a valuable source of information or reference for formulating urban land policies and housing programs. They provide a guide to general, yet basic, questions of land use, land subdivision, and land distribution. The models also provide a guide to more specific questions: How do these dwellings relate to different cultures and values? To what income groups are they accessible? What range of population densities do they permit? How efficint is the land utilization which they permit?

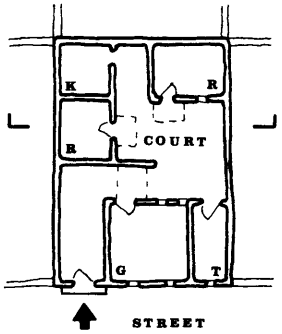
It is important to emphasize that from the six models described on the following pages, only the first three are traditionally Islamic. The others are imported from Western cultures. It can be seen that the new dwelling types (row/grouped, semi-detached) are growing fast, while the traditional rural/urban houses are tending to disappear.

KEY

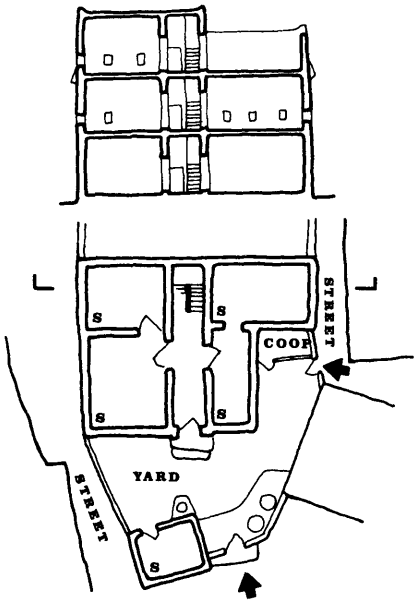
B Bed room
G Guest room
K Kitchen
R Room(multi-use)
S Storage
T Toilet







		ROW/GROUPED SHANTIES	TRADITIONAL ROW HOUSES
IDENTIFICATION	*Dwelling Configuration*	Irregular	Irregular/Rectangular
	Dwelling System	1	1
	Lot	Multi-use room(s) open to court(s) where the private area is separated from the public by a panel, inward opening rooms.	Rooms open to court where the private area is separated by a wall, inward opening rooms.
	Stories		
	Layout		
	Location	Periphery	Center
	Block Layout	Accretion	Accretion
	Land Utilization	Acceptable percentage of private land. Excess of public land. No semi-public land.	Acceptable
	Origin	Adaptation of traditional Islamic Models.	Moslem traditional model
	Localities	Al-Arghal Ashamaly, Al-Arghal Alghnoubi	Al-Ghamber, Al-Humaylah, Al-Darb
	Urban Population Served	25%	15%
PAST	*User Income Groups*	Very Low/Low	Low/Middle
	Dwelling Utilization	Singles/Family	Family
	Population Density	Medium low	Low
	Trend	Continuing	Continuing
PRESENT	*User Income Groups*	Very Low/Low	Low/Middle
	Dwelling Utilization	Singles/Family	Singles/Family
	Population Density	Medium	Medium
	Trend	Proliferating	Diminishing
FUTURE	*User Income Groups*	Low	Very Low/Low
	Dwelling Utilization	Singles/Family	Singles/Family
	Population Density	High	Family
	Trend	Proliferating	Disappearing
RECOMMENDATIONS		- MINIMIZE PUBLIC LAND - PROVIDE SEMI-PUBLIC LAND - MAXIMIZE PRIVATE RESPONSIBILITY - PROVIDE UTILITIES AND SERVICES - CONTROL UNOCCUPIED LAND - DEVELOP THIS MODEL FOR LOW/MIDDLE INCOME GROUPS	- PROVIDE UTILITIES AND SERVICES - PROMOTE THIS MODEL FOR FURTHER DEVELOPMENT FOR THE LOW/MIDDLE INCOME GROUPS



TRADITIONAL GROUPED HOUSES

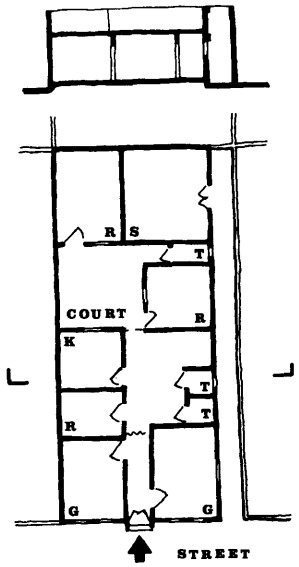
Irregular
2-3
Multi-use rooms with several storages for goods, and yard for animals. The upper floor is for the private use (family)

Center
Accretion
Acceptable

Moslem traditional model
Al-Ghamber, Al-Humailah, Al-Darb
17%

Middle	Family	Low	Continuing
Middle	Family	Medium	Diminishing
Low	Singles/Family	High	Disappearing

- PROVIDE UTILITIES AND SERVICES
- PROMOTE THIS MODEL FOR FURTHER DEVELOPMENT FOR THE LOW/MIDDLE INCOME GROUPS



ROW HOUSES

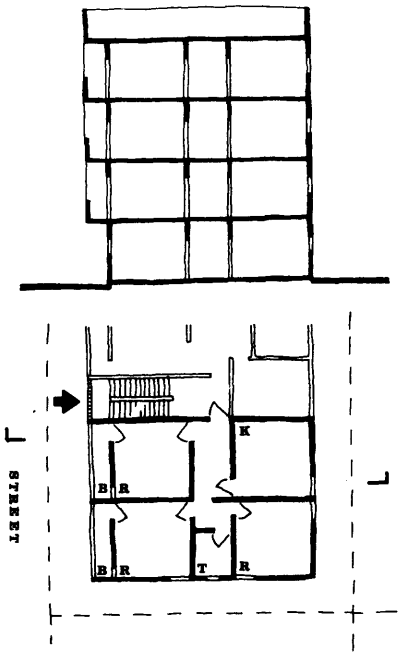
Rectangular
1-2
Rooms and galleries around side/central patio also in some cases, front/back yard

Center
Grid iron
Acceptable for private land utilization

Universal
Al-Khuttah Al-Thaniah
20%

Middle	Family	Low	Continuing
Middle	Family	Low	Continuing
Middle	Family	Low	Continuing

- MINIMIZE PUBLIC LAND
- MAXIMIZE PRIVATE RESPONSIBILITY
- INCREASE POPULATION DENSITY
- PROVIDE UTILITIES AND SERVICES
- CONTROL LAND SPECULATION
- REVISE THIS MODEL FOR THE LOW/MIDDLE INCOME GROUPS



WALK-UP APARTMENTS

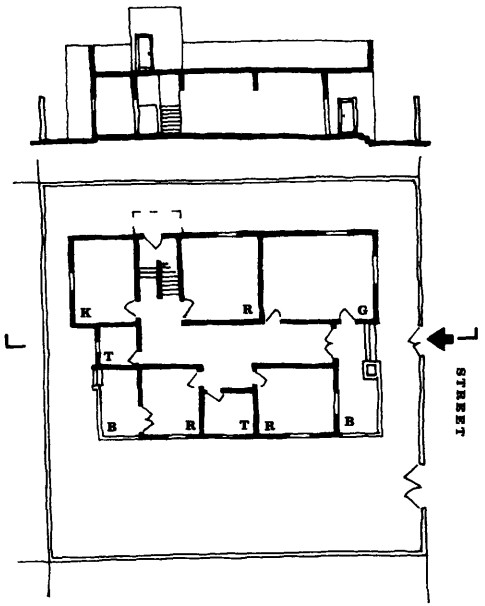
Rectangular/Square
2-5
Each floor is divided into apartments, with outward opening rooms and unusable area around the building.

Scattered through the urban area
Grid iron
Bad

Imported from western culture. Scattered through the urban area
10%

Middle	Singles/Family	Medium	Continuing
Middle	Singles/Family	Medium	Continuing
Low/Middle	Singles/Family	Medium	Continuing

- MINIMIZE PUBLIC LAND
- MAXIMIZE PRIVATE RESPONSIBILITY
- PROVIDE UTILITIES/SERVICES
- REVISE THIS MODEL TO MEET TRADITIONAL/ ENVIRONMENTAL REQUIREMENTS
- REVISE BUILDING CODES TO AVOID WASTE OF LAND AROUND THE BUILDING



DETACHED HOUSES

Square
1-2
Rooms together without focus activities, outward opening rooms, also wasted land around the dwelling.

Center
Grid iron
Bad

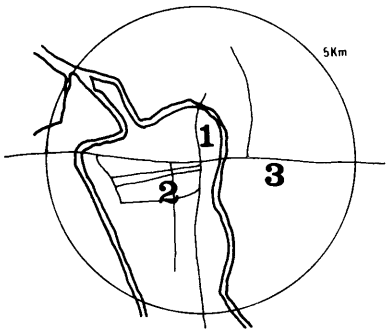
Imported from western models.
Al-Khuttah Al-Thaniah
13%

High	Family	Low	Continuing
High	Family	Low	Continuing
High	Family	Low	Continuing

- AVOID THIS MODEL FOR IT'S NEGATIVE RESULTS ON LAND UTILIZATION, TRADITION, AND CLIMATE, AND TO ALLEVIATE URBAN SPRAWL

LAND UTILIZATION

PATTERNS, PERCENTAGES, DENSITIES, CIRCULATION EFFICIENCY



The three case studies of the Khamis Mushait urban area illustrate different cases of land utilization. The case studies range from low to middle income groups; they represent different types of settlements: old (traditional) new-planned, new-unplanned (squatter).

Land utilization diagrams are arranged horizontally according to the type of settlement and the time of origin to easily render the comparisons between them; they are related vertically by their layout patterns, percentages, densities and circulation efficiencies. The chart assists in the evaluation of existing settlements in order to formulate urban land policies and programs.

From the chart, the last two settlements require additional efforts to upgrade and to implementing infrastructure networks which increase costs of construction, operation and maintenance, compared to the traditional settlement which has good land utilization, medium density and an acceptable circulation efficiency. The second case, the planned settlement, has a standard lot size of 20m x 20m, which were further divided into smaller 20m x 10m lots are ample in area for the individual to develop his own dwelling; in addition, land utilization percentage shows that this settlement has a good percentage of private land, but on the other hand, it has the least population density and a very high circulation length.

This indicates that the layout is unefficient and it will cost a tremendous amount of capital to develop or to implement infrastructure networks, since it serves less population compared to the other settlements. Furthermore, public land is higher than in the old settlement. This indicates that public maintenance responsibility and control will be excessive. The third case study, the squatter/unplanned settlement, indicates that many areas are still vacant with a medium population density and a high circulation length. By developing housing on the vacant land (public) the area will change into a higher percentage of private land, higher population density and increase the circulation efficiency which is representative of public expenditure. As a result of consumption being increased, waste generally turns into a serious problem, disrupting the city's amenity, hygiene, and even the cultural values. To minimize and control the waste collection (time, circulation lines, number of trucks,) a better layout should be considered where its circulation efficiency is low enough to facilitate pedestrian circulation among the community elements: dwellings, shops, services, etc.

The collection point for refuse plays a big role also, therefore, a control point such as the entrance of a cluster or dead-end street (cul-de-sac), will minimize truck stops for collections, furthermore, it encourages private maintenance and responsibility.

CASE STUDIES

CASE STUDIES: Three case studies have been surveyed to identify and analyze existing dwelling environment, regarding very low to middle high income groups.

The three case studies represent the prevailing housing systems at the time of the survey. This will assist to adentify the physical planning problems in the country, and particularly in Khamis Mushait.

LAYOUT PATTERNS

LAYOUT PATTERN: Lot configuration, block and circulation; determine infrastructure network lengths: e.g., the planned and the unplanned settlements, (second case and third case) will demand additional network lengths resulting in higher cost per capita.

LAND UTILIZATION PERCENTAGES

LAND UTILIZATION PERCENTAGES: The proportion of public and private areas, determine the responsibility, user control and functional efficiency of a layout; e.g., the planned and the unplanned settlements (2,3) have large percentages for circulation indicatting an inefficient layout that results in higher cost of construction per capita.

POPULATION DENSITIES

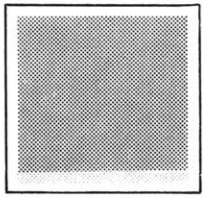
POPULATION DENSITY: Number of persons per hectare, relating to the numbers and type of dwellings per hectare. This determines the intensity of the net use of land; e.g., the planned settlement (2) has lowest density which means higher development per capita.

CIRCULATION LENGTHS

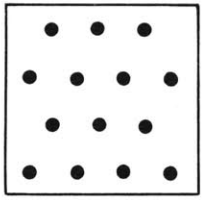
CIRCULATION EFFICIENCY: Low circulation length minimizes public land percentage and surplusages in order to minimize public cost in construction, maintenance and operation of utilities and services. High circulation length facilitates pedestrian circulation among the community elements; dwellings, shops, services, etc., but on the other hand, costs are greater: e.g., garbage collection and street cleaning will be greater in the new settlements (2,3); furthermore, travelling time for collecting trucks will be longer.

1 AL GHAMBER

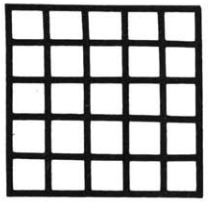
Old traditional settlement, row/grouped houses, low/middle incomes
Grid pattern/Accretion. Acceptable density, large blocks and good land utilization. Located in the north-east corner of the city.



% of public land	18
% of private land	77
% of semi-private land	5



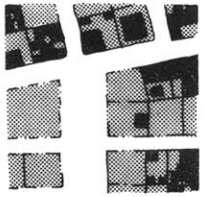
(gross) persons/Ha	289
(net)	388

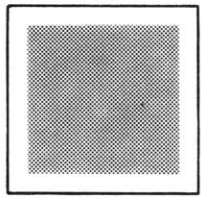


Meters/Ha	243

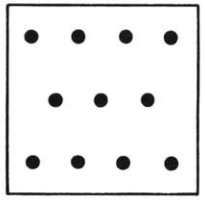
2 AL KHUTTAH AL THANYAH

New planned settlement, row/detached houses, middle/high incomes
Grid-iron pattern. Low density, small blocks and high percentage of public land. Located in the south of the city.





	29
	71
	-



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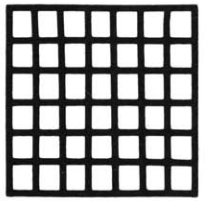

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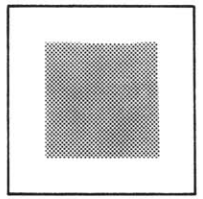
3 AL ARGHAL

New unplanned settlement, row/grouped houses, very low/low incomes
Accretion pattern. Acceptable density, and high percentage of unused land, and high circulation efficiency. Located to the east of Wadi Bishah.



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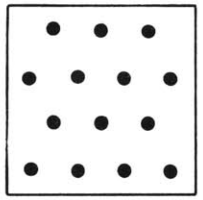

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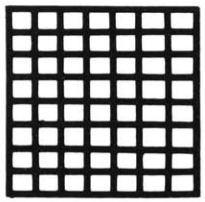

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CONCLUSION/POLICY RECOMMENDATIONS

From the analysis of the existing situation, we learned, first; that the shelter can be made by the individual if materials are provided, but there are several things which can not be made by himself. These are infrastructure, utilities and services, and maintenance. Second, a better land utilization and land subdivision should be implemented to preserve social-cultural values as well as to increase private responsibility which will result in a decrease of heavy burdens and public expenditure on implementation, maintenance, and operation of utilities/services and facilities.

It is obvious that Khamis Mushait, will continue growing as long as the city's economic activities grow as a consequence of its role as trade center of the southern region and as the military base commercial center.

Inmigrants from surrounding rural areas will continue demanding more houses and infrastructure. This rapid urbanization is affecting all aspects of the population life as well as originating large slum areas. In housing, the most common pattern has become illicit subdivisions. In addition the existing land subdivision demonstratates an inefficient layout.

New layouts should be implemented not only by public but private too with much emphasis on progressive development, taking in consideration the provision of utilities/services and community facilities over which the government has direct control and responsibility.

Housing by people must be encouraged and supported by the government, particularly the low and middle income sectors with ample subsidy to build their own dwellings suitable to their financial and social requirements.

Several recommendation policies are driven from evaluating the dwelling time/process perspective and land utilization:

- maximize private land ownership.
- maximize private participation and responsibility in development and maintenance.
- minimize public expenditure on public utilities/services and facilities.
- facilitate incremental development.
- provide flexible planning to facilitate suitable habitation of different income groups, and administration.
- maximize social integration and interaction.
- control land/construction materials speculations.
- control unoccupied land.
- encourage/develop sun-dried bricks and other local materials for construction.
- maximize weather protection.
- provide public transportation.
- increase population densities.
- to increase the awareness of local and foreign planners and architects to preserve the local architecture and urban patterns.

GLOSSARY

The criteria for the preparation of the definitions have been as follows:
-FIRST PREFERENCE: definitions from "Webster's Third New International Dictionary", Merriam-Webster, 1971.
-SECOND PREFERENCE: definitions from technical dictionaries, text books, or reference manuals.
-THIRD PREFERENCE: definitions from the Urban Settlement Design Program (U.S.D.P.) Files. They are used when existing sources were not quite appropriate/satisfactory.

Words included for specificity and to focus on a particular context are indicated in parenthesis.

Sources of definitions are indicated in parenthesis. (See also: REFERENCES).

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

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

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

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

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

ALTERNATINC CURRENT (A.C.) (an electric) current that reverses its direction of flow at regular intervals. (ROTC ST 45-7, 1953)

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

AMPERES. Amperes (amp) are a measure of the rate of flow of electricity. It is somewhat comparable to the rate of flow of water (quantity/time). A steady current produced by one volt applied across a resistance of one ohm. (ROTC ST 45-7, 1953)

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

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

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

ASSESSMENT. The valuation of property for the purpose of levying a tax or the amount of the tax levied. (Keyes, 1971)

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

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

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

BINDER COURSE. A transitional layer of bituminous paving between the crushed stone base and the surface course (to increase bond between base and surface course). (DePina, 1972)

BITUMINOUS. A coating of or containing bitumin; as asphalt or tar. (DePina, 1972)

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

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

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

BUILDING DRAIN. Lowest horizontal piping of the building drainage system receiving discharge from soil, waste, and other drainage pipes. It is connected to the building sewer. (ROTC ST 45-7, 1953)

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

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

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

CLAY. A lusterless colloidal substance, plastic when moist (crystalline grains less than 0.002mm in diameter). (U.S.D.P.)

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

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

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

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

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

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

COMMUNITY RECREATION FACILITIES. Facilities for activities voluntarily undertaken for pleasure, fun, relaxation, exercise, self-expression, or release from boredom, worry, or tension. (U.S.D.P.)

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

CONDOMINIUM. Condominium is a system of direct ownership of a single unit in a multi-unit whole. The individual owns the unit in much the same manner as if it were a single family dwelling: he holds direct legal title to the unit and a proportionate interest in the common land and areas. Two types of condominiums are recognized: *HORIZONTAL:* detached, semi-detached, row/grouped dwelling types; *VERTICAL:* walk-up, high-use dwelling types. (U.S.D.P.)

CONDUCTORS. Materials which allow current to flow such as aluminum, copper, iron. (ROTC ST 45-7, 1953)

CONDUIT. A pipe or other opening, buried or above ground, for conveying hydraulic traffic, pipelines, cables, or other utilities. (DePina, 1972)

CONSERVATION EASEMENT. An easement acquired by the public and designed to open privately owned lands for recreational purposes or to restrict the use of private land in order to preserve open space and protect certain natural resources. (U.S.D.P.)

CONURBATION. Area of large urban communities where towns, etc. have spread and became joined beyond their administrative boundaries. (A.S. Hornby, A.P. Cowie, J. Windsor Lewis, 1975)

CONURBATION. An aggregation or continuous network of urban communities. (Merriam-Webster, 1963)

CORPORATION COCK/CORPORATION STOP. A water or gas cock by means of which utility-company employees connect or disconnect service lines to a consumer. (Merriam-Webster, 1971)

COSTS OF URBANIZATION. Include the following: *CAPITAL:* cost of land and infrastructure; *OPERATING:* cost of administration, maintenance, etc.; *DIRECT:* include capital and operating costs; *INDIRECT:* include environmental and personal effects. (U.S.D.P.)

CURRENT (See: ALTERNATING CURRENT, DIRECT CURRENT). An electric current is a movement of positive or negative electric particles (as electrons) accompanied by such observable effects as the production of heat, of a magnetic field, or of chemical transformation. (Merriam-Webster, 1971)

CYCLE. One complete performance of a vibration, electric oscillation, current alternation, or other periodic process. (Merriam-Webster, 1971)

DAM. A barrier preventing the flow of water; a barrier built across a water course to confine and keep back flowing water. (Merriam-Webster, 1971)

DEPRECIATION ACCELERATION (TAX). A tax incentive designed to encourage new construction by allowing a faster write-off during the early life of a building. (U.S.D.P.)

DESIGN. 1) The arrangement of elements that make up a work of art, a machine or other man-made object. 2) The process of selecting the means and contriving the elements, steps, and procedures for producing what will adequately satisfy some need. (Merriam-Webster, 1971)

DETACHED DWELLING. Individual dwelling unit, separated from others. (U.S.D.P.)

DEVELOPMENT. Gradual advance or growth through progressive changes; a developed tract of land (U.S.D.P.)

DEVELOPMENT SIZE. There are two general ranges of size: *LARGE:* may be independent communities requiring their own utilities, services, and community facilities; *SMALL:* generally are part of an adjacent urbanization and can use its supporting utilities, services, and community facilities. (U.S.D.P.)

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

DISCHARGE (Q). Flow from a culvert, sewer, channel, etc. (DePina, 1972)

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

DISTRIBUTION (STATION). The part of an electric supply system between bulk power sources (as generating stations or transformation station tapped from transmission lines) and the consumers' service switches. (Merriam-Webster, 1971)

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

DRAINAGE. Interception and removal of ground water or surface water, by artificial or natural means. (De Pina, 1972)

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

DWELLING. The general, global designation of a building/shelter in which people live. A dwelling contains one or more 'dwelling units'. (U.S.D.P.)

DWELLING BUILDER. Four groups are considered: *SELF-HELP BUILT:* where the dwelling unit is directly built by the user or occupant; *ARTISAN BUILT:* where the dwelling unit is totally or partially built by a skilled craftsman hired by the user or occupant; payments can be monetary or an exchange of services; *SMALL CONTRACTOR BUILT:* where the dwelling unit is totally built by a small organization hired by the user, occupant, or developer; 'small' contractor is defined by the scale of operations, financially and materially; the scale being limited to the construction of single dwelling units or single complexes; *LARGE CONTRACTOR BUILT:* where the dwelling unit is totally built by a large organization hired by a developer; 'large' contractor is defined by the scale of operations, financially and materially; the scale reflects a more comprehensive and larger size of operations encompassing the building of large quantities of similar units, or a singularly large complex. (U.S.D.P.)

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

DWELLING DEVELOPER. Three sectors are considered in the supply of dwellings: *POPULAR SECTOR:* the marginal sector with limited or no access to the formal financial, administrative, legal, technical institutions involved in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Popular Sector generally for 'self use' and sometimes for profit. *PUBLIC SEC-*

TOR: the government or non-profit organizations involved in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Public Sector for service (non-profit or subsidized housing). *PRIVATE SECTOR:* the individuals, groups or societies, who have access to the formal financial, administrative, legal, technical institutions in the provision of dwellings. The housing process (promotion, financing, construction, operation) is carried out by the Private Sector for profit. (U.S.D.P.)

DWELLING DEVELOPMENT MODE. Two modes are considered: *PROGRESSIVE:* the construction of the dwelling and the development of the local infrastructure to modern standards by stages, often starting with provisional structures and underdeveloped land. This essentially traditional procedure is generally practiced by squatters with de facto security of tenure and an adequate building site. *INSTANT:* the formal development procedure in which all structures and services are completed before occupation. (U.S.D.P.)

DWELLING FLOORS. The following numbers are considered: *ONE:* single story; generally associated with detached, semi-detached and row/group dwelling types. *TWO:* double story; generally associated with detached, semi-detached and row/group dwelling types. *THREE OR MORE:* generally associated with walk-up and high-rise dwelling types. (U.S.D.P.)

DWELLING GROUP. The context of the dwelling in its immediate surroundings. (U.S.D.P.)

DWELLING/LAND SYSTEM. A distinct dwelling environment/housing situation characterized by its users as well as by its physical environment. (U.S.D.P.)

DWELLING LOCATION. Three sectors are considered in single or multi-center urban areas. Sectors are identified by position as well as by the density of buildings as follows: *CENTER:* the area recognized as the business center of the city, generally the most densely built-up sector; *INNER RING:* the area located between the city center and the urban periphery, generally a densely built-up sector; *PERIPHERY:* the area located between the inner ring and the rural areas, generally a scatteredly built-up sector. (U.S.D.P.)

DWELLING PHYSICAL STATE. A qualitative evaluation of the physical condition of the dwelling types: room, apartment, house; the shanty unit is not evaluated. *BAD:* generally poor state of structural stability, weather protection, and maintenance. *FAIR:* generally acceptable state of structural stability, weather protection, and maintenance with some deviation. *GOOD:* generally acceptable state of structural stability, weather protection, and maintenance without deviation. (U.S.D.P.)

DWELLING TYPE. The physical arrangement of the dwelling unit: *DETACHED:* individual dwelling unit, separated from others. *SEMI-DETACHED:* two dwelling units sharing a common wall (duplex). *ROW/GROUPED:* dwelling units grouped together linearly or in clusters. *WALK-UP:* dwelling units grouped in two to five stories with stairs for vertical circulation. *HIGH-RISE:* dwelling units grouped in five or more stories with stairs and lifts for vertical circulation. (U.S.D.P.)

DWELLING UNIT. A self-contained unit in a dwelling for an individual, a family, or a group. (U.S.D.P.)

DWELLING UNIT AREA. The dwelling unit area (m^2) is the built-up, covered area of a dwelling unit. (U.S.D.P.)

DWELLING UNIT COST. The initial amount of money paid for the dwelling unit or the present monetary equivalent for replacing the dwelling unit. (U.S.D.P.)

DWELLING UNIT TYPE. Four types of dwelling units are considered: *ROOM:* A SINGLE SPACE usually bounded by partitions and specifically used for living: for example, a living room, a dining room, a bedroom, but not a bath/toilet, kitchen, laundry, or storage room. SEVERAL ROOM UNITS are contained in a building/shelter and share the use of the parcel of land on which they are built (open spaces) as well as common facilities (circulation, toilets, kitchens). *APARTMENT:* A MULTIPLE SPACE (room/set of rooms with bath, kitchen, etc.) SEVERAL APARTMENT UNITS are contained in a building and share the use of the parcel of land on which they are built (open spaces) as well as some common facilities (circulation). *HOUSE:* A MULTIPLE SPACE (room/set of rooms with or without bath, kitchen, etc.) ONE HOUSE UNIT is contained in a building/shelter and has the private use of the parcel of land on which it is built (open spaces) as well as the facilities available. *SHANTY:* A SINGLE OR MULTIPLE SPACE (small, crudely built). ONE SHANTY UNIT is contained in a shelter and shares with other shanties the use of the parcel of land on which they are built (open spaces). (U.S.D.P.)

DWELLING UTILIZATION. The utilization indicates the type of use with respect to the number of inhabitants/families. *SINGLE:* an individual or family inhabiting a dwelling. *MULTIPLE:* a group of individuals or families inhabiting a dwelling. (U.S.D.P.)

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

EFFICIENCY. Capacity to produce desired results with a minimum expenditure of energy, time, money or materials. (Merriam-Webster, 1971)

EFFLUENT. Outflow or discharge from a sewer or sewage treatment equipment. (DePina, 1972)

ELECTRIC FEEDER. That part of the electric distribution system between the transformer and the service drop or drops. (HUD, Mobile Court Guide, 1970)

ELECTRIC SERVICE DROP. That part of the electric distribution system from a feeder to the user's service equipment serving one or more lots. (HUD, Mobile Court Guide, 1970)

ELECTRIC TRANSFORMER. A device which changes the magnitude of alternating voltages and currents; generally from distribution voltages to user voltages; a distribution component that converts power to usable voltage. (TM 5 765 US Army, 1970; U.S.D.P.)

ELECTRICAL CIRCUIT. A closed, complete electrical path with various connected loads. Circuits may either be 'parallel' (voltage constant for all connected loads) or 'series' (voltage divided among connected loads). Parallel circuits are fixtures wired independent of each other, which are used in nearly all building wiring. (U.S.D.P.; ROTC ST 45-7, 1953)

ELECTRICAL FREQUENCY. The number of times an alternating electric current changes direction in a given period of time. Measured in cycles per second: hertz. (ROTC ST 45-7, 1953)

ELECTRIC GROUND. The electrical connection with the earth or other ground. (Merriam-Webster, 1971)

ELECTRICAL NETWORK COMPONENTS. It is composed of the following: *GENERATION:* produces electricity; *TRANSMISSION:* transports energy to user groups; *DISTRIBUTION STATION:* divides power among main user groups; *SUBSTATION:* manipulates power into useful energy levels for consumption; *DISTRIBUTION NETWORKS:* provides electric service to user. (U.S.D.P.)

ELECTRIC PHASE. May be either a single-phase circuit (for small electrical devices) or a three-phase circuit (for heavy equipment, large electrical devices). In single-phase only one current is flowing through the circuit with the voltage dropping to zero twice in each cycle. In three-phase currents flow through the circuit with the power never dropping to zero. (U.S.D.P.)

ELECTRICAL POWER. The source or means of supplying energy for use; measured in watts. (U.S.D.P.)

ELECTRICAL WIRING SYSTEMS. May either be single-phase or three-phase. *SINGLE-PHASE:* 2 hot wires with 1 neutral wire; *THREE-PHASE:* 3 hot wires with 1 neutral wire. (ROTC ST 45-7, 1953)

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

EMBANKMENT (or FILL). A bank of earth, rock, or other material constructed above the natural ground surface. (DePina, 1972)

EROSION. The general process whereby materials of the earth's crust are worn away and removed by natural agencies including weathering, solution, corrosion, and transportation; (specific) land destruction and simultaneous removal of particles (as of soil) by running water, waves and currents, moving ice, or wind. (Merriam-Webster, 1971)

EXCRETA. Waste matter eliminated from the body. (U.S.D.P.)

EXISTING STRUCTURE. Something constructed or built (on the site). (U.S.D.P.)

EXPLORATORY BORING. Initial subsurface investigations (borings) are done on a grid superimposed on the areas of interest and on areas indicated as limited/restricted/hazard in the initial survey. (U.S.D.P.)

EXTERIOR CIRCULATION/ACCESSES (SITE PLANNING). The existing and proposed circulation system/accesses outside but affecting the site. These include limited access highways as well as meshing access to the surrounding area. Exterior circulation/accesses are generally given conditions. (U.S.D.P.)

FAUCET (also TAP). A fixture for drawing liquid from a pipe, cask, or other vessel. (Merriam-Webster, 1971)

FINANCING. The process of raising or providing funds. *SELF FINANCED:* provided by own funds; *PRIVATE/PUBLIC FINANCED:* provided by loan; *PUBLIC SUBSIDIZED:* provided by grant or aid. (U.S.D.P.)

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

FIRE FLOW. The quantity (in time) of water available for fire-protection purposes in excess of that required for other purposes. (Merriam-Webster, 1971)

FIRE HYDRANT. A water tap to which fire hoses are connected in order to smother fires. (U.S.D.P.)

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

FLEXIBLE PAVEMENT. A pavement structure which maintains intimate contact with and distributes loads to the subgrade and depends upon aggregate interlock, particle friction, and cohesion for stability. (DePina, 1972)

FLOODING. A rising and overflowing of a body of water that covers land not usually under water. (U.S.D.P.)

FLOODWAY FRINGE. The floodplain area landward of the natural floodway which would be inundated by low velocity flood waters. (U.S.D.P.)

FLOW METER. A device to measure flow of water. (U.S.D.P.)

FLUSH TANK TOILET. Toilet with storage tank of water used for flushing bowl. (U.S.D.P.)

FLUSH VALVE TOILET. Toilet with self-closing valve which supplies water directly from pipe. It requires adequate pressure for proper functioning. (U.S.D.P.)

FOOT CANDLE. A unit of illuminance on a surface that is everywhere one foot from a uniform point source of light of one candle and equal to one lumen per square foot. (Merriam-Webster, 1971)

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

GAS. A system for supplying natural gas, manufactured gas, or liquefied petroleum gas to the site and individual users. (U.S.D.P.)

GRADE. Profile of the center of a roadway, or the invert of a culvert or sewer. (DePina, 1972)

GRID BLOCKS. The block determined by a convenient public circulation and not by dimensions of lots. In grid blocks some lots have indirect access to public streets. (U.S.D.P.)

GRIDIRON BLOCKS. The blocks determined by the dimensions of the lots. In gridiron blocks all the lots have direct access to public streets. (U.S.D.P.)

GRID LAYOUTS. The urban layouts with grid blocks. (U.S.D.P.)

GRIDIRON LAYOUTS. The urban layouts with gridiron blocks. (U.S.D.P.)

GOVERNMENT/MUNICIPAL REGULATIONS. In urban areas, the development of the physical environment is a process usually controlled by a government/municipality through all or some of the following regulations: Master Plan, Zoning Ordinance, Subdivision Regulations, Building Code. (U.S.D.P.)

HEAD. (Static). The height of water above any plane or point of reference. Head in feet = (lb/sq. in. x 144)/(Density in lb/cu. ft.) For water at 68°F. (DePina, 1972)

HIGH-RISE. Dwelling units grouped in five or more stories with stairs and lifts for vertical circulation. (U.S.D.P.)

HOT WIRE. Wire carrying voltage between itself and a ground. (ROTC ST 45-7, 1953)

HYDRAULICS. That branch of science or engineering that deals with water or other fluid in motion. (DePina, 1972)

ILLEGAL. That which is contrary to or violating a rule or regulation or something having the force of law. (Merriam-Webster, 1971)

INCOME. The amount (measured in money) of gains from capital or labor. The amount of such gain received by a family per year may be used as an indicator of income groups. (U.S.D.P.)

INCOME GROUPS. A group of people or families within the same range of incomes. (U.S.D.P.)

INCREMENT (TAX). A special tax on the increased value of land, which is due to no labor/expenditure by the owner, but rather to natural causes such as the increase of population, general progress of society, etc. (U.S.D.P.)

INFRASTRUCTURE. The underlying foundation or basic framework for utilities and services: streets; sewage, water network; storm drainage, electrical network;

gas network; telephone network, public transportation; police and fire protection; refuse collection, health, schools, playgrounds, parks, open spaces. (U.S.D.P.)

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

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

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

KILOWATT (kw). (1000 watts) A convenient manner of expressing large wattages. Kilowatt hours (kwh) measure the total quantity of energy consumed in a given time. One kwh represents the use of an average of 1 kilowatt of electrical energy for a period of 1 hour. (ROTC ST 45-7, 1953)

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

LAND COST. Price: the amount of money given or set as the amount to be given as a consideration for the sale of a specific thing (the site). (Merriam-Webster, 1971)

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

LAND LEASE. The renting of land for a term of years for an agreed sum; leases of land may run as long as 99 years. (U.S.D.P.)

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

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

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

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

LAND UTILIZATION. A qualification of the land around a dwelling in relation to user, physical controls and responsiblity. *PUBLIC* (streets, walkways, open spaces): user -anyone/unlimited; physical controls -minimum; responsibility -public sector. *SEMIPUBLIC* (open spaces, playgrounds, schools): user -limited group of people; physical controls -partial or complete; responsibility -public sector and user. *PRIVATE* (dwellings, lots): user -owner or tenant or squatter; physical controls -complete; responsibility -user. *SEMI-PRIVATE* (cluster courts): user -group of owners and/or tenants; physical controls -partial or complete; responsibility -user. (U.S.D.P.)

LAND UTILIZATION: PHYSICAL CONTROLS. The physical/legal means or methods of directing, regulating, and coordinating the use and maintenance of land by the owners/users. (U.S.D.P.)

LAND UTILIZATION: RESPONSIBILITY. The quality/state of being morally/legally responsible for the use and maintenance of land by the owners/users. (U.S.D.P.)

LATERAL SEWER. A collector pipe receiving sewage from building connection only. (U.S.D.P.)

LATRINE. A receptacle (as a pit in the earth or a water closet) for use in defecation and urination, or a room (as in a barracks or hospital) or enclosure (as in a camp) containing such a receptacle. (Merriam-Webster, 1971)

LAYOUT. The plan or design or arrangement of something that is laid out. (Merriam-Webster, 1971)

LEVELS OF SERVICES. Two levels are considered: *MINIMUM*, are admissible or possible levels below the standard; *STANDARD*, are levels set up and established by authority, custom of general consent, as a model, example or rule for the measure of quantity, weight extent, value or quality. (U.S.D.P.)

LIFT PUMP. A collection system component that forces sewage to a higher elevation to avoid deep pipe networks. (U.S.D.P.)

LOCALITY. A relatively self-contained residential area/community/neighborhood/settlement within an urban area which may contain one or more dwelling/land systems. (U.S.D.P.)

LOCALITY SEGMENT. A 400m x 400m area taken from and representing the residential character and layout of a locality. (U.S.D.P.)

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

LOT. A measured parcel of land having fixed boundaries and access to public circulation. (U.S.D.P.)

LOT CLUSTER. A group of lots (owned individually) around a semipublic common court (owned in condominium). (U.S.D.P.)

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

LOT PROPORTION. The ratio of lot width to lot depth. (U.S.D.P.)

LUMINAIRE. In highway lighting, a complete lighting device consisting of a light source, plus a globe, reflector, refractor, housing and such support as is integral with the housing. (DePina, 1972)

MANHOLE. An access hole sized for a man to enter, particularly in sewer and storm drainage pipe systems for cleaning, maintenance and inspection. (U.S.D.P.)

MATRIX (OF BASIC REFERENCE MODELS). A set of models of urban layouts arranged in rows and columns. (U.S.D.P.)

MASTER PLAN. A comprehensive, long range plan intended to guide the growth and development of a city, town or region, expressing official contemplations on the course its transportation, housing and community facilities should take, and making proposals for industrial settlement, commerce, population distribution and other aspects of growth and development. (Abrams, 1972).

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

MESHING BOUNDARIES. Characterized by continuing, homogeneous land uses or topography, expressed as: *LINES:* property lines, political or municipal divisions, main streets, etc.; *AREAS:* similar residential uses, compatible uses (as parks with residential). (U.S.D.P.)

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

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

MODEL (OF URBAN LAYOUT). A representation of an urban residential area illustrating circulation, land utilization, land subdivision, and utility network of a specific layout and lot. (U.S.D.P.)

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

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

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

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

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

NEUTRAL WIRE. Wire carrying no voltage between itself and a ground. (ROTC ST 45-7, 1953)

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

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

OHMS (electrical). The unit of resistance to the flow electricity. The higher the number of ohms, the greater the resistance. When resistance is constant, amperage (and wattage) are in direct proportion to voltage. Resistance varies inversely with the cross-sectional area of the wire. Ohms = volts/amperes. R = E/I. The practical mks unit of electrical resistance that is equal to the resistance of a circuit in which a potential difference of one volt produces a current of one ampere or to the resistance in which one watt of power is dissipated when one ampere flows through it and that is taken as standard in the U.S. (U.S.D.P.; ROTC ST 45-7, 1953; Merriam-Webster, 1971)

OPTIMIZE/OPTIMALIZE. To bring to a peak of economic efficiency, specially by the use of precise analytical methods. (Merriam-Webster, 1971)

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

OXIDATION POND (LAGOON). A method of sewage treatment using action of bacteria and algae to digest/decompose wastes. (U.S.D.P.)

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

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

PLANNING. The establishment of goals, policies, and procedures for a social or economic unit, i.e. city. (U.S.D.P.)

PLOT/LOT. A measured parcel of land having fixed boundaries and access to public circulation. (U.S.D.P.)

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

POPULATION DENSITY. It is the ratio between the population of a given area and the area. It is expressed in people per hectare. It can be: *GROSS DENSITY:* includes any kind of land utilization, residential, circulation, public facilities, etc. *NET DENSITY:* includes only the residential land and does not include land for other uses. (U.S.D.P.)

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

PRIMER. A small introductory book on a specific subject. (U.S.D.P.)

PRIVATE LAND OWNERSHIP. The absolute tenure of land to a person and his heirs without restriction of time. (U.S.D.P.)

PRIVY. A small, often detached building having a bench with one or more round or oval holes through which the user may defecate or urinate (as into a pit or tub) and ordinarily lacking any means of automatic discharge of the matter deposited. (Merriam-Webster, 1971)

PROJECT. A plan undertaken; a specific plan or design. (U.S.D.P.)

PUBLIC CIRCULATION. The circulation network which is owned, controlled, and maintained by public agencies and is accessible to all members of a community. (U.S.D.P.)

PUBLIC FACILITIES. Facilities such as schools, playgrounds, parks, other facilities accessible to all members of a community which are owned, controlled, and maintained by public agencies. (U.S.D.P.)

PUBLIC SERVICES AND COMMUNITY FACILITES. Includes: public transportation, police protection, fire protection, refuse collection, health, schools, and playgrounds, recreation and open spaces, other community facilities, business, commercial, small industries, markets. (U.S.D.P.)

PUBLIC SYSTEM (general). A system which is owned and operated by a local governmental authority or by an established public utility company which is controlled and regulated by a governmental authority. (HUD/AID, Minimum Standards, 1966)

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

PUMP. A device or machine that raises, transfers, or compresses fluids or that attenuates gases especially by suction or pressure or both. (Merriam-Webster, 1971)

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

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

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

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

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

occupied by a railroad, the land used by a public utility. Rights-of-way may be shared (as streets; pedestrians and automobiles) or exclusive (as rapid transit routes; subways, railroads, etc.) (Merriam-Webster, 1971; U.S.D.P.)

ROADWAY (HIGHWAY). Portion of the highway included between the outside lines of gutter or side ditches, including all slopes, ditches, channels, and appurtenances necessary to proper drainage, protection, and use. (DePina, 1972)

ROW/GROUPED HOUSING. Dwelling units grouped together linearly or in clusters. (U.S.D.P.)

RUNOFF. That part of precipitation carried off from the area upon which it falls. (DePina, 1972)

RUNOFF-RAINFALL RATIO. The percentage (ratio) of stormwater runoff that is not reduced by evaporation, depression storage, surface wetting, and percolation; with increased rainfall duration, runoff-rainfall ratios rise increasing runoff flow. (U.S.D.P.)

SAND. Loose, distinguishable grains of quartz/feldspar, mica (ranging from 2mm to 0.02mm in diameter). (U.S.D.P.)

SANITARY SEWERAGE. The system of artificial usually subterranean conduits to carry off sewage composed of: *excreta:* waste matter eliminated from the human body; *domestic wastes:* used water from a home/community containing 0.1% total solids; and some *industrial wastes*, but not water from ground, surface, or storm. (U.S.D.P.)

SEMI-DETACHED DWELLING. Two dwelling units sharing a common wall (duplex). (U.S.D.P.)

SEPTIC TANK. A tank in which the organic solid matter of continuously flowing sewage is deposited and retained until it has been disintegrated by anaerobic bacteria. (Merriam-Webster, 1971)

SERIES CIRCUIT. Fixtures connected in a circuit by a single wire. When one fixture is out, the circuit is broken. Fixtures with different amperages cannot be used efficiently in the same circuit. (ROTC ST 45-7, 1953)

SETTLEMENT. Occupation by settlers to establish a residence or colony. (U.S.D.P.)

SEWAGE. The effluent in a sewer network. (U.S.D.P.)

SEWER. The conduit in a subterranean network used to carry off water and waste matter. (U.S.D.P.)

SEWER BUILDING CONNECTION. The pipe connecting the dwelling with the sewer network. (U.S.D.P.)

SEWERAGE. Sewerage system: the system of sewers in a city, town or locality. (Merriam-Webster, 1971)

SHAPE. Form/configuration of the site surface as defined by its perimeter/boundaries. (U.S.D.P.)

SHOPPING. (Facilities for) searching for, inspecting, or buying available goods or services. (U.S.D.P.)

SILT. Loose, unconsolidated sedimentary rock particles (ranging from 0.02mm to 0.002mm in diameter). (U.S.D.P.)

SITE. Land (that could be) made suitable for building purposes by dividing into lots, laying out streets and providing facilities. (Merriam-Webster, 1971)

SITE AREAS. Two types are considered: *GROSS AREA:* includes the whole site or the bounded piece of ground. *USABLE AREA:* includes only the portion of the site that can be fully utilized for buildings, streets, playgrounds, recreation facilities, gardens, or other structures. (U.S.D.P.)

SITE AND SERVICES. The subdivision of urban land and the provision of services for residential use and complementary commercial use. Site and services projects are aimed to improve the housing conditions for the low income groups of the population by providing: *a) SITE:* the access to a piece of land where people can build their own dwellings; *b) SERVICES:* the opportunity of access to employment, utilities, services and community facilities, financing and communications. (U.S.D.P.)

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

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

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

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

SOIL INVESTIGATION. It is the process to find the soil structure and other characteristics. It may include the following stages: initial soil survey, exploratory boring, construction boring. (U.S.D.P.)

SOIL PIPE. The pipe in a dwelling which carries the pipe discharge from water closets. (U.S.D.P.)

SOIL SURVEY (INITIAL). An on-site examination of surface soil conditions and reference to a GENERAL SOIL MAP. It is used to reveal obvious limitations/restrictions/hazards for early planning consideration. (U.S.D.P.)

STACK. The vertical pipe in a dwelling of the soil-, waste-, or vent-pipe systems. (ROTC ST 45-7, 1953)

STANDARD. 1) Something that is established by authority, custom or general consent as a model or example to be followed. 2) Something that is set up and established by authority as a rule for the measure of quantity, weight, extent, value or quality. (Merriam-Webster, 1971)

STANDPIPE. A pipe riser with tap used as a source of water for domestic purposes. (HUD/AID, Minimum Standards, 1966)

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

STREET LIGHTING. Illumination to improve vision at night for security and for the extension of activities. (U.S.D.P.)

SUBDIVISION REGULATIONS. Regulations governing the development of raw land for residential or other purposes. (Abrams, 1972)

SUBGRADE. The layer of natural soil or fill (compacted soil) upon which the pavement structure including curbs is constructed. (DePina, 1972)

SUBMAIN or BRANCH SEWER. A collector pipe receiving sewage from lateral sewer only. (U.S.D.P.)

SUBSISTENCE INCOME. The minimum amount of money required for the purchase of food and fuel for an average family to survive. (U.S.D.P.)

SULLAGE. Drainage or refuse especially from a house, farmyard, or street. (Merriam-Webster, 1971)

TAP (also FAUCET). A fixture for drawing a liquid from a pipe, cask, or other vessel. (Merriam-Webster, 1971)

TAX EXEMPTION. A grant by a government of immunity from taxes; (a ten-year tax exemption on new housing in New York stimulated new construction in the 1920's; to ease its housing shortage, Turkey granted a ten-year tax exemption on new buildings). (Abrams, 1966)

TAX INCENTIVE. Favorable tax treatment to induce the beneficiary to do something he would not otherwise be likely to do. (U.S.D.P.)

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

TELEPHONE. An electrical voice communication network interconnecting all subscribing individuals and transmitting over wires. (U.S.D.P.)

TENURE. Two situations of tenure of the dwelling units and/or the lot/land are considered: *LEGAL:* having formal status derived from law; *EXTRALEGAL:* not regulated or sanctioned by law. Four types of tenure are considered: *RENTAL:* where the users pay a fee (daily, weekly, monthly) for the use of the dwelling unit and/or the lot/land; *LEASE:* where the users pay a fee for long-term use (generally for a year) for a dwelling unit and/or the lot/land from the owner (an individual, a public agency, or a private organization); *OWNERSHIP:* where the users hold in freehold the dwelling unit and/or the lot/land which the unit occupies; *EMPLOYER-PROVIDED:* where the users are provided a dwelling unit by an employer in exchange for services, i.e. domestic live-in servant. (U.S.D.P.)

TITLE. The instrument (as a deed) that constitutes a legally just cause of exclusive possession (of land, dwellings, or both). (Merriam-Webster, 1971)

TOILET. A fixture for defecation and urination, esp. water closet. (7th Collegiate Webster, 1963)

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

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

TRAP. A fitting that provides a water seal to prevent sewer gases and odors being discharged through fixtures. (ROTC ST 45-7, 1953)

TREATMENT WORKS. Filtration plant, reservoirs, and all other construction required for the treatment of a water supply. (ROTC ST 45-7, 1953)

UNIT. A determinate quantity adopted as a standard of measurement for other quantities of the same kind. (Merriam-Webster, 1971)

URBAN TRANSPORTATION. Means of conveyance of passengers or goods from one place to another along ways, routes of circulation in a metropolitan context. (U.S.D.P.)

URBANIZATION. The quality or state of being or becoming urbanized; to cause to take on urban characteristics. (U.S.D.P.)

USE TAX. The tax on land aimed primarily at enforcing its use or improvement. (U.S.D.P.)

USER INCOME GROUPS. Based upon the subsistence (minimum wage) income per year, five income groups are distinguished: *VERY LOW (below subsistence level):* the income group with no household income available for housing, services, or transportation; *LOW (1 x subsistence level):* the income group that can afford no or very limited subsidized housing; *MODERATE (3 x subsistence level):* the income group that can afford limited housing and rent only with government assistance; *HIGH (5 x subsistence level):* the income group that can afford housing without subsidy, by cash purchase, through mortgage payments, or by rent; *VERY HIGH (10 x subsistence level):* the income group that represents the most economically mobile sector of the population. (U.S.D.P.)

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

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

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

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

VENT. A pipe opening to the atmosphere, which provides ventilation for a drainage system and prevents trap siphonage or back pressure. (ROTC ST 45-7, 1953)

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

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

WALK-UP. Dwelling units grouped in two to five stories with stairs for vertical circulation. (U.S.D.P.)

WASTE PIPE. A pipe (in a dwelling) which carries water from wash basins, sinks, and similar fixtures. (ROTC ST 45-7, 1953)

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

WATERSHED. The catchment area or drainage basin from which the waters of a stream or stream system are drawn. (Merriam-Webster, 1971)

WATERWORKS. The whole system of reservoirs, channels, mains, and pumping and purifying equipment by which a water supply is obtained and distributed to consumers. (Merriam-Webster, 1971)

WATT. Watts (w) measure the power of the flow of energy through a circuit. Wattage is the product of volts times amperes. Both watts and hosepower denote the rate of work being done. 746w = 1hp. (ROTC ST 45-7, 1953)

ZONING ORDINANCE. The demarcation of a city by ordinance into zones (areas/districts) and the establishment of regulations to govern the use of land and the location, bulk, height, shape, use, population density, and coverage of structures within each zone. (U.S.D.P.)

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EQUIVALENTS

METRIC SYSTEM EQUIVALENTS

Linear Measures

1 centimeter		= 0.3937 inches
1 meter	= 100 centimeters	= 39.37 inches or 3.28 feet
1 kilometer	= 1,000 meters	= 3,280.83 feet or 0.62137 miles
1 inch		= 2.54 centimeters
1 foot		= 0.3084 meters
1 mile		= 1.60935 kilometers

Square Measures

1 square meter	= 1,550 square inches or 10.7639 square feet
1 hectare = 10,000 sq meters	= 2.4711 acres
1 square foot	= 0.0929 square meters
1 acre	= 0.4087 hectares

DOLLAR EQUIVALENTS

All income, cost, and rent/mortgage data have been expressed in terms of the U.S equivalent;
1 U.S. dollar = 3.28 Saudi Riyals

QUALITY OF INFORMATION

The quality of information given in the drawings have been qualified in the following manner:

Tentative: when based upon rough estimations of limited sources

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

Accurate: when taken from reliable or actual sources

QUALITY OF SERVICES, FACILITIES AND UTILITIES

Non: when the existence of services, facilities and utilities are unavailable to a locality

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

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

PHOTOGRAPH, opposite page:
OLD TRADITIONAL: A minor street in front of traditional houses and new emerging apartment buildings.