

DWELLING ENVIRONMENTS: URBAN EXPANSION PROJECT
GUJJARPURA, LAHORE, PAKISTAN

by

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Submitted in Partial Fulfillment
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ABSTRACT

This study deals with housing for the low/middle income sector in Lahore, Pakistan. The subject focuses on land subdivision and provision of services for a proposed site at Gujjarpura, Lahore. The policies and guidelines for the development of the project were determined after a comparison and evaluation of existing low/middle income dwelling environments within the city which include traditional housing, squatter settlements and public housing schemes. The study covers two aspects; firstly it provides a set of guidelines that affect decision at policy making level and secondly the physical design aspects, the aim being to optimize physical products and minimize costs at both levels.

Thesis Supervisor: Horacio Caminos

Title: Professor of Architecture

CONTENTS

| | |
|--|-----------|
| PREFACE | 6 |
| INTRODUCTION | 7 |
| PROJECT DATA: GUJJARPURA URBAN EXPANSION SCHEME | 10 |
| URBAN SECTOR | 12 |
| POLICIES AND GOALS | 18 |
| LAND USE PLAN | 20 |
| CIRCULATION PLAN | 22 |
| DEVELOPMENT PLAN | 24 |
| BLOCKS, LOTS, CLUSTERS | 26 |
| UTILITIES | 31 |
| Water Supply | 32 |
| Sewage Disposal | 33 |
| Storm Drainage | 34 |
| Street Lighting/Electricity | 35 |
| CONCLUSIONS | 36 |
| APPENDIX | 39 |
| LAHORE Urban Context | 40 |
| CASE STUDIES | 45 |
| Gujjarpura | 46 |
| Iqbal Town | 52 |
| EVALUATIONS | 61 |
| Land Utilization Patterns | 62 |
| GLOSSARY | 64 |
| REFERENCES/ABBREVIATIONS | 68 |

PREFACE

This study describes and evaluates different dwelling environments which cover the whole spectrum of low income settlements and related issues existing in Lahore today. The focus of the study is presented as a proposal for an Urban Expansion Scheme located in Lahore.

The study is derived from my field research carried out in the summer of 1978-79. Surveys and field research included socio-economic and physical aspects of the settlements. Additional information in terms of maps and reports has been collected from various authorities which include L.D.A. and Housing and Physical Planning Cell, Government of Punjab. Three of the case studies have been taken from "Dwelling Environments; A Comparative Analysis" (Parvez L. Qureshi 1979). The case studies are utilized as a reference for the formulation of policies for the proposed model. The case study analysis is based on the methodology developed in the Urban Settlement Design for Developing Countries Program under the direction of Professor Horacio Caminos.

I gratefully acknowledge the guidance and support of Professor Horacio Caminos during the 2 years of the study. I also sincerely appreciate the assistance, encouragement, and friendship of Reinhard Goethert at the various stages of this study, to Happy and members of my class and the class of 1977-79 and 1979-81 for their company and comments.

I am also indebted to many people at the Lahore Development Authority, Housing and Physical Planning

Cell, Government of Punjab, friends at National Engineering Services (Pakistan) Ltd. especially Mr. Irshad Ahmed and many others who directly or indirectly contributed to this study.

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Finally to Parvez for his love, encouragement, patience and support.

basic needs of food, shelter, medical care and education remain unfulfilled. The government's responses to the problems of the poor have been piecemeal solutions to immediate needs, which do not tackle the fundamental issues nor understand the long range implications. More often than not, the beneficiaries of such policies have been the higher income groups, with only a token improvement in the lot of the urban poor.

This study concentrates on the analysis of the various dwelling environments of the neglected low income sector. Selected case studies representing a cross section of housing systems of the very low, low and middle income groups have been evaluated. Included in the studies are traditional dwellings, squatter settlements and also public housing schemes which illustrate the government's response towards solving the housing problems of the city. The evaluation and comparisons of these dwelling environments are made in terms of land utilization, density and circulation patterns.

The existing situation of the dwelling systems must be accepted as a starting point for any reasonable program of action and improvement. The existing dwelling systems have both negative and positive attributes which the authorities need to recognize. Subsequently, the policies and actions should be geared towards exploiting these potentials and providing the framework for planning and executing future developments.

The results of the study are illustrated in a proposed model for the design of an Urban Expansion Scheme, at Gujjarpura, Lahore. The model is used as an example to show efficient land utilization, effective circulation and appropriate densities as well as minimum cost utility layouts.

The model is only a tentative layout. Essentially, it suggests means of optimization of physical products utilizing yardsticks for design decisions as indicated by the existing conditions. The primary aims are to minimize costs and to reduce public responsibility in terms of efficient infrastructure and utility layouts, and minimization of public areas, circulation areas and lengths. Private responsibility is stressed and the community resources are utilized at a maximum. The layout permits flexibility and is adaptable to different site conditions.

In summary, this study is intended as a reference for developing guidelines for those involved in planning of residential developments and in the formulation of housing policies.

INTRODUCTION

The pressures of urbanization have affected the cities of Pakistan at a rate much faster than that with which they can cope. Although only 27% of the total population of 75 million live in urban areas, migration to the cities has increased at such a rate that the urban population will more than double by the turn of the century. This migration has been due to the presumed better living conditions and employment prospects offered by the cities. This fast growth rate of urban areas has given rise to immense social, economic and physical problems which assume even greater proportions due to the government's limited resources, often short sighted policies and a lack of serious effort to improve the situation.

The housing situation is one of the major issues that has consistently deteriorated over the years, and it demands immediate attention. The large housing shortage is attributed to the scarcity of developed urban land, high costs of construction, unavailability of construction materials, outdated zoning regulations, poor administration, inadequate savings and a lack of institutional finances. Most affected by this shortage are the low and very low income groups, which comprise 80% of the total urban population.

This study focuses on the city of Lahore which is the second largest city of Pakistan with a population of 3.3 million. The majority of this population live in physically deteriorated dwellings, lacking even the basic utilities and services. More than half of this majority has limited financial resources, and their



PROJECT DATA

PROJECT: URBAN EXPANSION SCHEME, GUJJARPURA.

The project is a study for the development of a site at Gujjarpura. The data for land utilization, density and circulation patterns has been determined from the results of the evaluations of the case studies (refer to appendix). The primary use of the site will be for residential purposes with supporting facilities such as schools, clinics, parks and playgrounds, commercial facilities and markets catering to a population of 80,000 inhabitants.

The Site: LOCATION:

- Inner Metropolitan Area, Lahore
- Approximately 4 km. northeast of the city centre adjacent to Gujjarpura Katchi Abadi. in the south.
- The area to the east and west is mostly undeveloped agricultural land.
- The northern edge of the site is abutted by Bund Road which also forms a protective dyke to protect the city from flooding of the River Ravi.
- The existing neighbouring residential areas belong to the very low, low and middle income sector.
- A number of small industries exist within the neighbouring residential areas.

ACCESSES/APPROACHES

- Main approach from the city centre is from Grand Trunk Road via Bhogiwala Road.
- A second route is through Ghore Shah Road via Kot Khawja Saeed Road.
- All approaches provide very narrow and restrictive accesses to the site through residential areas.

AREA

- Defined by manmade barriers only; Bund Road on the north and unpaved roads on the east, west and south.
- Approximate area of the site: 232 Ha.
Usable area: 206 Ha.

MAIN CHARACTERISTICS

- Almost rectangular site presently used for agricultural purposes. A few isolated structures exist on the site.
- A number of ponds formed by the collection of surface water are scattered over the area.
- Two power transmission lines cross the site; one towards the north, the other in the south.
- The Chotta Ravi drain cuts across the centre of the site. This will form the main storm water drain for this sector of the city
- Land acquired from the private sector by the Lahore Development Authority for development purposes at the rate of Rs.8,000/- (U.S.\$800/-) per hectares
- Four large sectors of area within the site comprise of private built-up area amounting to a total of 17.5 hectares; lots in these areas will be provided with utility connections after development of the site.
- The site slopes gently from the north and south to the Chotta Ravi Drain towards the centre of the site.

The Plan: INTENDED USE:

- Primarily for residential use with supporting commercial and community services.
- Large lots to be reserved for industrial use.

POPULATION:

- 85,000 persons with a gross density of 400 persons per hectare.
- This figure may increase to 100,000 persons on saturation and population increase due to further subdivision of lots, subletting of rooms and construction of two, three or more floors per lot at a later stage.
- Target income groups; very low, low and middle.

DEVELOPMENT GOALS:

- Provide housing and serviced lots for very low, low and middle income sectors.
- to provide alternative housing options
 1. Serviced lot/ cluster unit
 2. Core/ shell units
 3. Single room with service core (kitchen/bath)
 4. Larger lot sizes for those with commercial potential
 5. Industrial lots
 6. Reserve land for development of cooperative housing schemes by various developers such as government institutions or private corporations.
- The level of services will be either minimum or standard.

LAND USE: PRELIMINARY ESTIMATES:

- Private/semi-private; 60 - 70 %
- Semipublic/ schools, parks, community facilities: 10 - 15 %
- Public areas/ streets 15 - 20 %

PLANNING ELEMENTS/ INNOVATIONS

- The physical plan will provide for maximum private responsibility in the development and maintenance of the project.
- Horizontal condominiums will provide the main residential components.
- Schools combined with playgrounds, mosques and parks to act as community centres.
- Flexible planning to allow maximum accommodation to change.
- Minimum number of streets to have piped or underground drainage to reduce costs. Other streets only to
- Street widths determined essentially for pedestrian and light traffic only; widths increase on streets with commercial potential to cater for heavier traffic.

URBAN SECTOR

A detail analysis for site development of the proposed model demands a study of a larger sector of the city around the site. The sector has been selected to specifically locate the site in the city context. The existing and projected constraints that will effect its development are defined here.

LAND USE:

- EXISTING: - The area surrounding the site has medium to high density residential for the very low to middle income sector
- Commercial areas run linearly along the main routes.
 - Schools, clinics and other semipublic facilities are barely adequate.
- A number of industries exist in scattered localities such as pharmaceutical works, steel rolling mills and other small workshops.
- Two large industries occur in the east of the site on Grand Trunk Road; the Bata Shoe Company and the Pakistan Mint. However no further industrial development is taking place in this direction due to the proximity of the Indian border.
- PROJECTED:- Residential from very low to middle income
- Small scale industry along Bund Road

CIRCULATION:

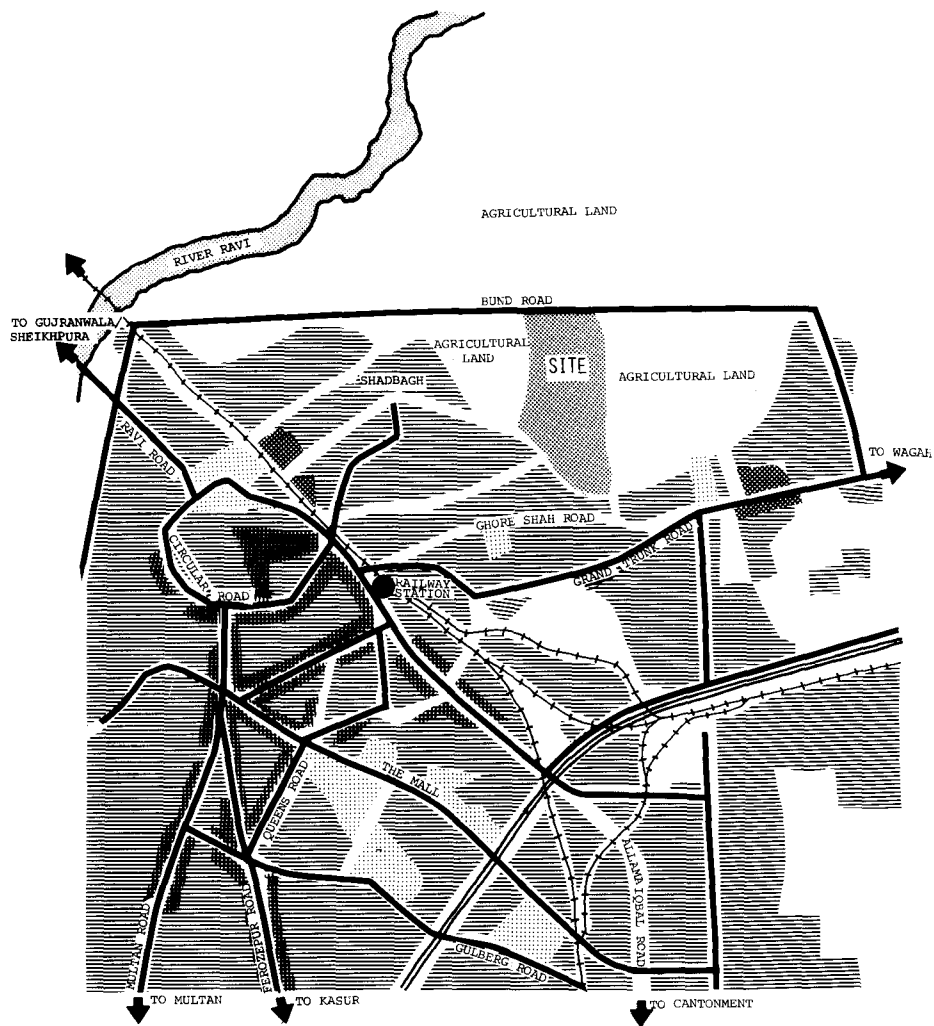
- EXISTING: - Bund Road to the north linking the site to Ravi Road
- Grand Trunk Road
 - Ghore Shah Road; main route presently connecting the site to the city centre; this road has recently undergone repair and widening.

- PROPOSED: - Extension of existing Katcha road in site to Shalimar Link Road on the east and Do Mori Pul on Circular Road on the west
- Link route along the Chotta Ravi Drain from Shalimar Link Road to Ravi Road.
 - Widening and extension of road from Shadbagh to the site.
 - Widening of Bhogiwal Road to Grand Trunk Road.

LIMITATIONS AND CONSTRAINTS:

The area surrounding the site is essentially low to middle income residential; its growth has been unplanned and haphazard. Most of the circulation network comprises of narrow streets which limit transportation to small vehicles only. This will be a great limitation for the development of the site. To ensure smooth public transportation means for the increased population in the locality, some of the roads will have to be widened and repaired particularly the link routes to Grand Trunk Road and to Circular Road. It is emphasised that the proposed routes be repaired and widened as soon as the project is initiated. The site was vacant private land used for agricultural purposes. Since the direction of growth of the city has been towards the south due to physical barrier on the north ((River Ravi and its annual flooding) and the political barrier (proximity to Indian border) on the east, this sector of the city did not develop although its close proximity to the city centre would suggest the contrary. However the city has continued to grow slowly in this direction and presently a small parcel of land between Bund Road and the built-up area remains undeveloped.

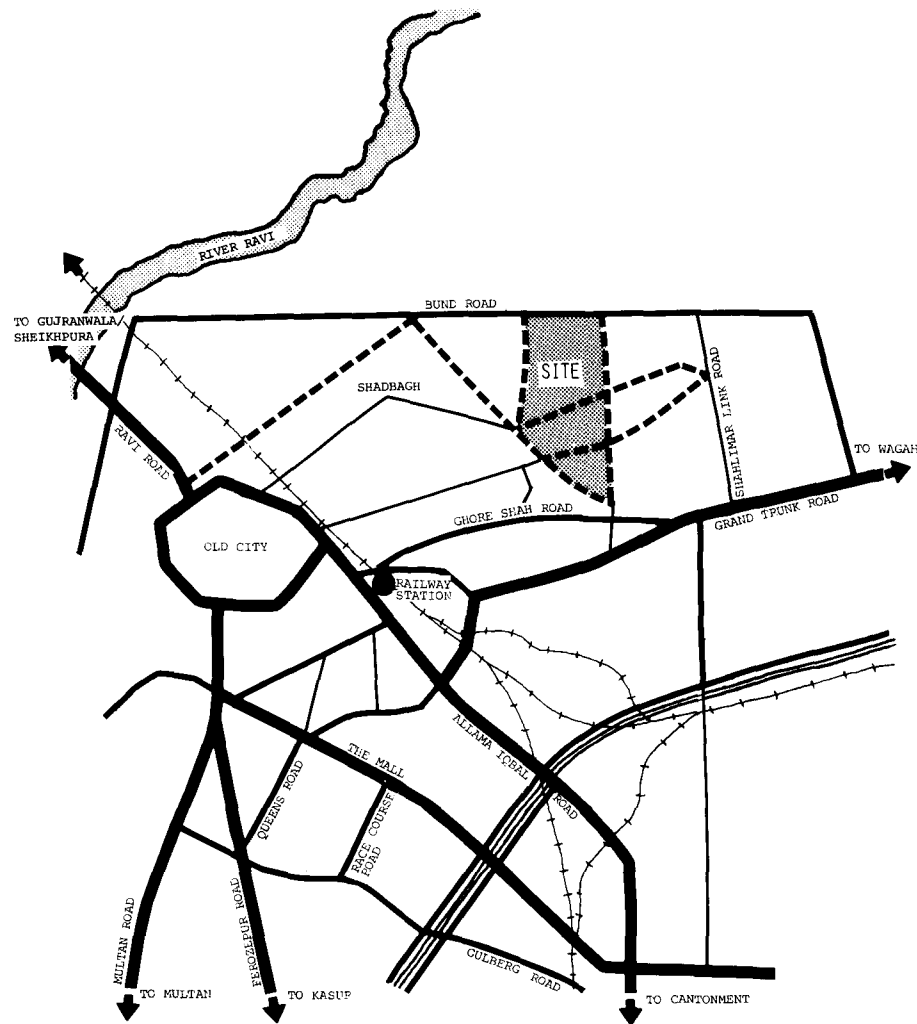
The major constraints of the surrounding areas are shown in the plans on the right. They help define the site and identify its possible development mode.



AREAS

- RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- OPEN SPACES
- BUS ROUTES

LAND USE

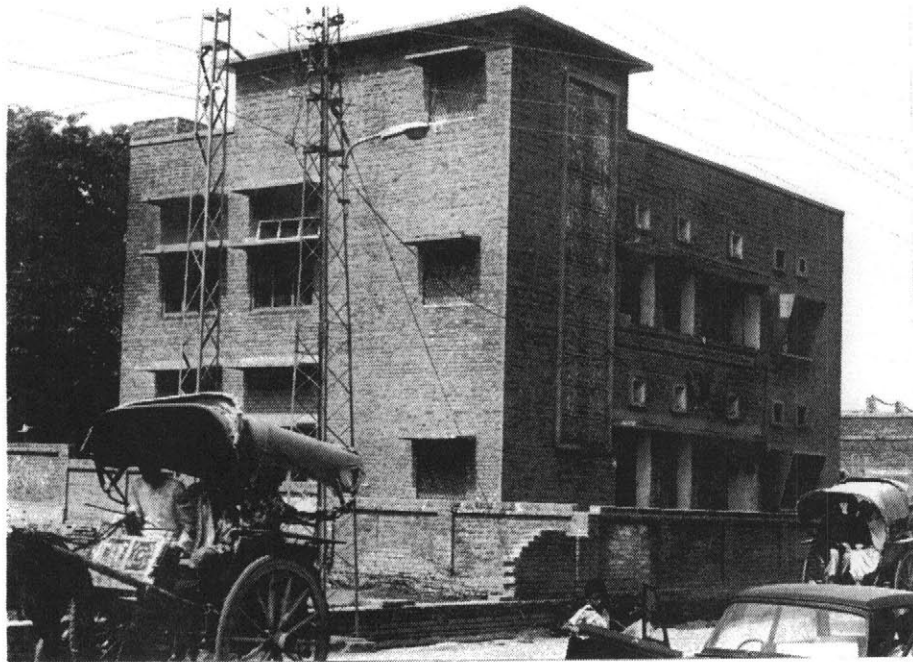
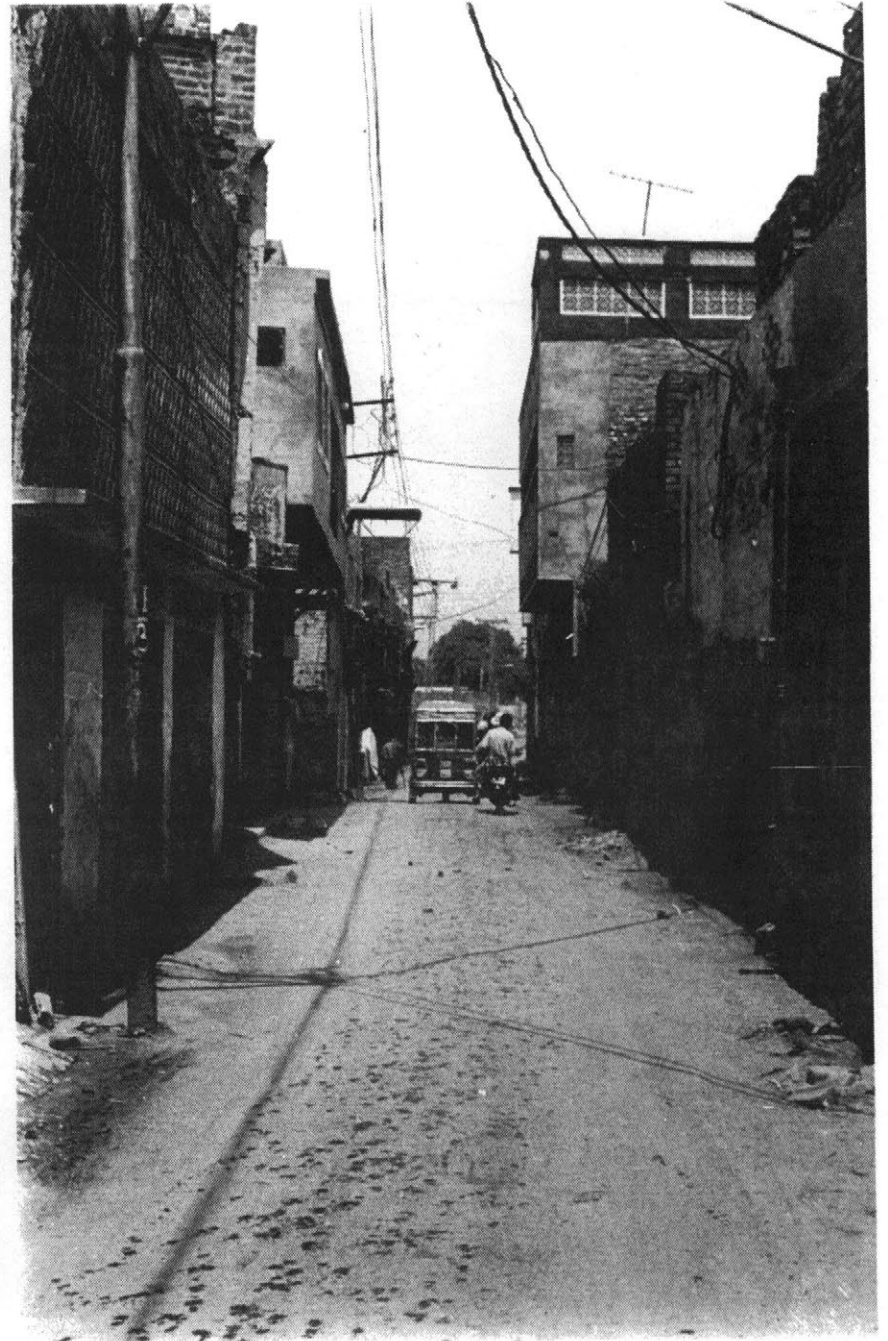


KEY

- EXISTING ROADS
- PROPOSED ROADS
- RAILWAY LINE

CIRCULATION







PHOTOGRAPH:
 SITE OF URBAN EXPANSION PROJECT, GUJJARPURA AND ITS
 VICINITY
 (OPPOSITE PAGE)
 (TOP LEFT) A view of Ghore Shah Road
 (BOTTOM LEFT) The only school building in Gujjarpura
 Katchi Abadi.
 (RIGHT) Bhogival road: The main approach route from
 Grand Trunk Road to the site in Gujjarpura.
 (TOP) View of the unpaved road linking Kot Khawja
 Saeed Road to Shahlimar Link Road.
 (BOTTOM) Sewage water from the existing Gujjarpura
 Abadi being pumped and disposed onto the fields
 which form part of the site for the Urban Expansion
 Project.

SITE DATA

AREA:

Gross area of the site: 234.0 Ha.
 Area covered by transmission lines: 2.4 Ha.
 Area covered by Chotta Ravi Drain: 2.7 Ha.

BOUNDARIES:

North: Bund Road
 South: Katcha Road
 East : Katcha Road
 West : Katcha Road

ACCESSES:

Existing Khawja Saeed Road on the west and Bhogiwal Road on the east. Bund Road on the north connects site to Ravi Road. Proposed roads to Shadbagh and Circular Road.

LOCATION:

4 Km. to city center. Sources of employment within walking and cycling distance.

TRANSPORTATION:

No convenient public transportation available near the site. Means of transportation include walking, cycling, tonga (horse-pulled cart), rickshaw.

TOPOGRAPHY:

Land slopes gently from North and South towards the Chotta Ravi Drain in the center of the site.
 A number of ponds which collect surface water.

LAND OWNERSHIP:

Lahore Development Authority.
 The land has been acquired by L. D. A.

UTILITIES:

Feasible connection of sewer, electricity, water to existing/planned networks.

EXISTING STRUCTURES, EASEMENTS, RIGHT OF WAY:

Two power lines running in the North and the South that will restrict use of land under it.
 The Chotta Ravi Drain running through the center of the site.

OTHER FACTORS:





Views : Neutral
 Smoke Odors: None
 Dust : None
 Flooding : Protective bund will prevent flood-water of the Ravi to enter the site
 Hazards : None; area under power lines should remain unbuilt and well protected
 Airports : None in proximity

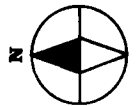
RECOMMEND INVESTIGATION:

The low lying areas in the site which contain surface water have to be drained and the utilization of that land is to be investigated. The sewage and drainage of the area will have to be thoroughly investigated prior to implementation of project.



KEY

-  BUILT-UP AREA
-  EASEMENTS
-  EXISTING ROADS/PATHS
-  CONTOUR LINES
(1 Foot Interval)



SITE PLAN

PLANNING POLICIES/GOALS

The site for the Gujjarpura Urban Expansion Scheme falls in a predominantly very low, low and middle income residential area. Heavy industrial growth does not exist in the vicinity due to geographical and political reasons. However small scale industry does exist and it can be predicted that industrial activity of this scale will continue to develop in the area.

The policies and goals that are proposed for the Urban Expansion Scheme are as follows:

PRIMARY USE: RESIDENTIAL

- The project will primarily be for residential use.
- Supporting land uses will include schools, clinics, mosques, parks, playgrounds, commercial facilities and markets.
- Areas will be reserved for industrial lots, specifically small scale industry.
- It is recommended that a larger block be reserved for the development of a dairy farm which will form a viable industry in the area considering that a large population of cattle is reared by a considerable portion of the population.
- Commercial activity will develop on main streets and main intersections; allowance shall be made in terms of larger lot sizes to permit development of commercial and related facilities along these roads

TARGET INCOME GROUPS: PREDOMINANTLY LOW INCOME

- Development will aim at very low, low, lower middle and middle income groups.
 - Very low : Rs. 300/- and below
 - Low : Rs. 300-500 per month
 - Lower middle: Rs. 500-700 per month
 - middle : Rs. 700-1200 per month
- In addition to these sites will also be provided for upper middle income groups and industrial lots.

INTENSITY OF LAND USE: MEDIUM/HIGH

- The gross density range will be between 200-400 persons per hectare.
- 200 persons per Hectare assumes single storey single family units.
- 400 persons per hectare assumes that over a period of time, density will increase by a 100% as a result of expansion to 2-3-4 storeys, higher room occupancies and encroachment on built-up areas.

LAND TENURE: PRIVATE/COOPERATIVE/LEASE/RENTAL

- A variety of tenure options will be offered which mainly include private ownership, cooperative/horizontal condominium ownership, lease and rental.
- Horizontal cluster/condominium will provide maximum flexibility in land subdivision
- Rental options will be available to very low income groups only to be eventually converted to private ownership.
- To check land speculation, no lot will be allowed to be resold to another owner except back to the authority or cooperative for the initial 5-7 years.

FINANCING: PUBLIC/ PRIVATE

- The initial cost of development will be borne by the Lahore Development Authority and the public sector.
- Development costs of the site shall be charged to the private sector in installments on purchase of lots.
- The private sector will finance its own construction costs as individuals or cooperatives.

CIRCULATION:

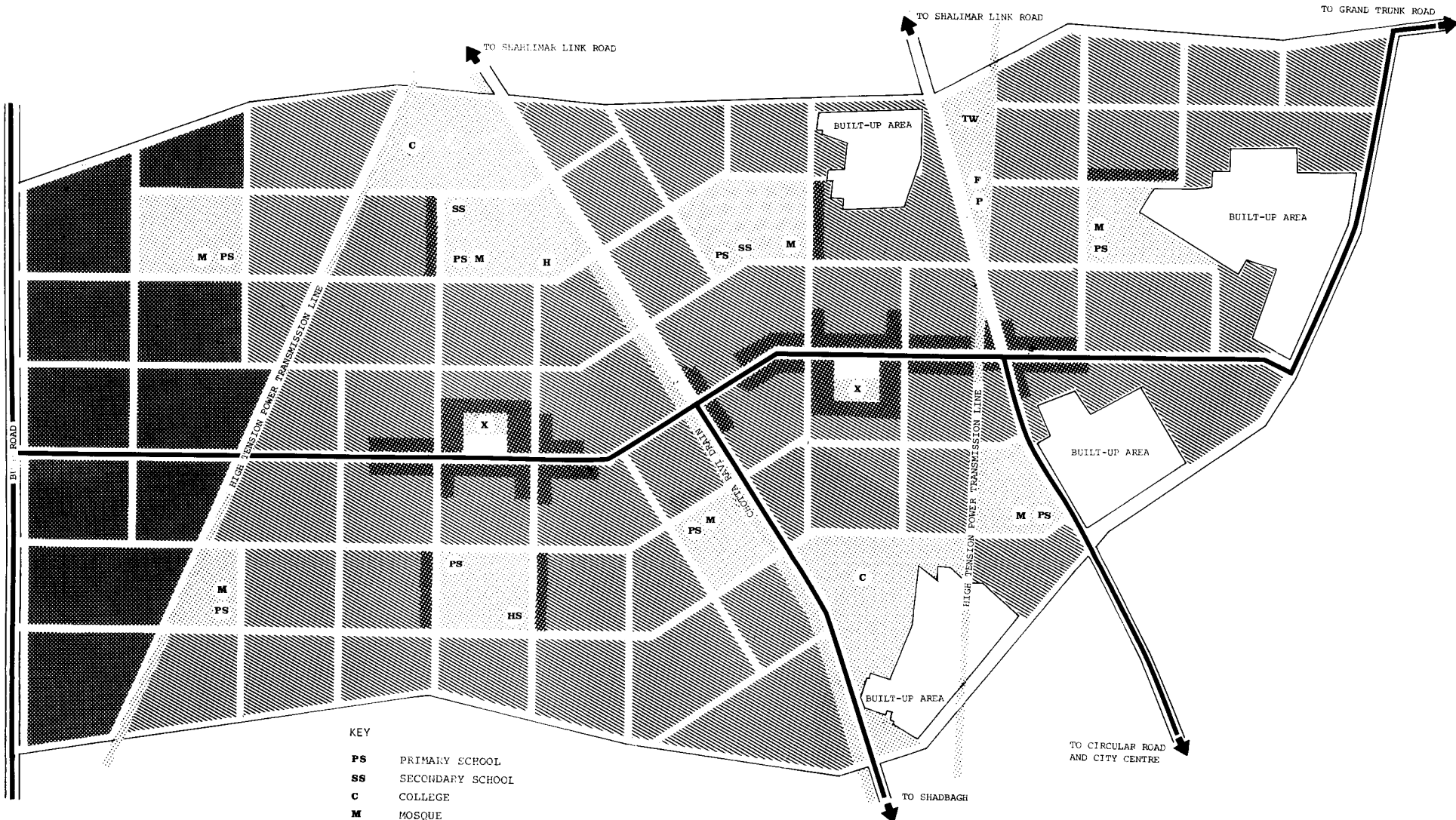
- The circulation network will provide the framework for development of the site.
- The internal circulation network will be linked to the main external routes that provide access to the city centre.
- The street layout will control the traffic frequency and character of the traffic.
- All internal traffic will be predominantly pedestrian and light traffic except for the main central spines and bus routes.
- All utilities will run along the main streets only.

UTILITIES

- Water supply will be provided from a main tubewell to be constructed within the site.
- Sewage will be disposed by underground sewage lines to the Chotta Ravi Drain from where it will be pumped to the River Ravi or the city sewage treatment works.
- Electricity will be provided by the WAPDA power supply network
- Storm water drainage is mandatory to prevent heavy flooding and standing stagnant water during the rainy season. Most of the water will be drained through open channels along the circulation networks to the Chotta Ravi drain.
- Refuse collection will be the responsibility of the Lahore Municipal Corporation.
- Gas connections can be supplied by Sui Northern by extension of the gas line from Ghore Shah Road along Khawja Saeed Road.

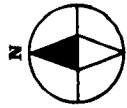
DEVELOPMENT MODE: INCREMENTAL GROWTH

- The site will be developed incrementally
 - Two main periods are considered:
 - Preliminary: Initial studies and planning.
 - Implementation: This will be staged into:
 1. Planning and design
 2. Allocation of lots, construction
 3. Habitation
 4. Evaluation and revision
- This cycle will be repeated until saturation.
- Progressive improvement of the site and services will take place over a period of time.



- KEY**
- PS PRIMARY SCHOOL
 - SS SECONDARY SCHOOL
 - C COLLEGE
 - M MOSQUE
 - F FIRE STATION
 - H POLYCLINIC
 - TW TUBEWELL
 - X MARKET
POST OFFICE
TELEGRAPH
CINEMA
 - BUS ROUTE

- AREAS**
- RESIDENTIAL
 - COMMERCIAL
 - INDUSTRIAL
 - OPEN SPACES



PROPOSED LAND USE PATTERN

CIRCULATION PLAN

The circulation network determines the framework for development of the site. It not only channelizes the pedestrian and vehicular movement but also formulates land utilization patterns, land subdivision as well as layouts of utilities which include water supply, sewage, storm water drainage, electricity and gas lines.

The circulation network has been developed keeping into consideration the following:

- Recognition of predominant pedestrian mode of circulation within the site.
- Main accesses from the city to the site. Presently there are two accesses to the site from Grand Trunk Road and Kot Khawja Saeed Road.
- The proposed and existing roads along Chotta Ravi Drain and the Katcha Road that will link Shadbagh and the Central city to Shahlimar Link Road.
- The drainage patterns of the site.

The following circulation modes are considered in the network:

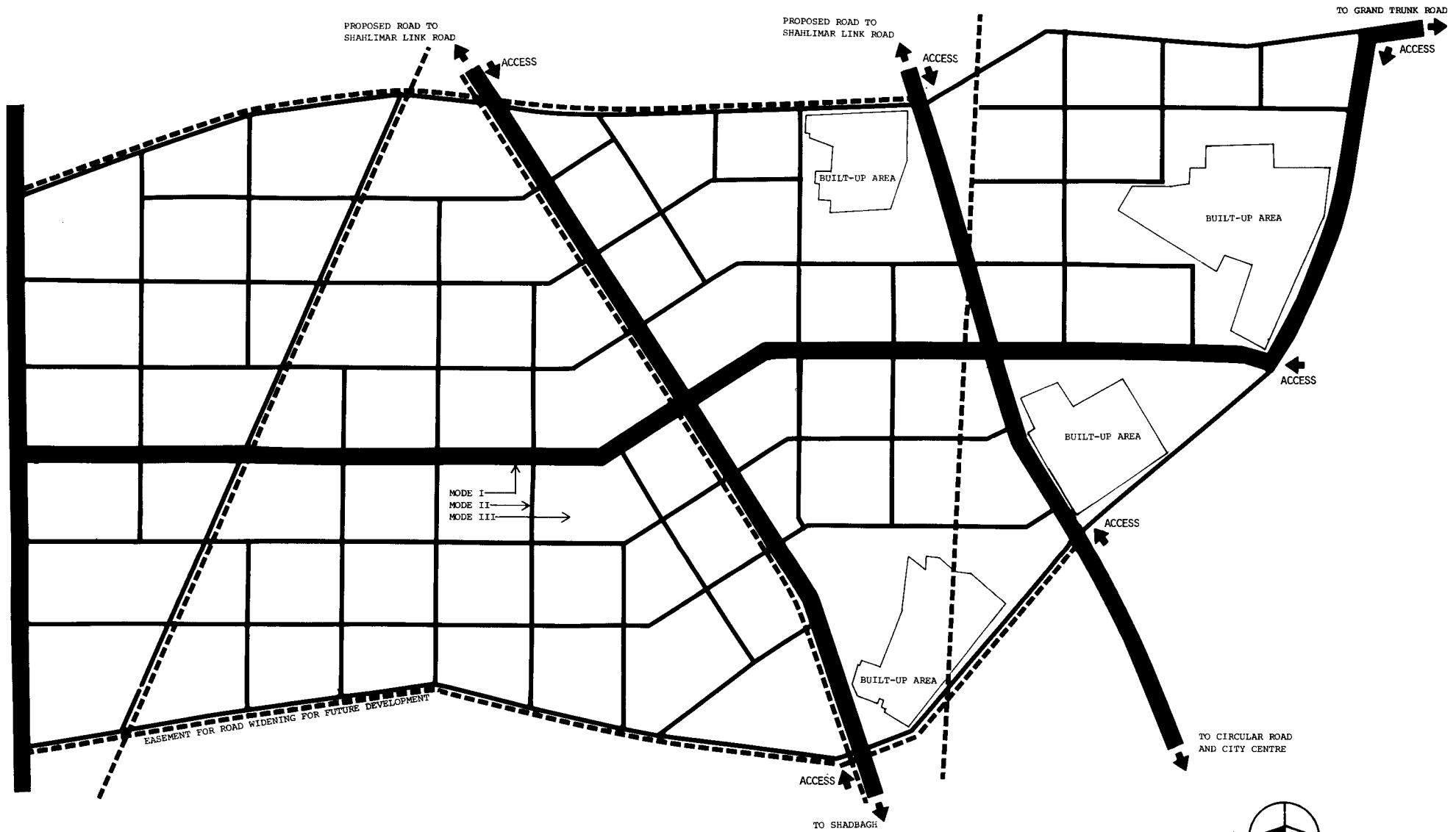
- MODE I : Primary streets; vehicles and pedestrian mixed, vehicles dominate but do not control circulation.
- MODE II: Residential streets; pedestrian and vehicles mixed, pedestrians dominate over vehicles; used mainly as access to lots, clusters and community facilities.
- MODE III: Pedestrian walkways and cluster courts; exclusive use by pedestrian.

The circulation network is planned on a grid system, the size of intervals being small enough to facilitate pedestrian circulation among the various community elements: shops, dwellings, services etc. and large enough to minimize land area percentage and reduce public costs in construction, maintenance and operation of utilities and services.

A central spine runs through the centre of the site in a north south direction serving as a main access into the locality. The central community facilities such as the market, post office, telegraph/telephone etc. have land reserved on this street to create a focus of activity. A bus route on this spine will provide local transportation to all the residential areas within walking distance.

All utilities are proposed to be laid on the horizontal streets running in the north south direction. The sewage and storm water drainage will be channeled along these streets to the Chotta Ravi Drain from where it will be further pumped to a main sewage treatment plant or the River Ravi.

The peripheral streets running in the north south direction of the locality will initially be designed as pedestrian/secondary streets so as to encourage use of the central spine. The peripheral streets will primarily serve this locality till the area on the side is developed. However as soon as development begins to occur east and west of the locality these streets will require widening and upgrading.



KEY
—— STREETS
- - - EASEMENTS

PROPOSED CIRCULATION PATTERN

0 100 500m
1:10000

DEVELOPMENT PLAN

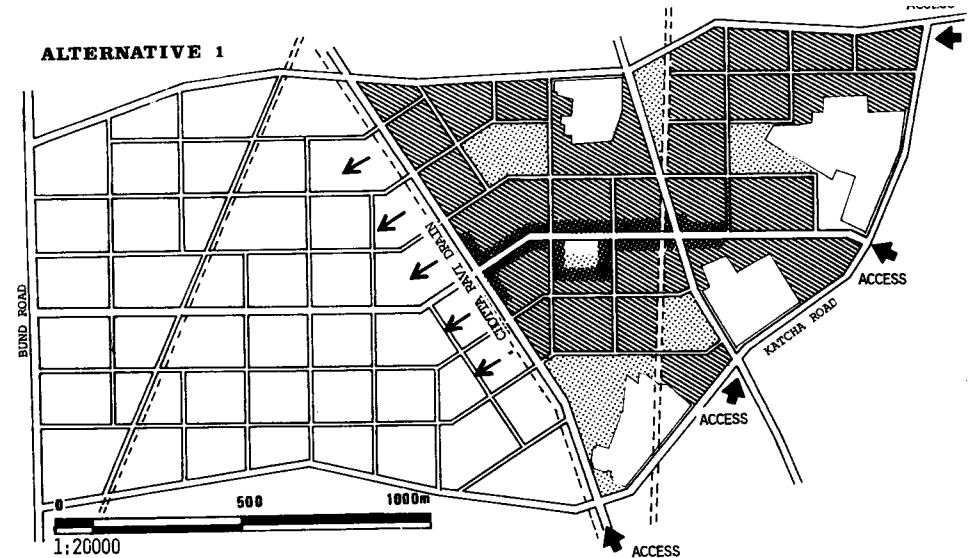
The rate and mode of development will be dependant on a number of issues - economic, social, political and physical. It is, therefore, difficult to forecast at this preliminary stage the development trends in the future. The development of the preliminary model is based on the following:-

- Land use, circulation and development are inseparable, interacting systems
- Maximum flexibility in the design should be provided to allow for the continuous process of construction, habitation, evaluation and revision.
- Maximum flexibility should be provided within the overall on-going and constantly changing social and economic contexts.

Some of the constraints that have been considered for the initial development are as follows:

- The easiest direct access from the city centre to the site will form the initial development area.
- Convenient pedestrian/vehicular access to public transportation
- Immediate utilization of existing and available infrastructure and services of the adjacent communities in terms of sewer, water supply, electricity connection, initial use of school, market and public facilities. This would result in lower initial costs by utilizing the available resources on more important priorities.

The development plans shown here illustrate the potential for various development options adaptable to the layout.



ASSUMPTIONS

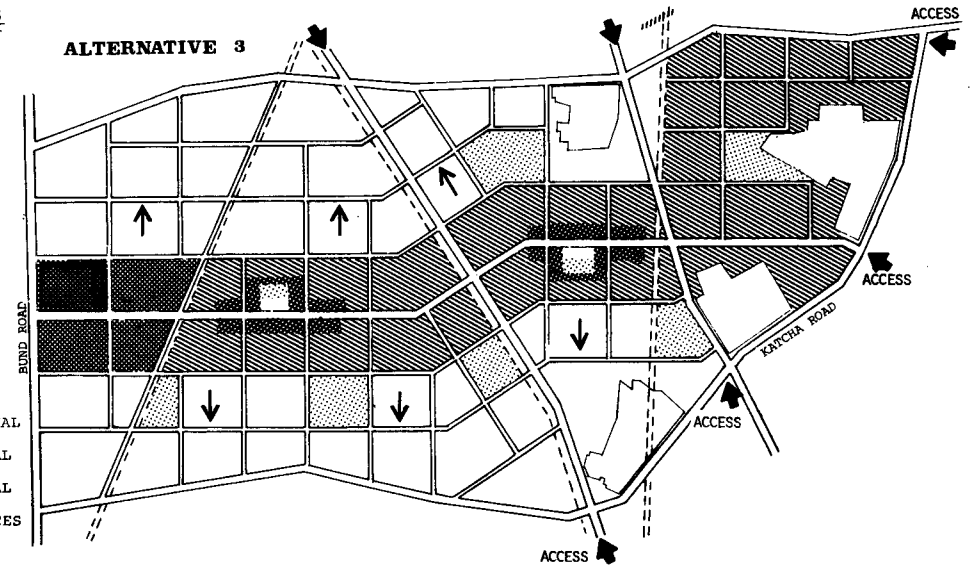
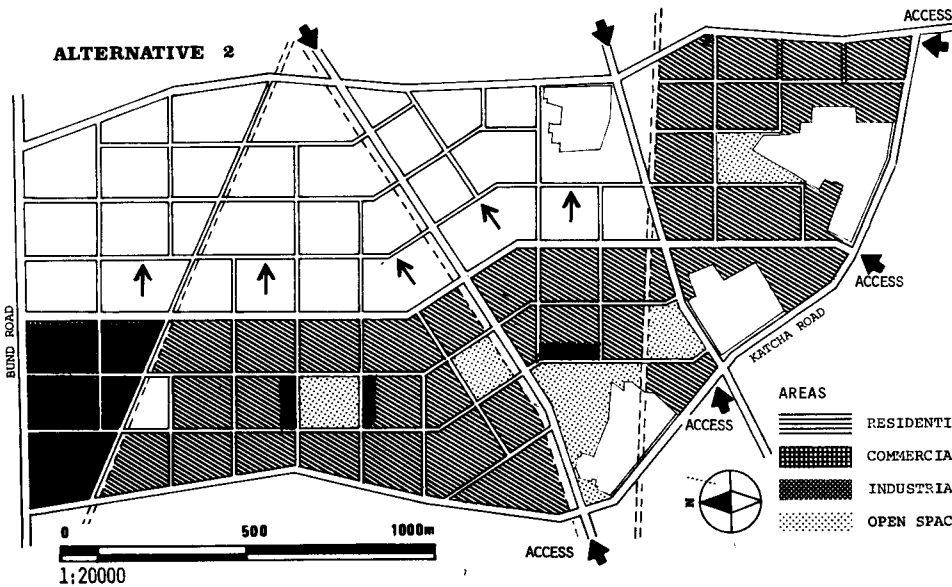
Development of the site will be initiated from the southern sector. The first phase will include areas bounded by the Katcha Road and the Chotta Ravi Drain. Growth will gradually extend towards Bund Road.

Advantages.

1. Areas with highest land value will develop instantly thereby increasing the overall pace of development.
2. The development plan progressively follows the layout of utilities, eliminating the costs of laying infrastructure in areas where development will occur at a later stage.
3. The first phase of the development will have direct access from all parts of the city.
4. The central spine will form a strong commercial focus for the first phase.

Disadvantages.

1. The area further away from the city will develop at a much slower rate. The initial development of the already high value land will result in an even greater land value difference between the northern and southern sectors.
2. Industrial areas will not develop till the completion of the second phase.



ASSUMPTIONS

Development to be initiated from the lower western sector gradually extending towards the east.

Advantages.

1. The layout has direct access to Bund Road as well as to Ghore Shah Road
2. Industrial areas will develop simultaneously with the residential.

Disadvantages.

1. A strong commercial node may result within the first phase; the central spine will develop as a commercial focus only after development of both sectors is complete.
2. Since semi-public facilities of the existing settlements of Gujjarpura will be at a distance, these facilities will have to be provided as soon as the area is settled.

ASSUMPTIONS

Area along the centre of the site to be developed in the first phase with gradual extension occurring in the east and west.

Advantages.

1. The central spine will form part of the oldest development after completion of the project as a whole, thus further consolidating a very strong commercial centre.
2. Land values on either side of the initial settlements will remain even and development will occur simultaneously at both ends.
3. Industrial areas will develop simultaneously with the residential.

Disadvantages.

1. Utility lines along the Chotta Ravi Drain will have to be completely laid out, and its under utilization will be dependant on the rate of growth of the development.

BLOCKS, LOTS, CLUSTERS

BLOCK is a portion of land bounded and served by lines of public streets, vehicular and pedestrian.

LOT is a measured parcel of land having fixed boundaries and access to public circulation or space.

CLUSTER COURT is a group of lots (owned individually) around a semi-private court (owned in condominium).

CONDOMINIUM is a system of direct ownership of a single unit in a multi-unit structure. The individual owns the unit in much the same way as if it were a single family dwelling. He holds direct legal title to the unit and a proportionate interest in the common areas and the underlying ground.

The proposed layout is based on the following:

- MINIMIZATION OF:
- public ownership of land
 - lengths of infrastructure per area served.
 - public/government ownership, responsibility and provision of of services.
- MAXIMIZATION OF:
- Private ownership of land and
 - private involvement and responsibility.

The block plan on the opposite page shows a typical block where lots are grouped around a court that serves both as a semiprivate space as well as access, leads to a subdivision type called 'horizontal condominium' or cluster. The control, use and maintenance of the court is a common responsibility of all within the particular cluster. The cluster court is initially one parcel of land which can be subdivided publically or privately/cooperatively. This type of subdivision offers flexibility in housing options, serviced dwelling lots, core dwellings and instant dwellings.

LOCALITY BLOCK LAND UTILIZATION DATA

| | Total Number | Area Hectares | Density N/Ha |
|--|-----------------|------------------|-----------------|
| DENSITIES | | | |
| LOTS | 156 | 2.63 | 56.2 |
| DWELLING UNITS | 156 | 2.63 | 56.2 |
| PEOPLE | 936 | 2.63 | 355.0 |
| AREAS | | Hectares | Percentages |
| PUBLIC (streets, walkways, open spaces) | | 0.26 | 9.8 |
| SEMI-PUBLIC (open spaces, schools, community centers) | | - | - |
| PRIVATE (dwellings, shops, factories, lots) | | 2.0 | 76.0 |
| SEMI-PRIVATE (cluster courts) | | 0.37 | 14.0 |
| TOTAL | | 2.63 | 100.0 |

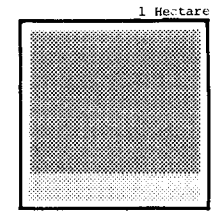
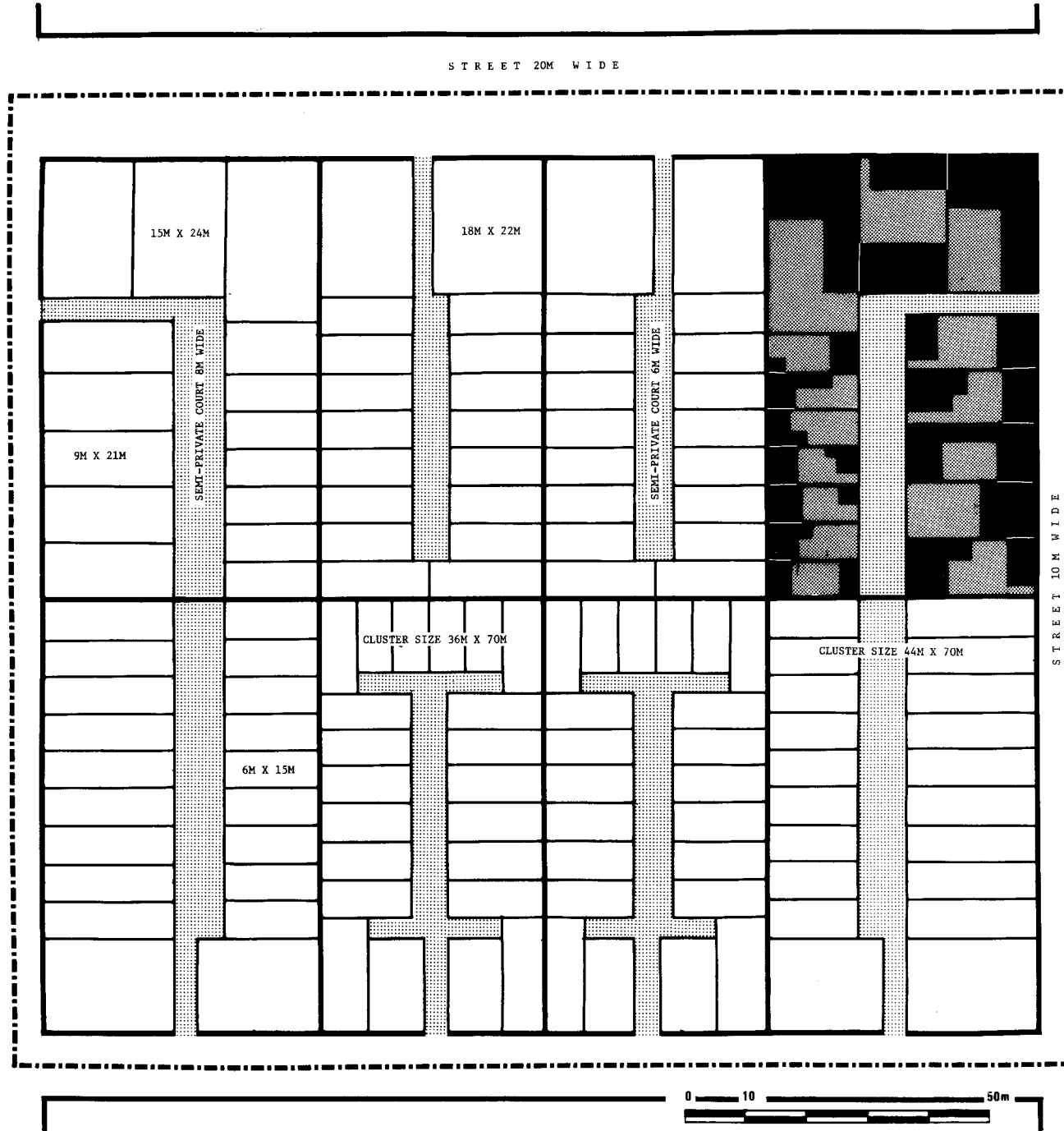
NETWORK EFFICIENCY

$\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 123.5$

LOTS

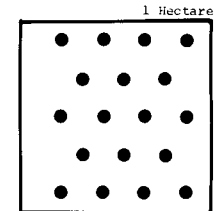
Average area, dimensions = 125 sq.m

LAND UTILIZATION DIAGRAMS



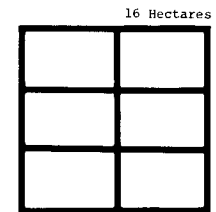
PERCENTAGES

| | |
|------------------|------|
| Streets/Walkways | 15 |
| Playgrounds | - |
| Cluster Courts | 12,5 |
| Dwellings/Lots | 72,5 |



DENSITY

| | |
|-----------------|-----|
| Persons/Hectare | 355 |
| ● 20 Persons | |



CIRCULATION EFFICIENCY

| | |
|----------------|-----|
| Meters/Hectare | 123 |
|----------------|-----|

KEY

- Public: streets/walkways
- Seni-Private: cluster courts
- Private: lots
- dwellings



1:1000

The block plans shown opposite are typical examples of how the proposed layout permits flexibility of land subdivision at the block level. The plans illustrate a few of the means by which the proposed layout will permit:

FLEXIBILITY IN LAND USES:

Different land uses can be accommodated in blocks of a similar shape and dimension.

- residential
- residential and commercial
- commercial and light industrial
- schools, playgrounds and parks
- clinics, post offices, fire and police station
- reserved areas and other uses

FLEXIBILITY IN RESIDENTIAL DENSITIES AND HOUSING SUBSYSTEMS WITHIN THE SAME LOT STRUCTURE:

Lot clusters are of minimum optimum dimensions to permit flexibility.

- progressive development units, company housing, tenement units, commercial units and high rise units.
- medium and high densities
- combinations of the above

DIFFERENT TYPES OF LAND TENURE:

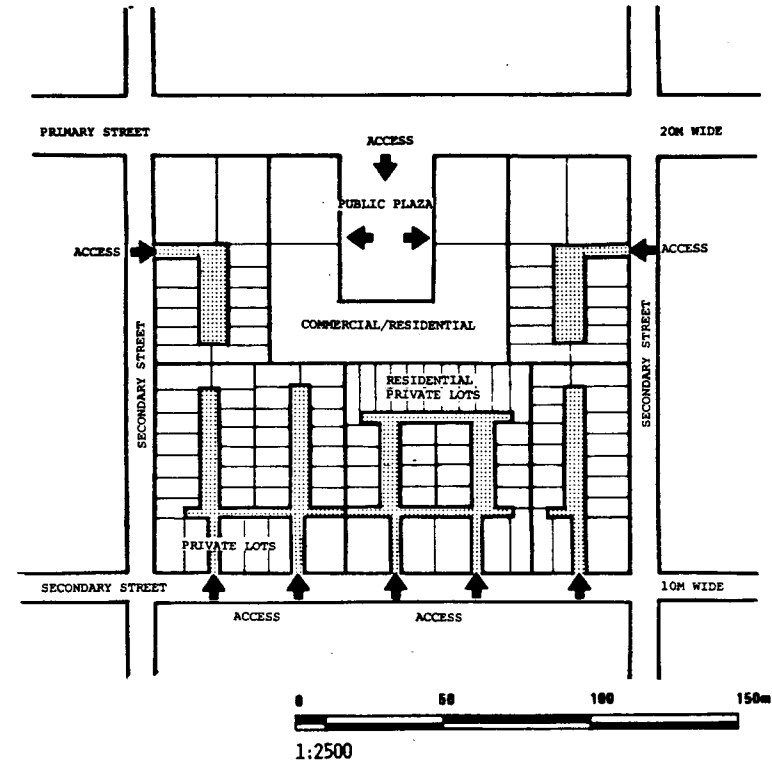
Lot clusters are of a minimum optimum dimension to allow different types of land tenure without legal or administrative complications.

- ownership
- rental
- lease
- sublet

EXPANSION AND TRANSFORMATION OF HOUSING SUBSYSTEMS:

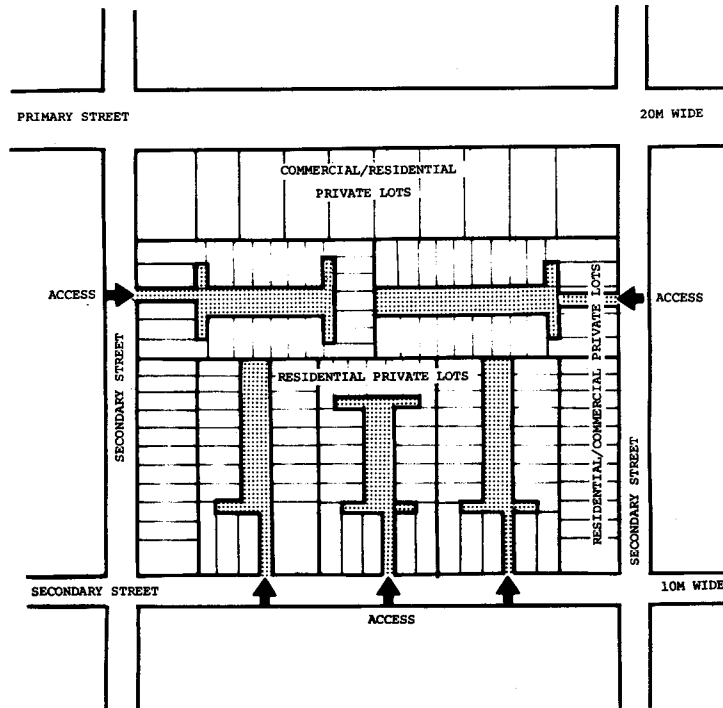
- Lot clusters will facilitate expansion and transformation of buildings.
- horizontal expansion on the ground and vertical expansion by addition of floors without changing the overall configuration of the lot cluster
 - control of minimum spaces in the lot cluster courts.

CASE ONE

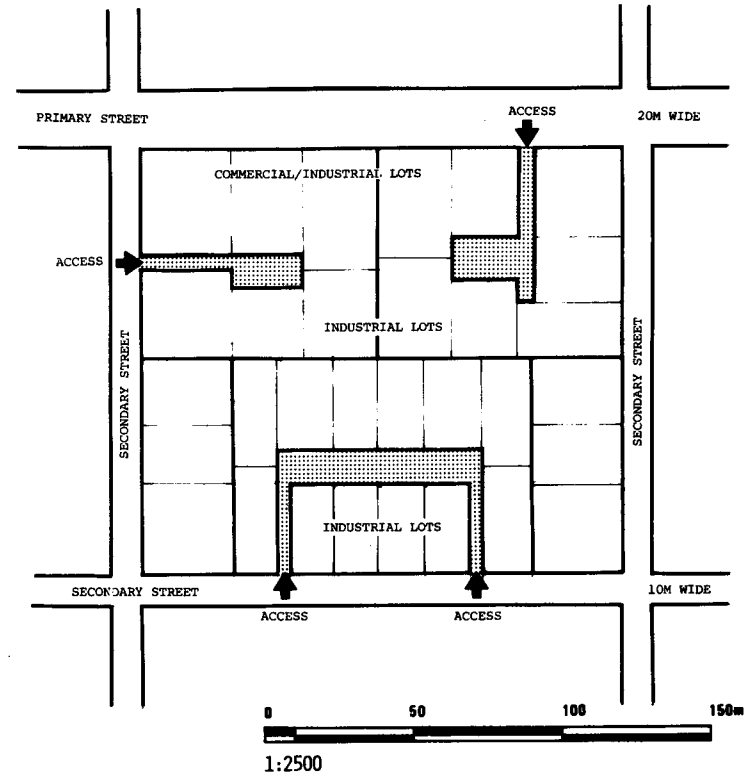


| | | | | | |
|--------------|--------------|----------------------|--------|--------|--------------------|
| BLOCK AREA | | 26350 m ² | | | |
| CLUSTER SIZE | | 30x70m | 35x70m | 40x70m | |
| BLOCK AREAS | PUBLIC | 5450 m ² | 20.6% | | |
| | PRIVATE | 18144 m ² | 68.8% | | |
| | SEMI-PRIVATE | 2756 m ² | 10.4% | | |
| LOT AREAS | CONDOMINIUM | 72 | 80 | 90 | 100 m ² |
| | INDIVIDUAL | 600 | | | |

CASE TWO

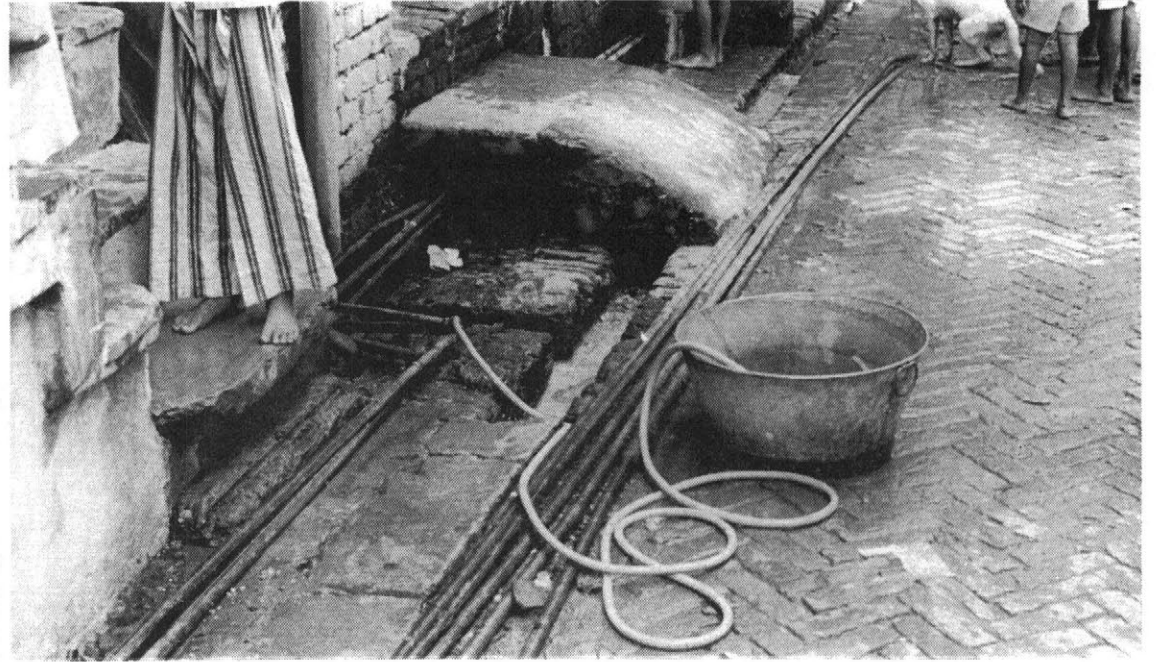


CASE THREE



| | | | | | |
|--------------|--------------|----------------------|-------|-----|--------------------|
| BLOCK AREA | | 26350 m ² | | | |
| CLUSTER SIZE | | 40x70m | | | |
| BLOCK AREAS | PUBLIC | 3950 m ² | 14.9% | | |
| | PRIVATE | 19212 m ² | 72.9% | | |
| | SEMI-PRIVATE | 3188 m ² | 12.2% | | |
| LOT AREAS | CONDOMINIUM | 900 | 120 | 144 | 360 m ² |
| | INDIVIDUAL | 120 | 450 | | |

| | | | | | |
|--------------|--------------|----------------------|---------|-----|--------------------|
| BLOCK AREA | | 26350 m ² | | | |
| CLUSTER AREA | | 80x70m | 100x70m | | |
| BLOCK AREAS | PUBLIC | 3950 m ² | 14.9% | | |
| | PRIVATE | 19644 m ² | 74.7% | | |
| | SEMI-PRIVATE | 2756 m ² | 10.4% | | |
| LOT AREAS | CONDOMINIUM | 450 | 750 | 875 | 900 m ² |
| | INDIVIDUAL | 600 | 900 | | |



UTILITIES

Utility networks are one of the basic components of any physical development. Costs of laying utilities are high and may cost between 40-70% of the total costs of urbanization. Utility planning should play a primary role in the design. It is then of utmost importance that a good layout should reflect efficiency and economy and comply with the demands of the utility network. This fact is further reinforced for development in the Third World countries, where limited financial, technical and administrative resources are available.

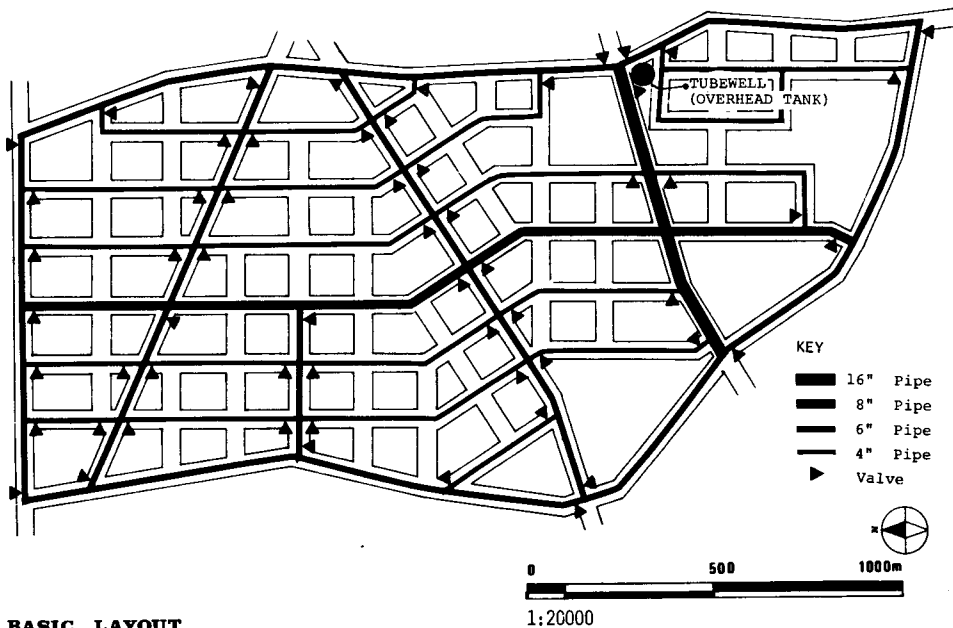
The following pages show a schematic study of utilities for the proposed model of the Gujjarpura Urban Expansion Scheme. The purpose and extent of the work is to offer a set of guidelines for preliminary estimates and evaluations. The layouts shown do not provide a design or a set of specifications for construction. The study includes the following: water supply, sewage disposal, circulation and storm drainage, electricity and street lighting. The pipe sizes for water supply and sewage are based upon approximate calculations of quantities. The storm water drainage is also calculated approximately and emphasis has been on streets acting as primary collectors instead of providing inlets and underground pipes, to reduce construction and maintenance problems.

The layouts illustrate the efficiency of the proposed model and the evaluations are based primarily upon the lengths of pipes/lines and the number of components: valves, manholes, poles, lamps. The lower the figures for the lengths and components, the lower the costs of installation and maintenance. Moreover, the number of different sizes of the same types of components are minimized to ease repairs and operation costs. A major

consideration that has been taken into account is that basic networks are channelled or confined to a few main public streets and not dispensed at random, resulting in ease of identification of lines and access for easy servicing.

PHOTOGRAPH: (OPPOSITE PAGE)
SERVICES IN THE CITY.
(LEFT) View of an open drain in Basti Saidan Shah - A squatter settlement.
(TOP RIGHT) Water supply and drainage in the Old City, Lahore; note the bundles of water supply pipe running along an open sewage drain.
(BOTTOM RIGHT) An open sewage drain in Basti Saidan Shah- A squatter settlement in the midst of a high income residential area.

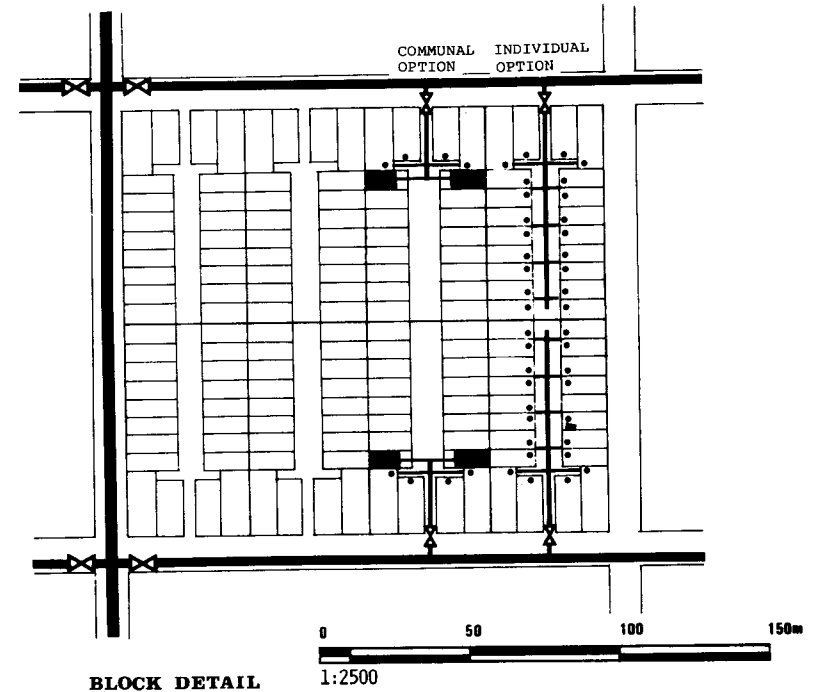
Water Supply



BASIC LAYOUT

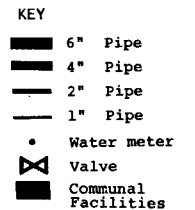
WATER SUPPLY

The distribution network has been designed as grid-iron system with no deadends. The main water supply source has been assumed from an overhead tank within the site. All primary distribution pipes are located in public areas (streets) to facilitate access for maintenance and installation. The 2" lot distribution pipes are in semi-private land. Gate valves to shut off supply for maintenance have been minimized such as to keep a balance between reduction of initial costs of installation and ease of maintenance. An acceptable maximum walking distance of 200 meters in emergencies is required for people to have access to water from another block if interior flow was interrupted. Meters have been suggested to reduce consumption and prevent waste although their costs of installation and billing and maintenance are substantial.

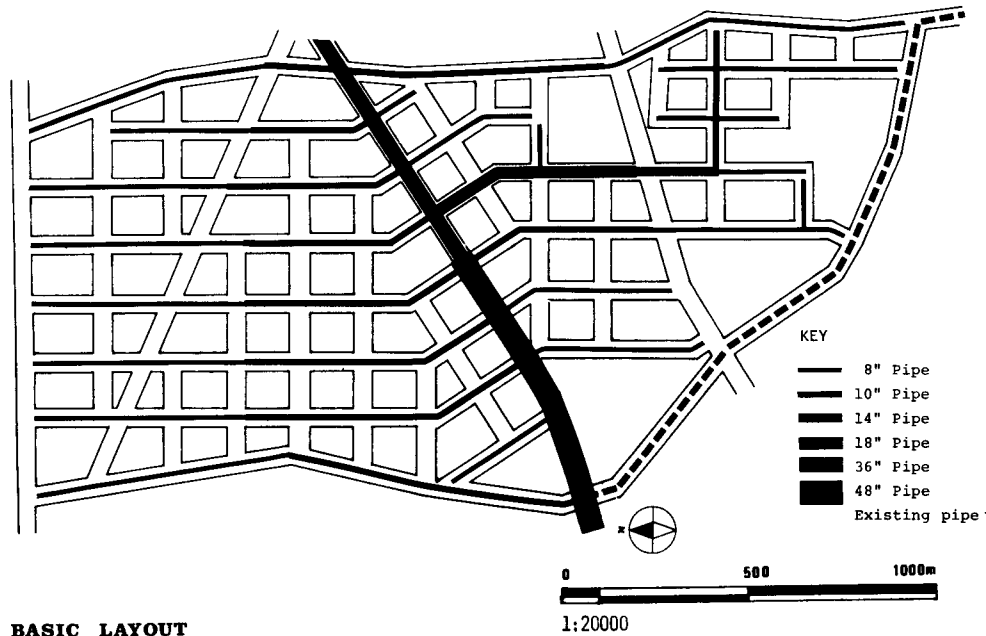


| PIPE SIZE (inches) | LENGTH (meters) | VALVES (numbers) |
|--------------------|-----------------|------------------|
| 16 | 845 | 1 |
| 8 | 2290 | 4 |
| 6 | 9565 | 15 |
| 4 | 10065 | 40 |
| TOTAL | 22765 | 60 |

Unit length per hectare = 97m/Ha.
Valves per hectare = 0.25



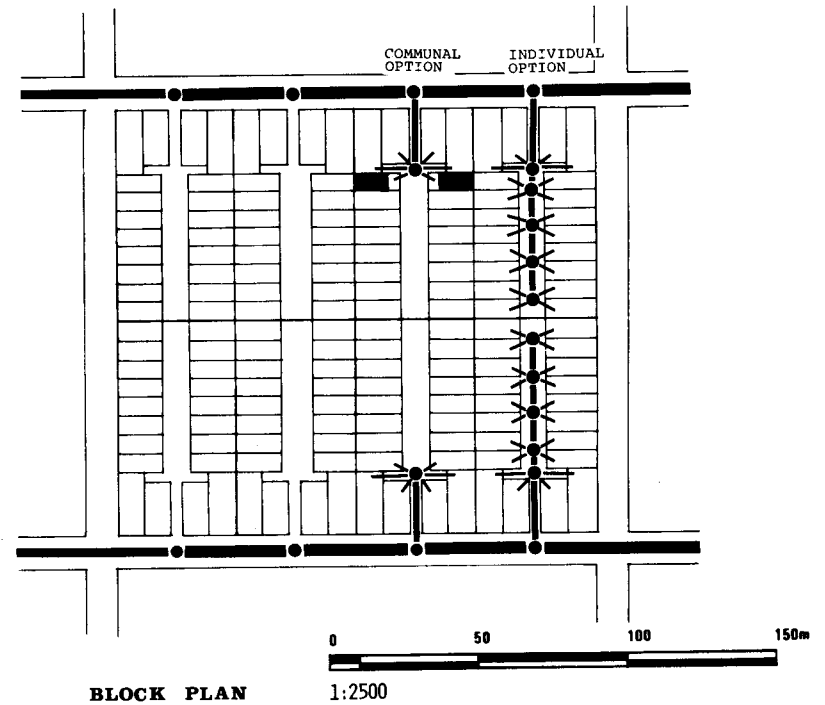
Sewage Disposal



**BASIC LAYOUT
SEWAGE**

The Chotta Ravi Drain dictates the layout for the sewage disposal. All sewage flow from the site is collected along the drain and from here it can be pumped to the River Ravi or a treatment plant. All primary collectors are located in public streets to facilitate access for maintenance and installation. 6" secondary collector pipes are laid on semi-private land. Manholes are located on all intersections, turns and deadends. The interior of a cluster has a minimum of four lots sharing a manhole.

Septic tanks and aqua privys can be provided as alternatives to the model. However these are feasible only after a study of the soil absorption characteristics of the site and the dangers of ground pollution. Septic tanks require large drain fields and would be acceptable only in lots over 200m.sq.unless communal facilities are provided.

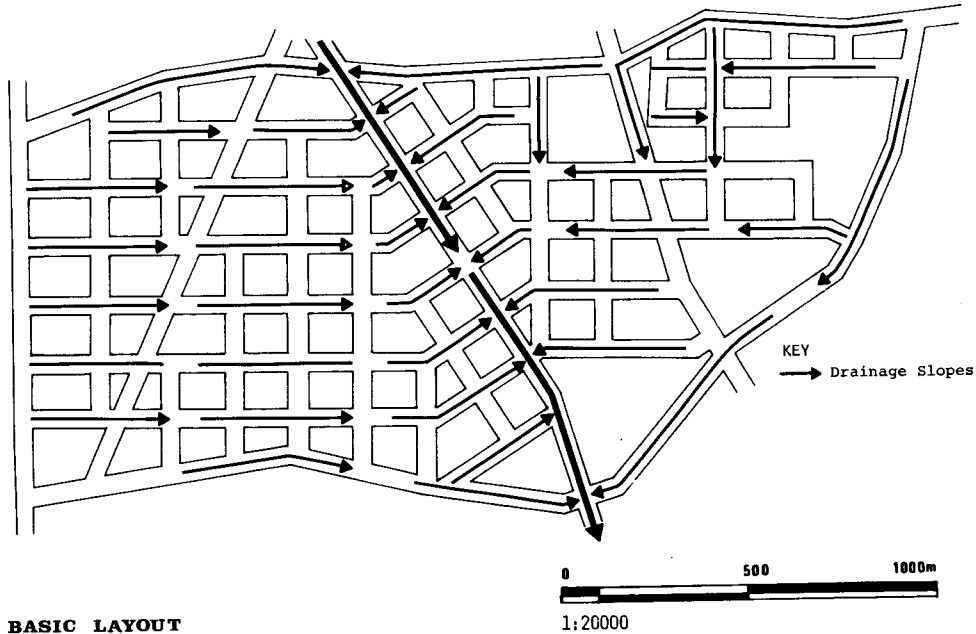


BLOCK PLAN

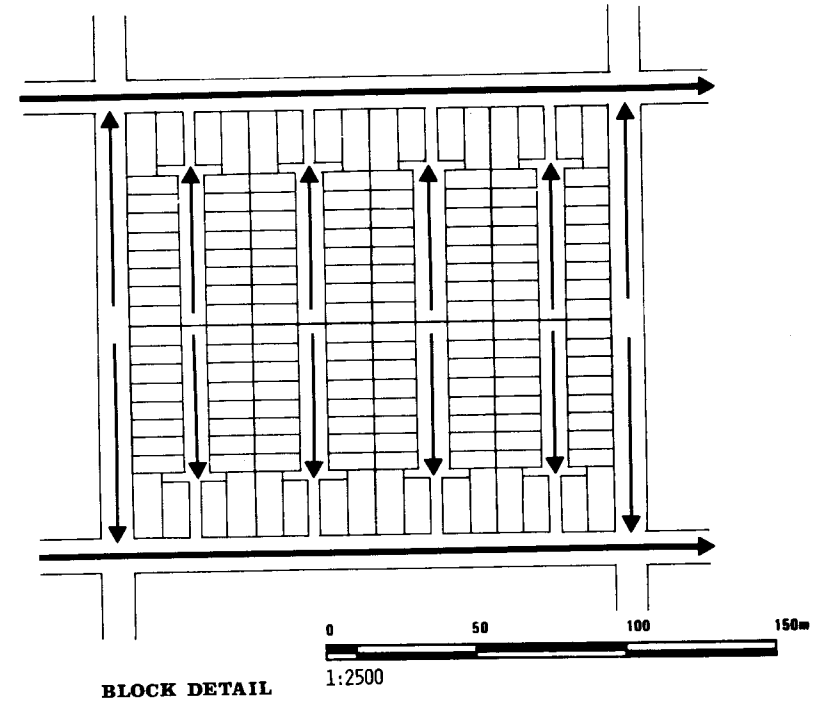
| PIPE SIZE (inches) | LENGTH (meters) | MANHOLES (numbers) |
|--------------------|-----------------|--------------------|
| 8 | 8590 | |
| 10 | 6805 | |
| 14 | 170 | |
| 18 | 600 | |
| 36 | 630 | |
| 48 | 720 | |
| TOTAL | 17515 | 399 |

Unit length of pipe per hectare = 74m/Ha
Manholes per hectare = 1.7/Ha

Storm Drainage



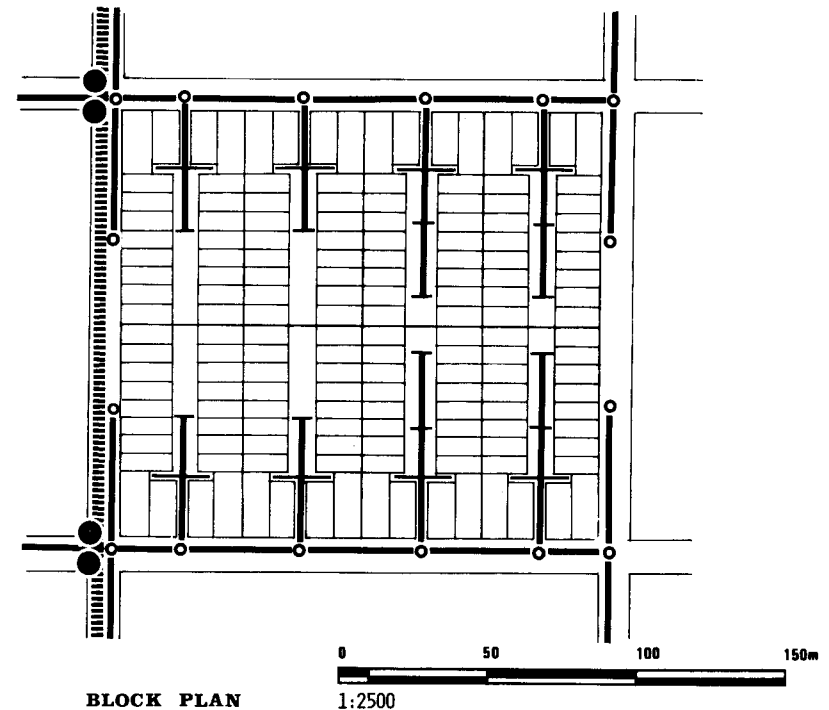
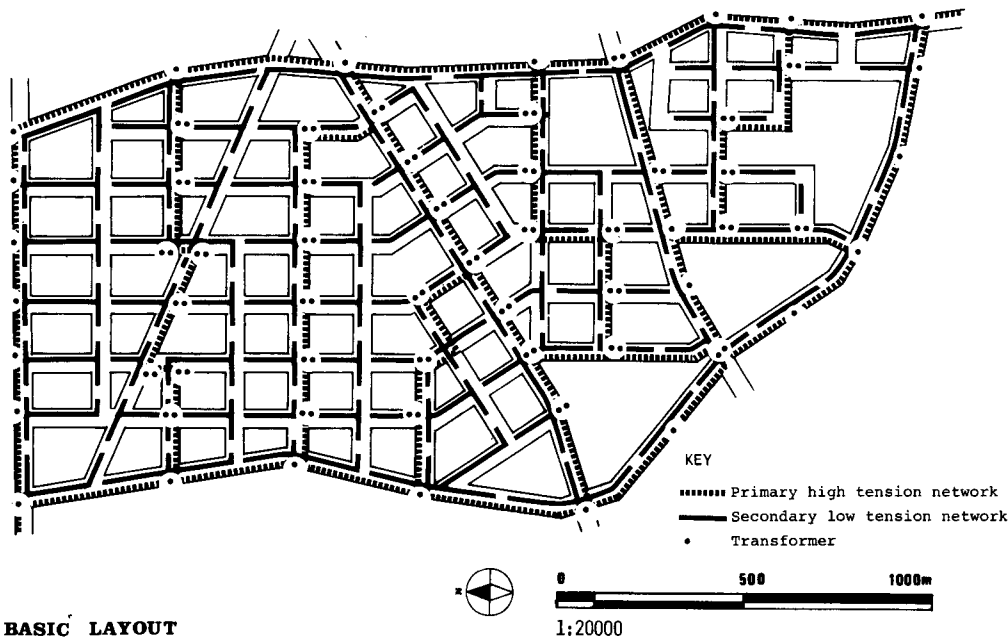
**BASIC LAYOUT
STORM DRAINAGE**



BLOCK DETAIL

The primary purpose of storm drainage is the removal of storm water runoffs to prevent flooding. This layout has been dictated by the existing contours of the site. The land slopes gently (0.3%) towards the Chotta Ravi Drain and full advantage of this has been taken for the design of the drainage system. The streets act as primary collectors and the water is channeled along the streets in shallow ditches. Curb gutters are expensive, require maintenance and have been avoided. Seasonal rainfall in Lahore will result in regular maintenance to prevent clogging in gutters and since they are expensive to install, they have been avoided altogether. If the slopes of the streets are carefully designed and constructed the shallow ditches will be adequate for drainage purposes. The water is collected along the Chotta Ravi Drain and eventually drained into the River Ravi.

Street Lighting/ Electricity



BASIC LAYOUT

BLOCK PLAN

STREET LIGHTING/ ELECTRICITY

The layout has been designed to provide power supply to lots and adequate street lighting. An aerial distribution network has been recommended. A primary high tension network with transformers has been located such that the secondary low tension lines have a maximum circuit length of 200 meters and voltage drops of 6 Volts assuming that the demand per lot is 1.5 KVA. Transformer capacities have been maintained at 150 KVA for ease of repairs, installation and stock-keeping. Poles, high and low tension wires, transformers and lamps are 10.5 meters high whereas those with low tension and lamps only are 7.5 meters. Service drops which form the electrical connection between the secondary low tension network and the individual lot or cluster have a maximum distance of 30 meters. Thus the possibility of linking several lots to one service drop is considered.

| CABLES | LENGTH (meters) | POLES (numbers) | LAMPS (numbers) | TRANSFORMERS (numbers) |
|--------------|-----------------|-----------------|-----------------|------------------------|
| HIGH TENSION | 13405 | | | |
| LOW TENSION | 31200 | 788 | 788 | 99 |
| TOTAL | 44605 | 788 | 788 | 99 |

KEY

- ▬ High tension cable
- ▬ Low tension cable
- Service drops
- Poles with lights
- Transformer

Unit length of high tension cable per hectare = 57m/Ha.
 Unit length of low tension cable per hectare = 133m/Ha.
 Number of transformers per hectare = 0.42

CONCLUSIONS

The housing problem in Lahore is going to continue to deteriorate with the city's current growth rate. The public sector's efforts so far have been questionable both qualitatively and quantitatively, the main reasons being unrealistic policies and limited resources.

The public sector can at the policy making level as well as at the physical design stage, optimize use of its resources and provide better land utilization to improve the housing stock of the city, specifically for the low income sector. The emphasis of this thesis is that optimum land utilization and circulation patterns are the basic criteria for the design of an efficient layout. Where resources are scarce and demands high, it is imperative that optimum ranges are achieved. Moreover after implementation and development physical designs require evaluation and revision of policies. Thus any layout should be flexible enough to accommodate changes.

LAND UTILIZATION

The key to proper and adequate land utilization is a coherent relationship among users, responsibility and physical controls. This coherence should be reflected in the physical plan or layout. The controls should define clearly the extent of the territory, facilitate its specific function and allow users to assume their responsibility in terms of maintenance and operation.

Land utilization can be divided into four types as follows:

- PUBLIC LAND: Primary purpose is circulation, streets walkways for vehicles and pedestrians; includes open spaces; responsible agent is the public sector and only minimum legal controls can be enforced.
- SEMIPUBLIC LAND: community utilization includes areas for schools, playgrounds; users are unlimited number of people and these together with the public sector are the responsible agents; partial legal and physical control possible.
- PRIVATE LAND: This includes lots/dwellings for residential, industrial and commercial purposes; very limited number of users and the responsible agent is the individual user; complete legal and physical control.
- SEMIPRIVATE LAND: Urban area shared by a group, held in condominium; users are limited in number and are the responsible agents for operation and maintenance partial or complete social, legal and physical control.

In an urban layout, the type of land utilization must be identified, the users defined and the individual sector/group responsible for operation and maintenance determined. Finally, all physical controls should be spelt out very clearly for effective implementation. Public land demands immense capital for construction and operation costs which are paid by taxes on private land. Thus public land should be minimized to maximize private/semi-private land. Controls should be oriented so as to further maximize private responsibility and minimize public responsibility. Private sector participation in land development and housing should be encouraged to reduce public involvement.

CIRCULATION

The circulation system besides channelizing movement of pedestrians and vehicles determines land utilization patterns, land values, subdivision and layouts of utilities. In the design of a circulation system the modes of circulation should be considered, users

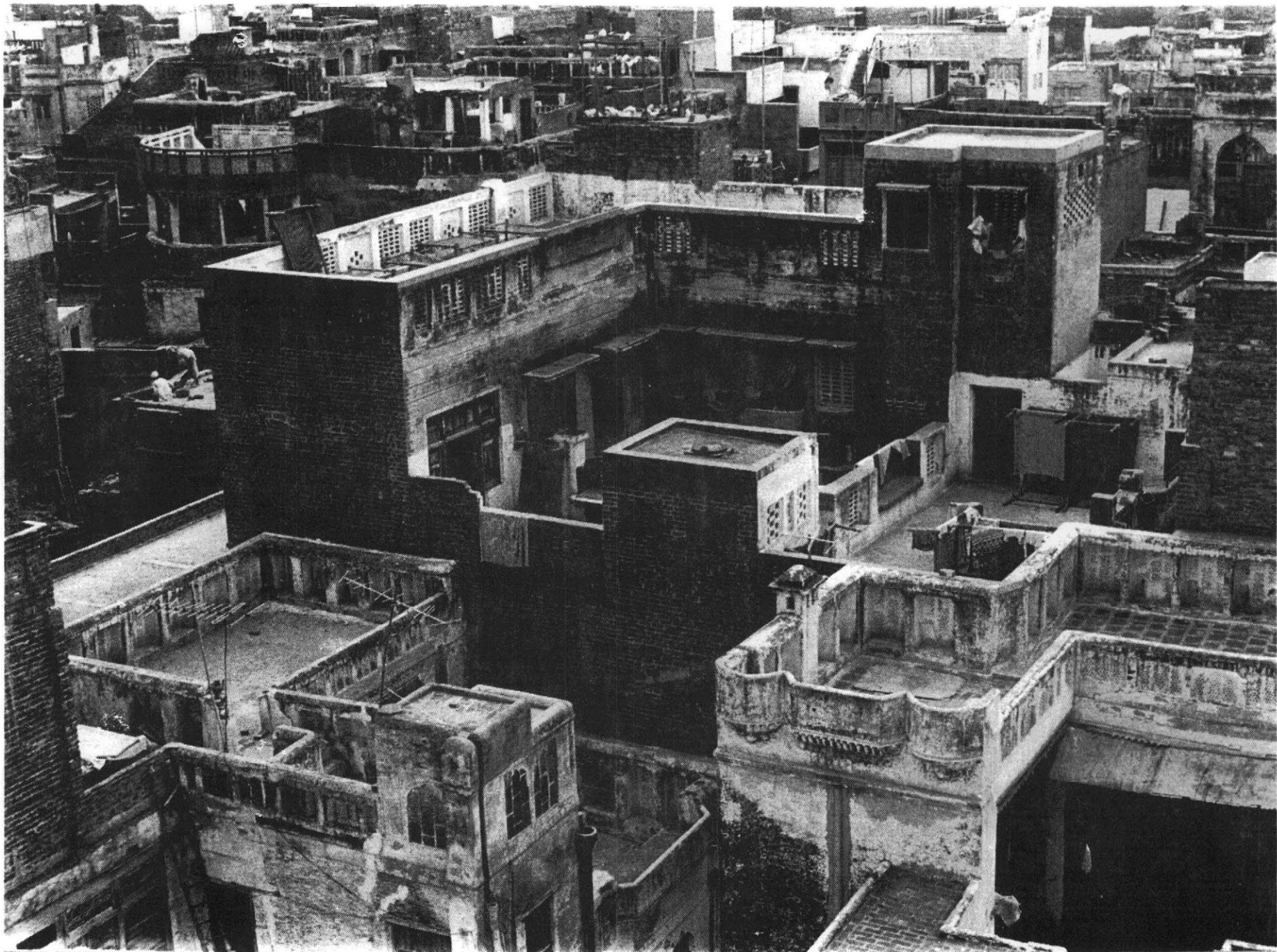
identified (vehicles or pedestrian) and the relative domination of vehicles or pedestrians or both determined.

The following factors need to be considered in any circulation system:

- LINES OF CIRCULATION: These are public streets that serve unlimited number of people, provide through traffic and are therefore on public land. They are generally long and connected at both ends to other circulation lines.
- LINES OF ACCESS: These provide access to lots from lines of circulation and are not for through traffic; They are generally dead end streets serving only a limited number of people and therefore are placed on semiprivate land. Moreover they are usually short in length and connected on one end to a line of circulation.
- DISTANCES AND INTERVALS BETWEEN LINES OF CIRCULATION: These determine the block size and therefore play a very important role. The intervals should be small enough to facilitate pedestrian circulation among the community elements - dwellings, shops, services etc. and large enough to minimize land area and therefore public costs in construction, maintenance and operation of utilities and services. Moreover the block size should be such so as to provide flexibility so that adequate changes and modifications can be made, in terms of land utilization within a block if desired.

The public sector has limited resources and its fundamental aim should be to provide the basic infrastructure and assume minimum responsibility for upkeep of private/semiprivate land. The circulation areas should be minimized and lengths optimized as

this would reflect directly on costs of laying utilities and infrastructure. Circulation designed on a grid block where distances or intervals between lines of circulation and boundaries are independent of the dimensions of lots because lots have lines of access, result in immense savings for laying infrastructure as well as operation costs. Moreover they help in sharing of responsibility between the public and private sector.



APPENDIX

This section provides the supporting and complimentary references that have been utilized for the design of the proposed Urban Expansion project at Gujjarpura.

The section is divided into three parts:

1. Lahore; Urban Context
2. Case Studies
3. Evaluations

This is followed by a glossary, references and explanatory notes.

PHOTOGRAPH: (OPPOSITE PAGE)
An oblique aerial view of a residential area of the Old City, Lahore. Note the use of roof terraces as living spaces, for circulation and sleeping especially during the summer months.

LAHORE, PAKISTAN

URBAN CONTEXT

1. PRIMARY INFORMATION:

Lahore the second largest city in Pakistan is situated about 1300 km north of Karachi in the central part of the country. The city is located about 225 meters above sea level on 32 north latitude and 74 east longitude. It is connected to other parts of the country by extensive railway, highway and air route networks. Physical features which define the boundaries of the city is the river Ravi which flows from north east - south west direction in relation to the city. Other than this the city is situated on almost flat land.

The city is characterized by its hot dry climate; summer temperatures go as high as 44°C, with hot winds and occasional sand storms. The four coldest months (Nov.-Feb.) are mild with temperatures reaching 4°C. Monsoons occur during June to September and result in an average rainfall of 90 mm.

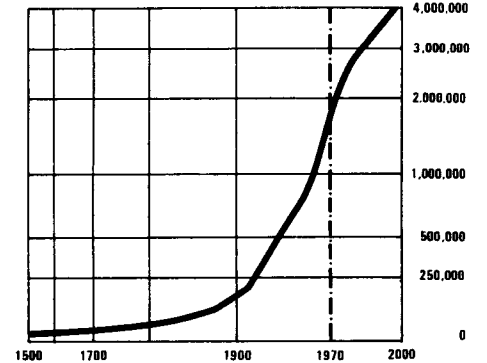
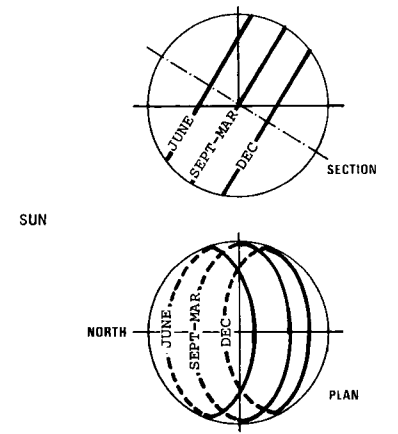
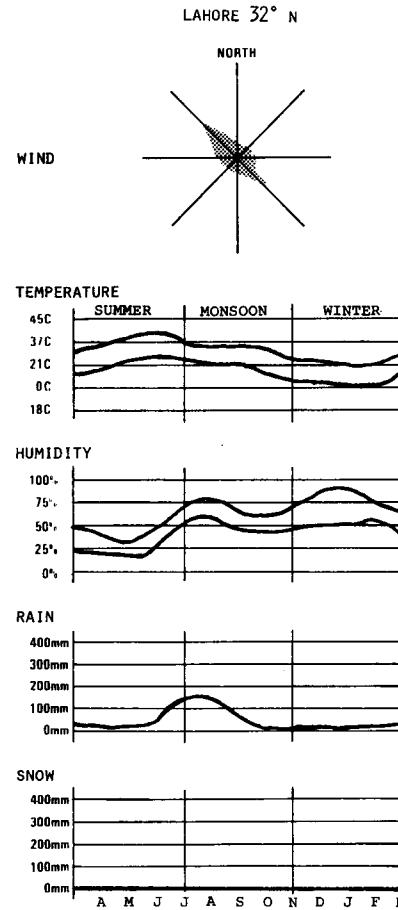
2. HISTORY

Lahore is a city located where the historical route from the Khyber Pass to Delhi crosses the River Ravi. The strategic location of the city which led to its foundation is also the reason for its continued growth and importance as a regional trade, military and administrative center. The early history of Lahore, its exact date of founding and place of origin are obscure and controversial. Archeological evidence indicates that Lahore emerged as a settlement between the first and the seventh centuries A.D. It developed into an important market for grain, a center for manufacture of wooden and metal handicrafts. Lahore entered its Muslim period in 1002 A.D. when it was captured by Mahmud of Ghazni. Under the Ghaznavid rule it re-

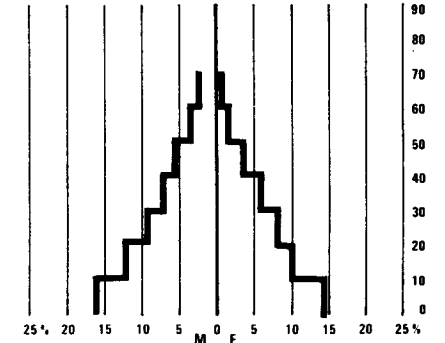
gained its importance both as a military stronghold and as a capital city for the whole region. Due to its strategic location, it was an important military objective. As a result, the history of Lahore is one of alternating periods of devastation, decay and magnificence. However, it was under the Moghul Empire (1525-1747) that Lahore reached its glory. The Moghuls consolidated, fortified and enlarged the city they inherited. They covered vast areas with richly designed architecture comprising of mosques, tombs, palaces and gardens. The wall around the city was constructed by Emperor Akbar in 1594-98. Emperor Shah Jahan had the Shalimar Gardens built and in the mid 1600's Emperor Aurangzeb supervised the construction of the Badshahi Mosque. The sikhs eventually gained control over the area and ruled it for over a hundred years, after which came the British. Over the remains of the Moghul and Sikh empires, the British (1846-1947) built their extensive establishment of military cantonments and administrative centers.

After independence, (1947) the city suffered its major crisis with a large influx of migrants from India and a significant increase in the population of the city. This taxed the services and infrastructure of the city to its maximum. Lahore became the provincial capital of the Punjab. Over the last thirty years, it has become a center of commerce, education, industry and administration.

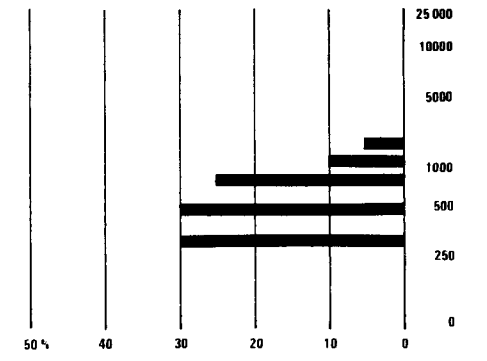
PHOTOGRAPH: (OPPOSITE PAGE)
Tongas or Horse driven carriages are one of the main means of public transport in the city.



URBAN POPULATION GROWTH
horizontal: dates vertical: population
Source: Master Plan for Lahore, 1973

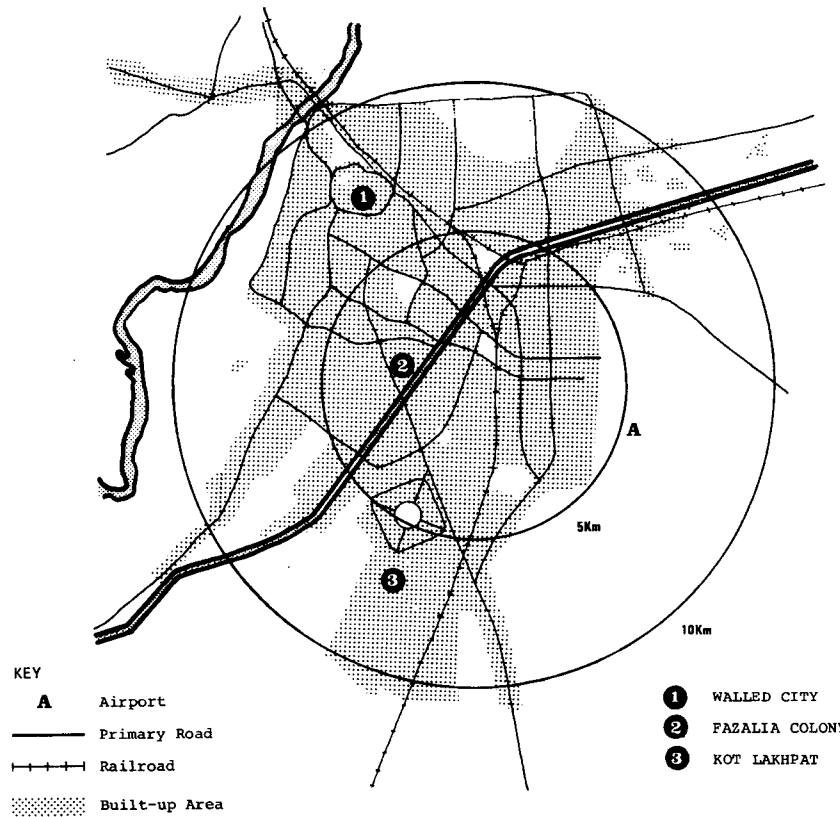


URBAN POPULATION DISTRIBUTION
horizontal: percentages vertical: ages
males: M females: F
Source: Master Plan for Lahore, 1973



URBAN ANNUAL INCOME DISTRIBUTION
horizontal: percentages vertical: dollars
Source: Master Plan for Lahore, 1973





KEY

- A Airport
- Primary Road
- +—+— Railroad
- Built-up Area

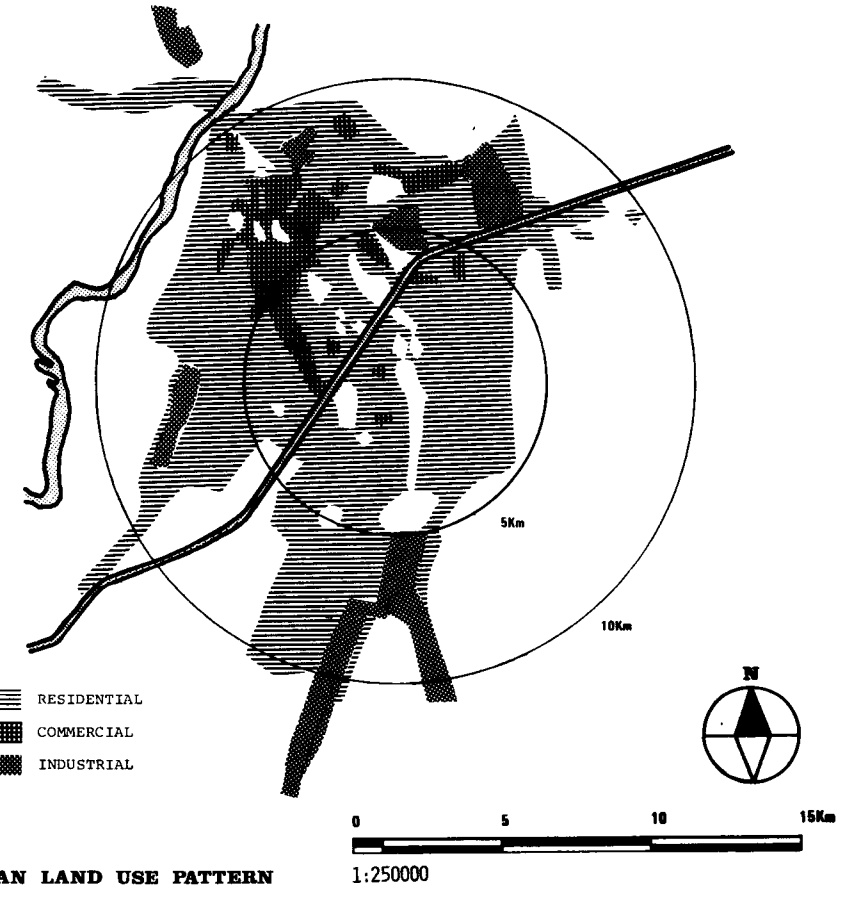
- ① WALLED CITY
- ② FAZALIA COLONY
- ③ KOT LAKHPAT

URBAN TOPOGRAPHY AND CIRCULATION

3. ECONOMY:

Lahore is a major commercial, industrial, administrative and educational center of the country. The commercial and industrial activity are the economic backbone of the city. Lahore, being the capital of the Province of Punjab, is the second most important commercial center of the country. It has all types and patterns of commercial activity - from major, district, local, and specialized shopping centers to wholesale, retail and mixed markets. The evolution and growth of these centers and markets have primarily contributed to the rapid expansion of the city. Most shopping centers and business activities located within the Walled City and in adjacent lo-

cations tend towards specialization while shopping centers in newly developed areas are more heterogeneous, in character. According to estimates, there are over 10,000 industrial units in Lahore, ranging from one man workshops to large industrial concerns employing more than a thousand people. The small scale manufacturing industry is scattered throughout the city especially in the older localities and in major roads and main bazars of the central areas. Large scale industries, however, follow a well defined pattern. They are concentrated in a linear pattern on both sides of the roads leading to Wagah, Kasur, Pattokim Sheikhpora, and Cugranwala. In the older parts of the city, particularly



AREAS

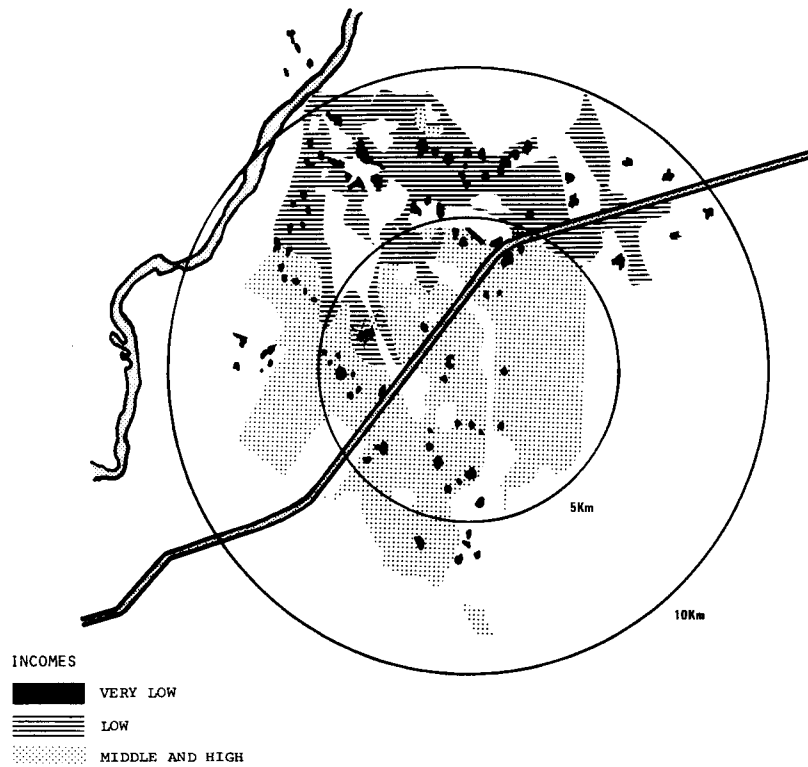
- ▬▬▬ RESIDENTIAL
- COMMERCIAL
- ▩▩▩ INDUSTRIAL

URBAN LAND USE PATTERN

1:250000

4. GOVERNMENT

The Lahore Municipal Corporation (LMC) is headed by a Chairman - who is appointed by the provincial government. The executive power of the municipality vests in the Chairman who is responsible for prescribing duties of various establishments and supervision of their work. The municipality administers and executes functions relating to taxation and finance, engineering works, transportation, health and education. A separate and somewhat parallel organization known as the Lahore Development Authority (LDA) exists whose functions comprise of formulation and execution of major developmental works of the city in the spheres of planning, transportation, housing, water



INCOMES
 ■ VERY LOW
 ▨ LOW
 ▩ MIDDLE AND HIGH

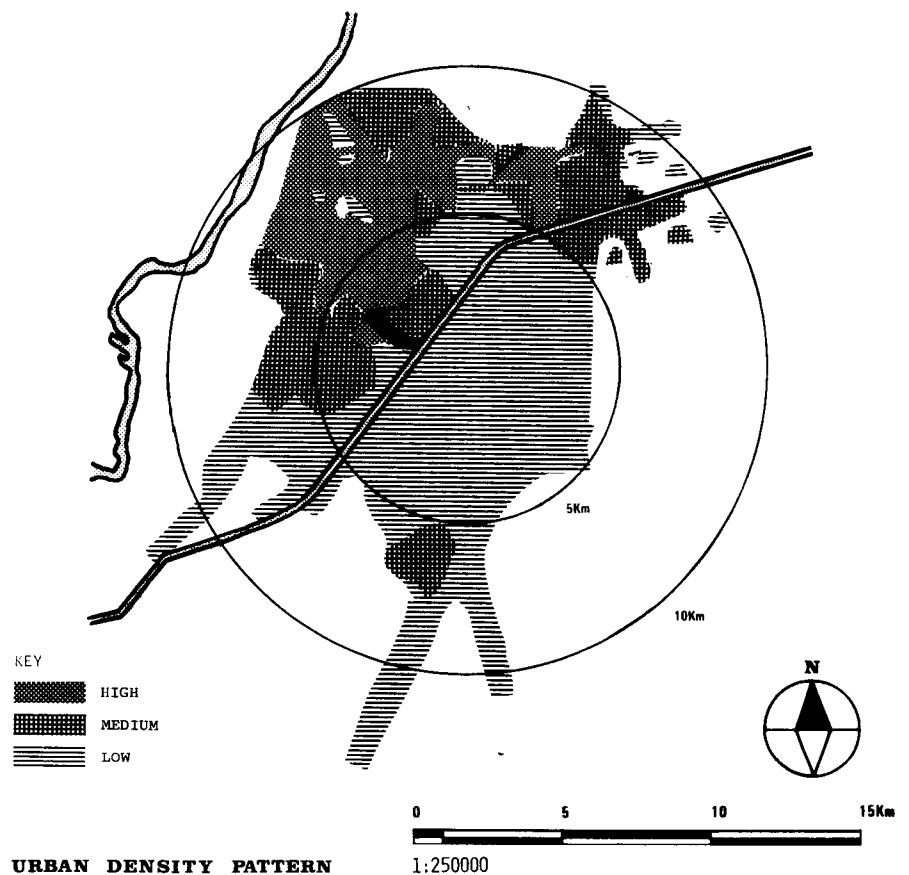
URBAN INCOME PATTERN

supply and sewage networks. The LDA is headed by a Director General who is responsible directly to the Provincial Government. It has within its framework various agencies which deal with a variety of aspects concerning the development of the city. One of these is the Water and Sanitation Authority which is essentially responsible for the planning and execution of water supply and sewage networks for the city. Another autonomous organization known as the Cantonment Board also exists in the city which is responsible for the administration of Cantonment (military) areas. The Cantonment Board is controlled directly by the Ministry of Defence and is outside the pur-

view of the Provincial Government. The Board is responsible for planning, sub-division, community facilities and services of the areas under its jurisdiction.

5. DEMOGRAPHY

The population of Lahore Municipal Area was 2,148,000 according to the 1971 census. This population represents an increase of over 55 % in the last decade. Approximately, 52 % of the existing population was born outside the city. 44 % of the population is female. The population can be divided into the following age groups; 42 % below 14 years, 53 % between 15 - 59 years, and 5 % above 60 years.



KEY
 ■ HIGH
 ▩ MEDIUM
 ▨ LOW

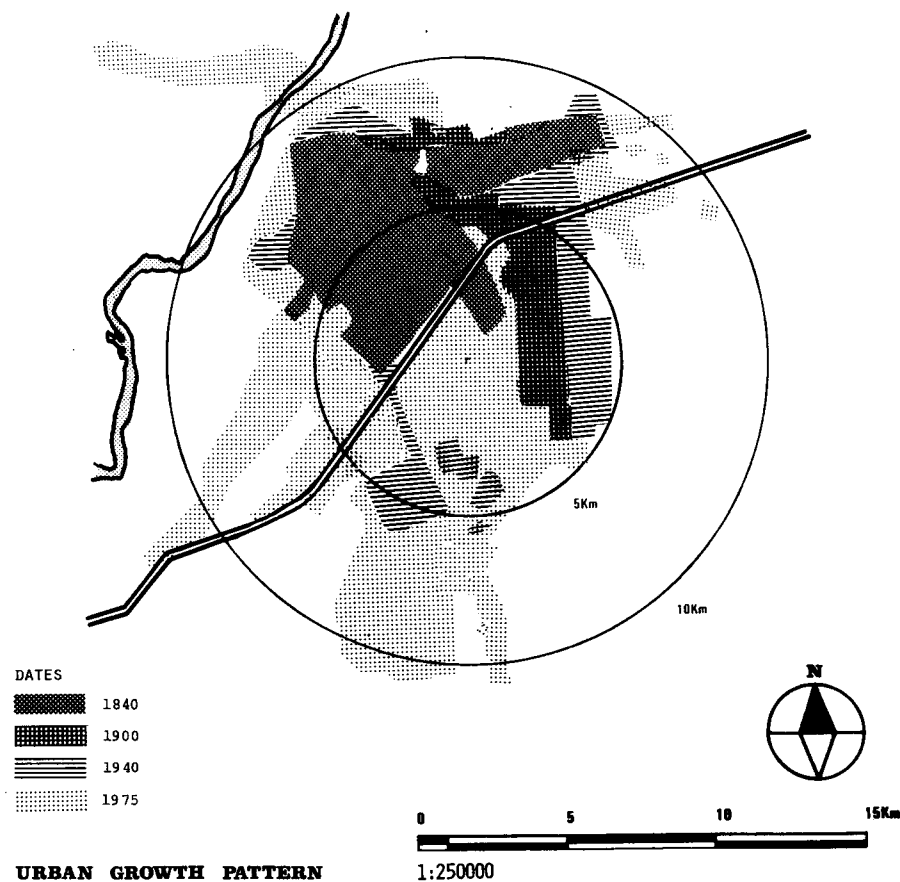
URBAN DENSITY PATTERN

1:250000

6. SOCIO-CULTURAL

Like most cities in Pakistan, Lahore has people from diversified ethnic origins, socio-cultural backgrounds and occupations. The social system is one in which traditional values, institutions and patterns coexist with those arising from economic development and social change. But equality of participation in the overall socio-economic development has been partially successful. In spite of the fact that there are limited cultural differences amongst the overall population of the city - three characteristic class lines can be distinguished. The upper class - large storekeepers, landlords, industrialists - hold the highest political positions. The middle class - small

emergent and heterogenous - occupies mid-level professional, commercial and bureaucratic positions. In the lower class - economic and cultural variations are more predominant than in other groups. It is composed of a variety of people; recent migrants, urban dwellers living in slums or illegal settlements. They reap few benefits from economic development and expansion which virtually excludes them. Expression of living patterns of various groups is frequently found in their dwelling environments through uses of areas and spaces of varying characters: verandahs, central courtyards, front and back yards, quality of the dwellings, number of rooms, usage of roofs, etc.



7. SOCIO-ECONOMIC:

Approximately 40 percent of the city's population, the low and very low income, earns less than Rs. 3600 (US\$360.00) per year. About 50 percent consists of moderately low and lower income groups earning up to Rs. 10,000 (US\$1,000.00) per year. The rest comprises of middle and high income groups. The low and very low income population is concentrated in the northern and western part of the city - in the industrial areas and in small pockets scattered throughout the city. A large part of the lower income groups live in the walled city. The remaining population is housed in the north eastern and southern parts of the city.

8. URBAN DEVELOPMENT:

The history of the physical growth of the city is closely related with the history of the course of the River Ravi. The shifting course of the river and its consequent flooding have played an effective role in determining the direction of the expansion of the city. During the Moghul period, the Ravi flowed through a course which was about three kilometers to the east of its present direction. In 1662, the shifting course of the river threatened the city and Emperor Aurangzeb ordered the construction of a four mile long brick and mortar dyke around the city. The remnants of the bund can still be seen to the northeast of the city. Soon after completion of the bund, the river

abandoned its course and has never since returned to it. After the British took over, the city expanded towards the south and the east where a large military and administrative establishment was built. Areas like the cantonment, Civil Lines, the Secretariat along with large areas for the railways were developed. In order to control the changing course of the river and to protect the city from flooding, numerous dykes and bunds were constructed and the river which used to have several branches, was contained in one channel. The first few years after independence did not see much development in Lahore. By the mid 1950's several development schemes were initiated and implemented. However, it was not until the early 60's that effort towards making an overall Master Plan was made. Under the plan, the city's undeveloped land was subdivided, circulation and infrastructure networks developed. Zoning regulations, municipal building by-laws, and other ordinances controlling the urban growth formulated, but all these have not been successfully implemented or enforced. As a result the city has grown haphazardly with a concentration of commercial and business in the centre and industries in small pockets all over the city.

9. HOUSING:

A large part of the city's population lives in housing classified by the authorities as sub-standard or unfit. More than forty percent of the population lives in one room dwellings shared by six persons on the average. Approximately forty percent of the population lives in traditional housing, thirty percent in squatter settlements and twenty-seven percent in housing by private sector and three percent in government housing projects. According to estimated housing shortages in the city in 1975, about seventy percent was among low income people. A majority of low income people live in squatter settlements. This problem goes back to 1947, at the time of partition when a large influx of mainly destitute refugees came to the city. Due to a high demand for housing, squatting became prevalent on open land of the city. The problem was further exacerbated by the process of urbanization which has taken place over the last thirty years. The settlements developed as rural

pockets in the urban area with physical environments resembling the villages. These illegal settlements lack basic services. The quality of housing, material and technology used for construction depends on the age of the settlement. Newer settlements have small dwellings made from assorted salvage materials. The dwellings are often made of scraps of wood, pieces of gunny sack, cardboard, straw, or sticks, supplemented by mud and stone and roofed with straw and mud. The houses frequently are located in areas subject to flooding and are often destroyed during heavy rains. The dwellings in the older settlements are consolidated using mud or brick walls and clay tiles or galvanized iron roofs. They are spacious having one or two rooms and a verandah in the front. In general, the settlements have substandard living conditions with high population densities.

The squatters, as illegal occupants of the public and private land they occupy live in constant threat of evacuation and demolition by the municipality. However, the development authority in recent policies has undertaken a de-facto recognition of squatter settlements and are in the process of legalizing them to a certain extent. In this connection, certain essential utilities like water supply, sewerage and electricity is being provided to them in the process of upgrading these areas. Many pilot projects have been initiated where this policy is being currently implemented. As a result of this, many squatters have started improving their physical environments by consolidating and improving their dwellings. The analysis of the existing situation indicates that the public sector involvement has been very marginal. The city lacks realistic urban development and housing policies. The development efforts are on a very small scale, scattered and only in response to immediate needs and requirements. The type of housing options and the size of individual projects have varied according to the needs and economic constraints of the past years.

CASE STUDIES

The following section contains case study examples of selected dwelling environments within the Lahore metropolitan Area. The case studies have been selected on the basis of income groups, housing type, location, and percentage of population that each system houses. The case studies are represented at four levels:

LOCALITY: A locality is defined as a relatively self-contained area. It is generally confined within physical boundaries.

LOCALITY SEGMENT: All localities differ in size and shape; for purposes of comparison, a segment of 400 meters by 400 meters is taken from each locality.

LOCALITY BLOCK: Within each locality segment, a typical residential block is selected in order to compare land utilization (patterns, percentages, densities and circulation).

DWELLING UNIT: A typical self contained unit for an individual, a family or a group is selected in each locality segment.

A total of five case studies were evaluated (see EVALUATIONS page 59); the first three were selected from "Dwelling Environments: A Comparative Analysis, Lahore" (Parvez L. Qureshi).

The case studies are arranged by locality as indicated in the following:

- GUJJARPURA

A squatter settlement with parcels of land developed privately. It is located in the inner ring of the city and houses very low to lower middle income groups. This type of a settlement is representative of about fifteen percent of the total population.

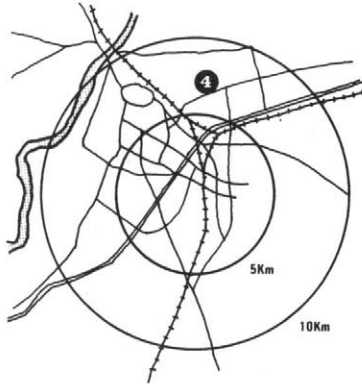
- IQBAL TOWN

A site and services housing scheme developed by the Lahore Development Authority essentially for the upper and upper middle income sector. A few sites were developed by the LDA for walk-up apartments to house the lower income sector. However it presently houses the middle income sector. Two different block plans are studied in detail in this locality. This type of settlement is representative of about 2% of the population of Lahore.

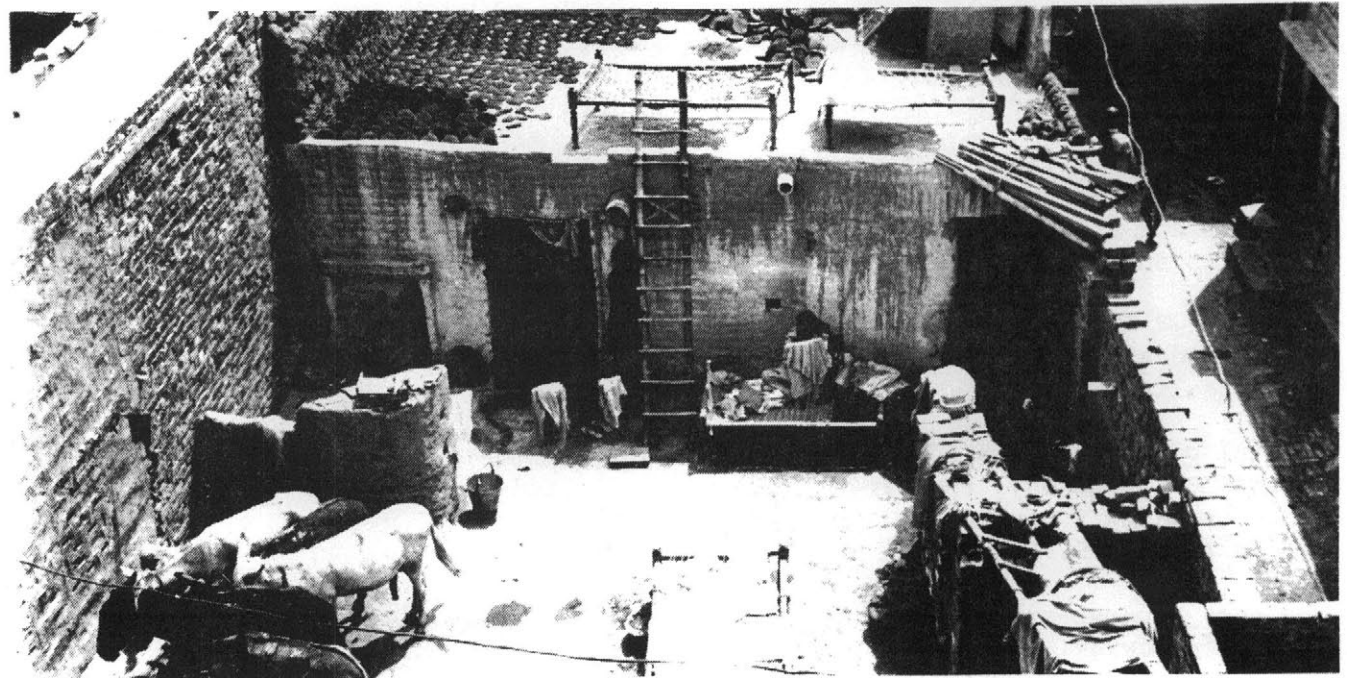
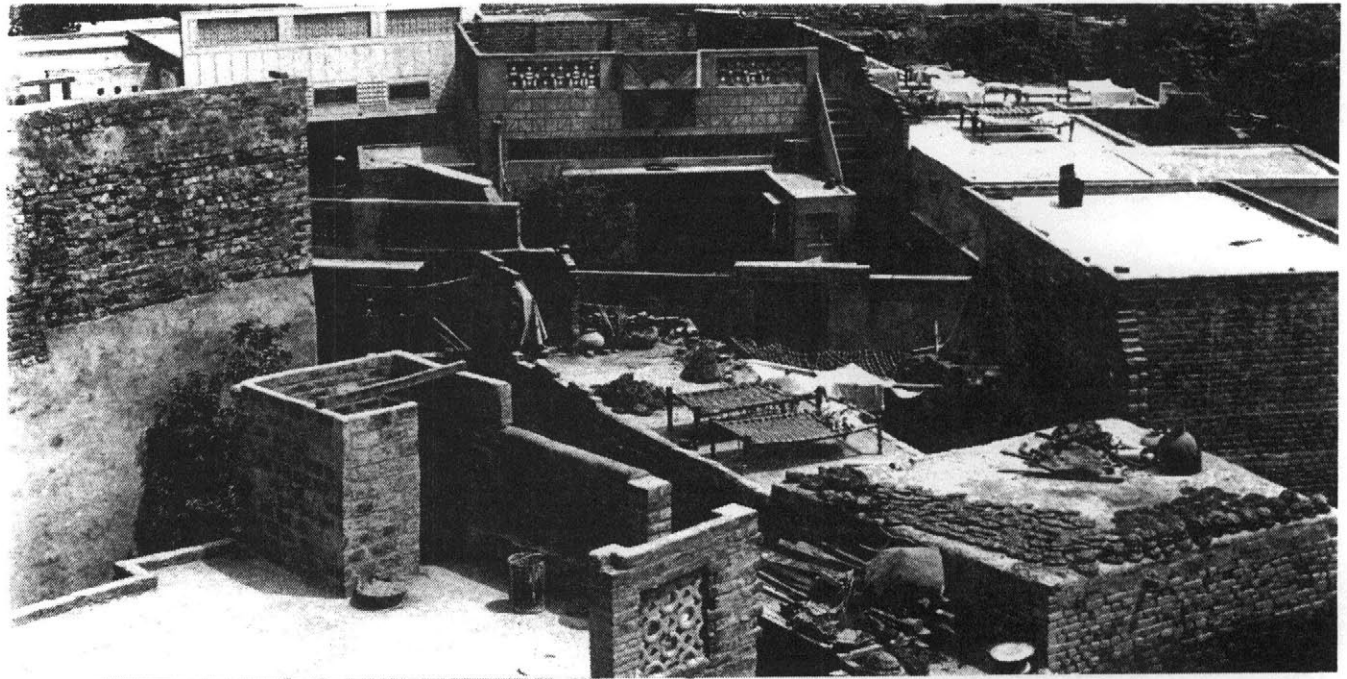
1 GUJJARPURA

Lahore

SQUATTER SETTLEMENT, PRIVATE,
POPULAR, VERY LOW, LOW, MIDDLE INCOME



LOCATION: The Gujjarpura settlement is located about five kilometers from the city centre at the north eastern fringe of the inner metropolitan area of Lahore. The area has developed high density land on the east, west and the south whereas the north comprises of agricultural land and the Bund road. The main approach to the area is from Grand Trunk Road by Bhogiwal Road and Ghore Shah Road. Both these roads are narrow and restrict movement to the site. The settlement covers an area of eighty hectares. A notable feature located on the eastern periphery of the locality is the Paradari (pavillion) of Nawab Bhikari built during the Mughal period.

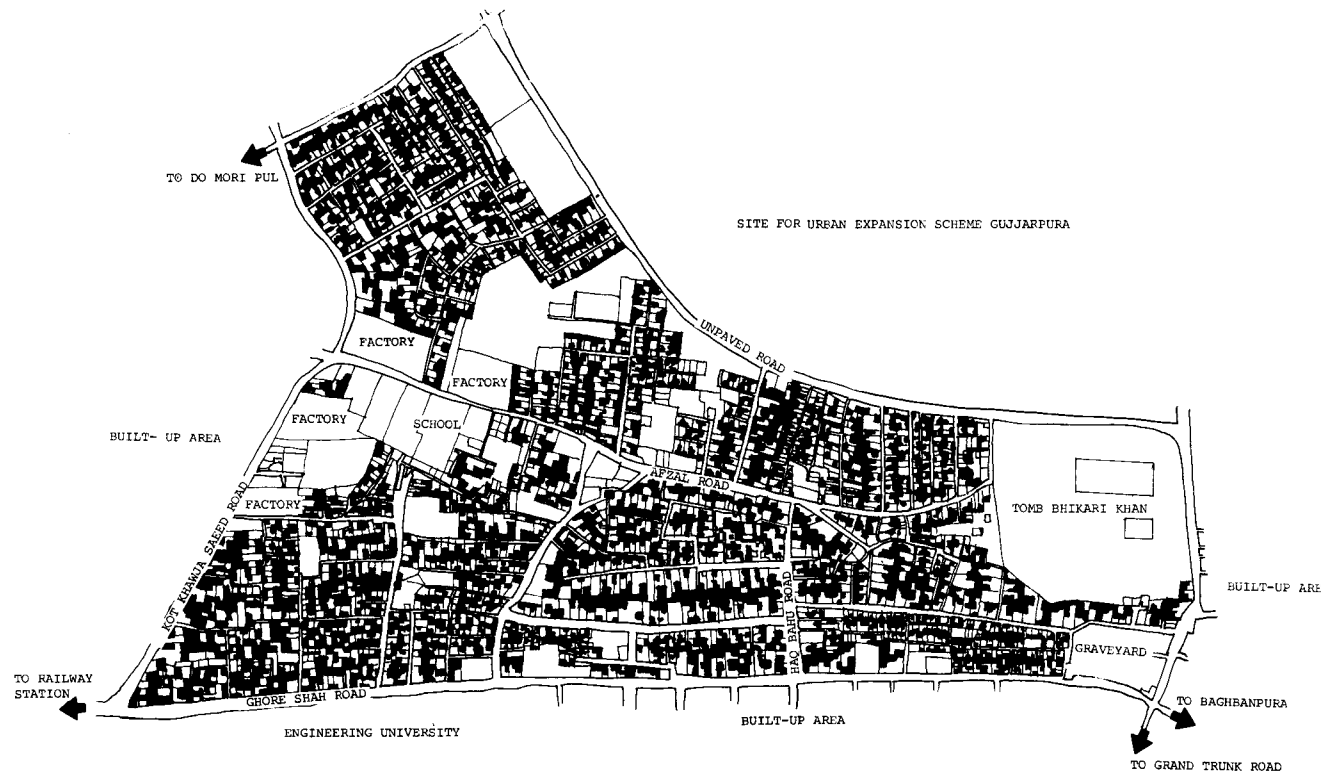


PHOTOGRAPH:
(TOP) Oblique aerial view of the housing conditions in Gujjarpura. Note the multi-use of the roof terraces.
(BOTTOM) A view of the front courtyard of a house. Note the numerous uses of the courtyard as a kitchen, toilet and stable for animals.

ORIGIN: The settlement comprises of a number of neighbourhoods, the oldest being Gujjar-pura. The neighbourhoods include three squatter settlements and the rest are privately developed lots. Originally the land belonged to a few landlords who gradually sold off lots or rented them out. All of the settlements are relatively new, that is they have developed after partition in 1947. Most of the inhabitants have been living here prior to 1971.

LAYOUT: The locality is bound on the south by Ghore Shah Road which forms the most important artery and commercial street. the western boundary is Kot Khawja Saeed Road. along which a few large industries exist. The eastern boundary is formed by Bhogiwal Road and the settlement of Begumpura. A secondary commercial spine is located across the middle of the area in an east-west direction parallel to Ghore Shah Road. A characteristic of the area is the large number of ponds that have formed in the low lying areas by the collection of surface water.

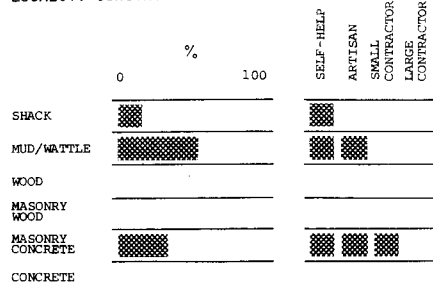
LAND USE: The area is predominately residential with commercial activity along the main spines. A few scattered industries exist particularly along the western boundary. A number of small scale manufacturing workshops are scattered within the neighbourhood. A few large vacant lots are the only open spaces within the site which are used for keeping cattle. There are no planned playgrounds or recreational areas. Most of the area is connected to a water supply network although the pressure is frequently low due to the long runs of the supply pipes from the mains to the house. The sewage network is limited to the main streets and a limited number of houses are connected to these lines. The waste water and night soil is carried mainly in open drains along each street and these in turn flow into manholes on the main sewer lines. The heavy load and the insufficient size of the sewer results in frequent overflowing of the mains. No system of solid waste disposal exists on site, refuse being normally dumped onto vacant lots. Gas is available on Ghore Shah Road. Electricity is supplied by overhead cables. A large number of mosques exist on the site and only two schools.



LOCALITY PLAN



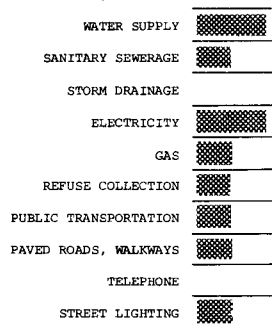
LOCALITY CONSTRUCTION TYPES



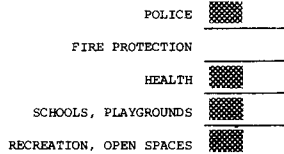
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Approximate

LOCALITY UTILITIES AND SERVICES

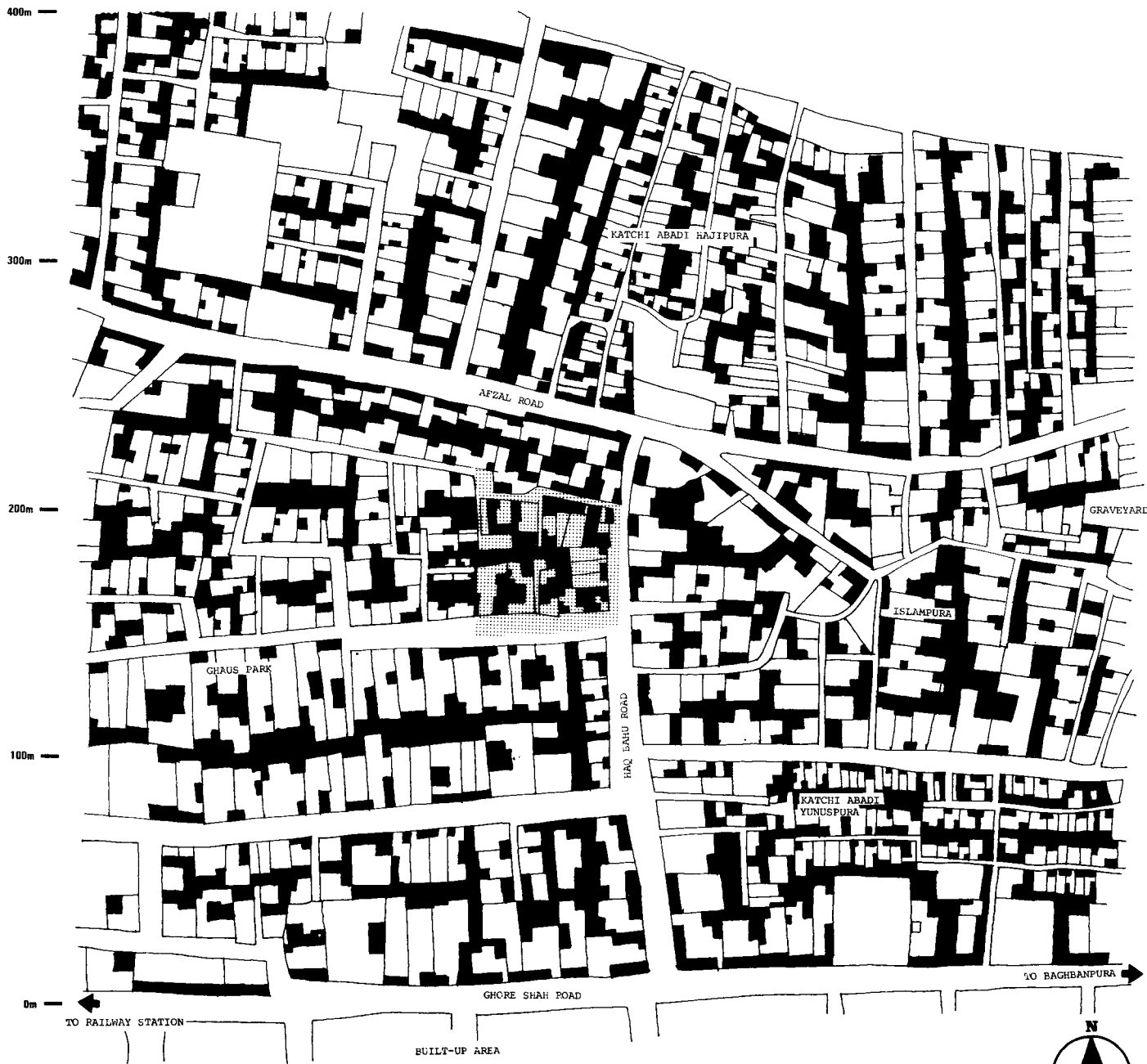


LOCALITY COMMUNITY FACILITIES



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

Quality of information: Approximate



[Dotted Pattern] SELECTED BLOCK

LOCALITY SEGMENT PLAN

1:2500

LAND UTILIZATION DIAGRAMS

CIRCULATION: The primary approach to the area is via Ghore Shah road. Most of the internal streets are narrow and brick paved. The only vehicular streets are the peripheral roads, Afzal Road Haq Bahu Road and Intiaz Road, although there is no vehicular public transport except rickshaws and tongas (horse-drawn carts) which are available within the locality. The nearest bus service is on Grand Trunk Road, one kilometer away

LOCALITY SEGMENT/ BLOCK: The area has a high population density; streets are essentially pedestrian ways, brick paved or unpaved with open drains running along the sides. The dwellings are mostly brick walled with concrete roofs. However a number of shacks built with mud and wood are also found scattered in the locality. A large number of lots are rented and have shacks constructed on them. The majority of the residences contain 1-2 rooms with a verandah and a kitchen. The bath and toilet facilities are provided in one corner of the courtyard. Most of the activities take place outside in the courtyard and roofs are commonly used for sleeping during the summer months..

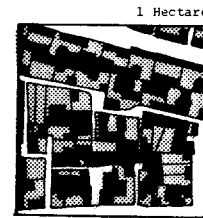
LOCALITY BLOCK LAND UTILIZATION DATA

| DENSITIES | Total Number | Area Hectares | Density N/Ha |
|----------------|--------------|---------------|--------------|
| LOTS | 32 | .5 | |
| DWELLING UNITS | 32 | .5 | 64 |
| PEOPLE | 188 | .5 | 376 |

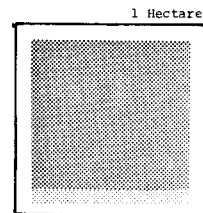
| AREAS | Hectares | Percentage |
|---|----------|------------|
| PUBLIC (streets, walkways, open spaces) | .105 | 21 |
| SEMI-PUBLIC (open spaces, schools, community centers) | .02 | 4 |
| PRIVATE (dwellings, shops, factories, lots) | .35 | 71 |
| SEMI-PRIVATE (cluster courts) | .02 | 4 |
| TOTAL | .5 | 100 |

NETWORK EFFICIENCY
 $\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 324$

LOTS
 Average area = 109 sq.m.

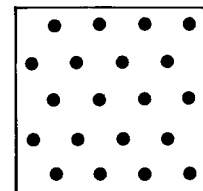


PATTERN



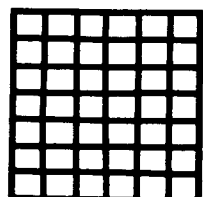
PERCENTAGES

| | |
|------------------|----|
| Streets/Walkways | 21 |
| Playgrounds | 4 |
| Cluster Courts | 4 |
| Dwellings/Lots | 71 |



DENSITY 376

| | |
|-----------------|-----|
| Persons/Hectare | 376 |
| ● 20 Persons | |



CIRCULATION EFFICIENCY

| | |
|----------------|-----|
| Meters/Hectare | 324 |
|----------------|-----|



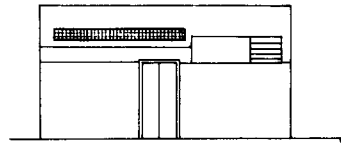
PATTERN

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

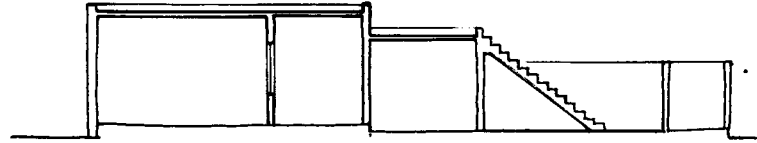


1:1000

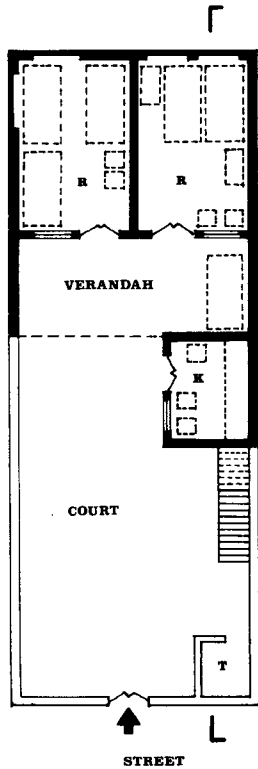
LOCALITY BLOCK PLAN



ELEVATION



SECTION



PLAN

KEY

- R Room (multi-use)
- K Kitchen/Cooking Area
- T Toilet/Bathroom

CASE STUDY SOURCES

- Locality Plan : Lahore Development Authority
- Segment Plan : *IBID*
- Block Plan : *IBID*; Field Survey (1978-79)
- Typical Dwelling : Field Survey, Lahore Development Authority
- Physical Data : *IBID*
- Photographs : The Author (1979-80)
- Other Information : Field Survey, Lahore Development Authority

PHYSICAL DATA
(related to dwelling and land)

DWELLING UNIT
type: HOUSE
area (sq m): 57
tenure: LEGAL OWNERSHIP

LAND/LOT
utilization: PRIVATE
area (sq m): 122
tenure: LEGAL OWNERSHIP

DWELLING
location: PERIPHERY
type: ROW/SEMI-DETACHED
number of floors: ONE
utilization: SINGLE
physical state: GOOD

DWELLING DEVELOPMENT
mode: INCREMENTAL
developer: PRIVATE
builder: SELF/ARTISAN
construction type: MASONARY
year of construction: 1976

MATERIALS
foundation: BRICKS
floors: CEMENT PLASTER
walls: BRICKS
roof: REINFORCED BRICK

DWELLING FACILITIES
wc: 1
shower: 1
kitchen: 1
rooms: 2
other: VERANDAH

SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL
user's ethnic origin: PUNJABI
place of birth: LAHORE
education level: SECONDARY SCHOOL

NUMBER OF USERS
married: 2
single: -
children: 2
total: 4

MIGRATION PATTERN
number of moves: 1
rural - urban:
urban - urban: 1976
urban - rural:

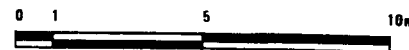
why came to urban area:

GENERAL: ECONOMIC
user's income group: LOW
employment: RAILWAY
distance to work: 4 KM.
mode of travel: BICYCLE

COSTS
dwelling unit: RS. 15,000
land - market value: RS. 10,000

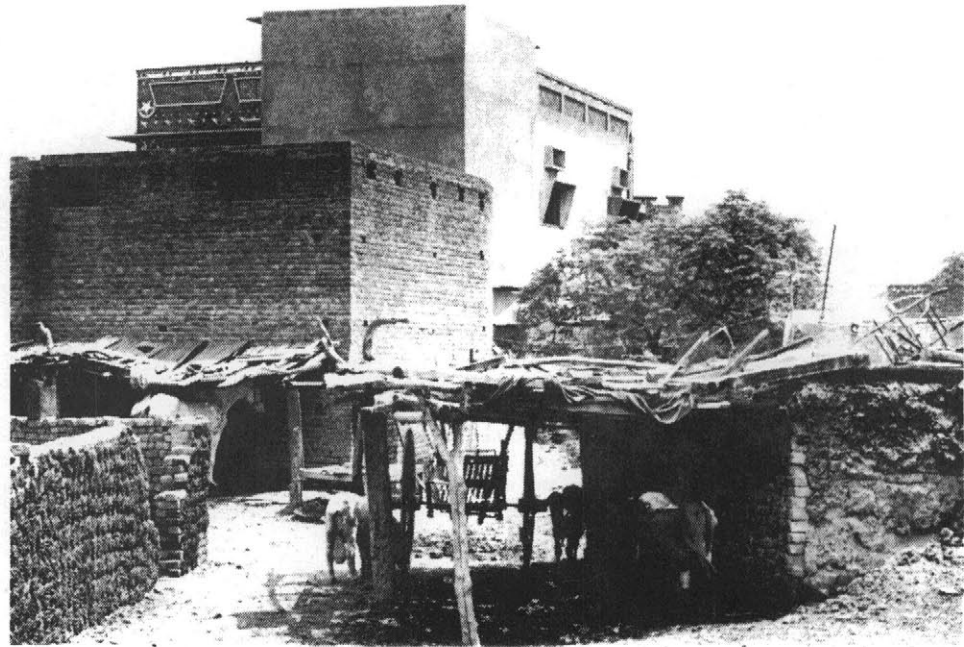
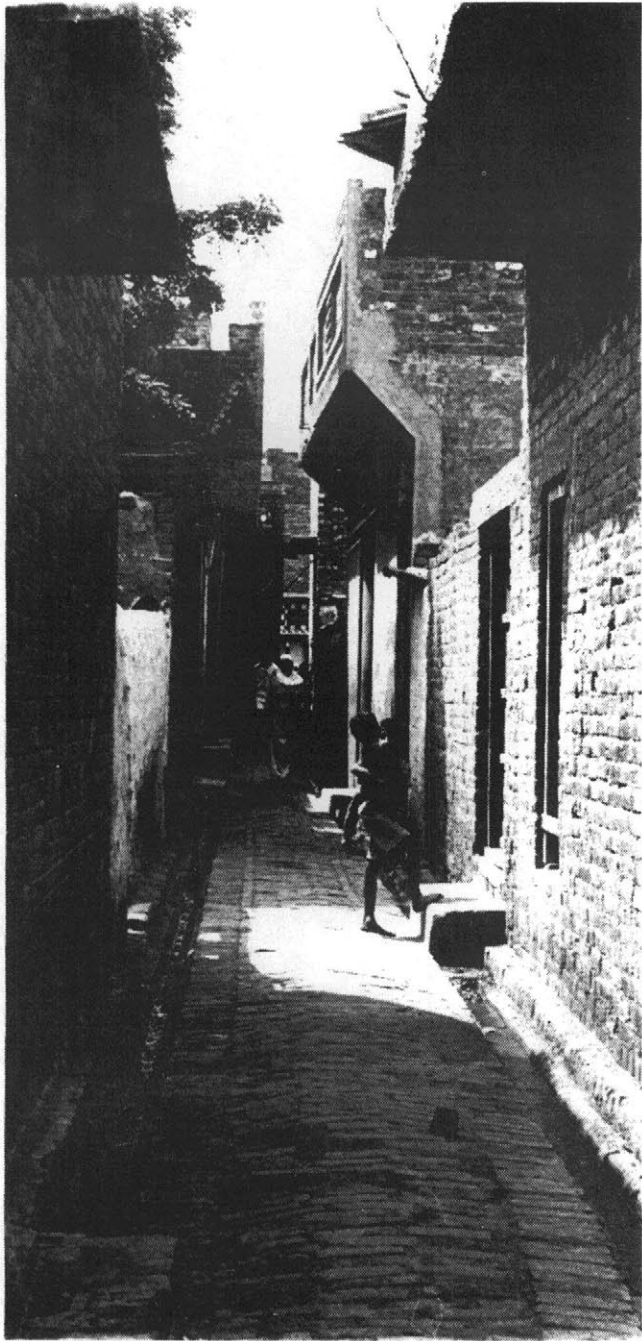
DWELLING UNIT PAYMENTS
financing: SELF FINANCED
rent/mortgage:
% income for rent/mortgage:

PHOTOGRAPH: (OPPOSITE PAGE)
(LEFT) A residential street in Gujjarpura. Note the open sewage drains.
(TOP RIGHT) View of the main commercial street in Gujjarpura.
(BOTTOM RIGHT) Open spaces or vacant lots are used as stables for animals.



1:200

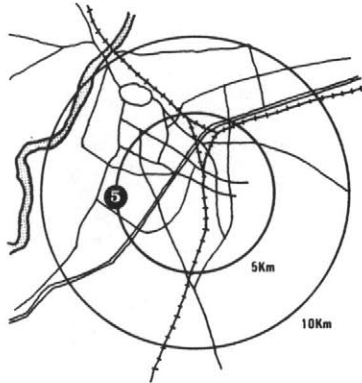
TYPICAL DWELLING



2 IQBAL TOWN

Lahore

PRIVATE SITE AND SERVICES,
PUBLIC HOUSING, WALK-UPS,
MIDDLE, HIGH INCOME



LOCATION: The Allama Iqbal Township scheme is located in the south west limit of the urban area of the city, approximately 7 kilometers from the city centre. The overall scheme encompasses about 560 Hectares roughly triangular in shape, bounded on the west by Multan Road and by Wahdat Road on the south. The north and north east of the site has the high to medium density developments of Icchra. Only "Phase one" of the whole scheme is under consideration for the purpose of this case study which covers an area of 150 Hectares.

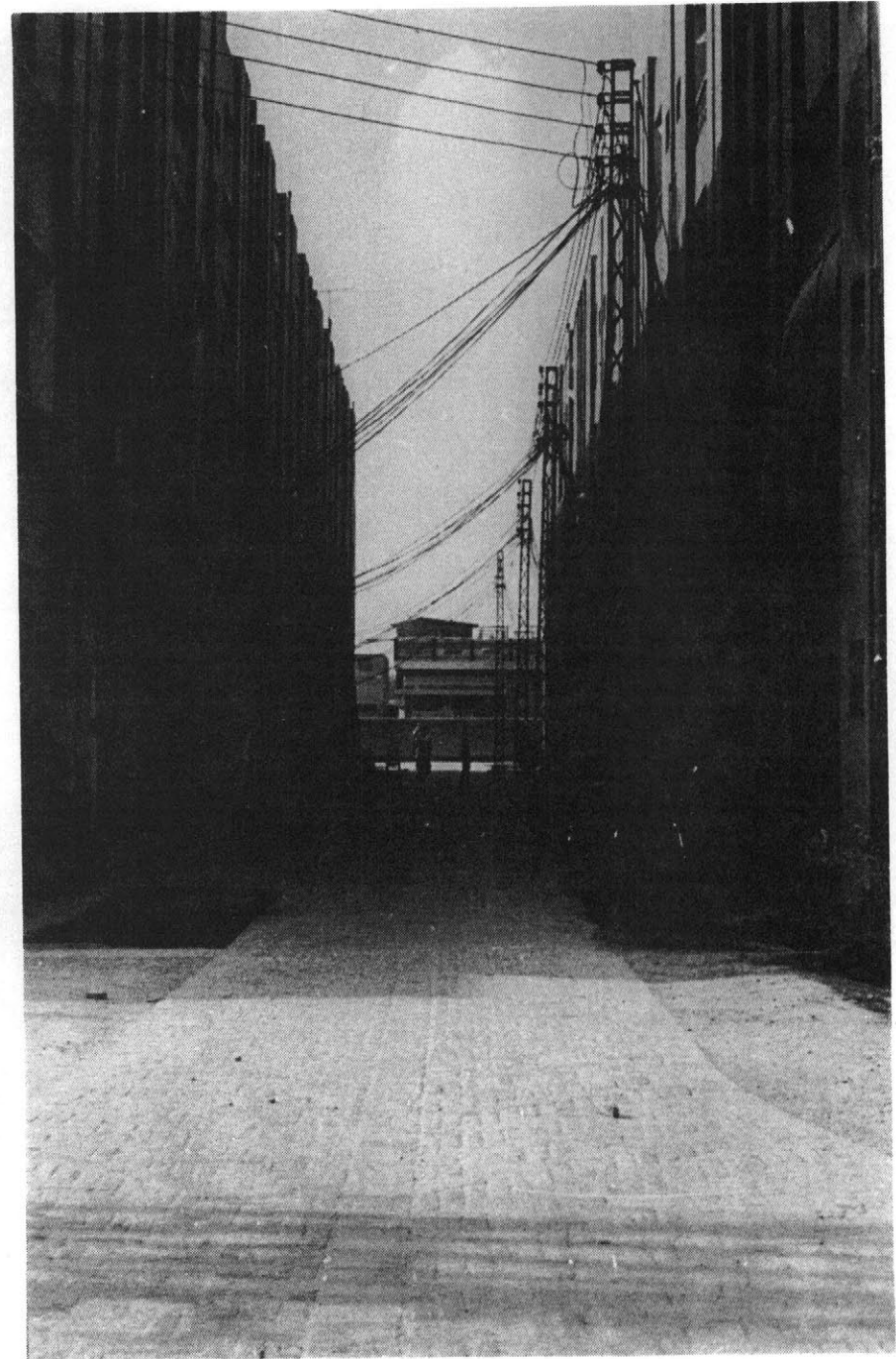
ORIGINS: The scheme was initially conceived in the mid-sixties by the Lahore Improvement Trust as a response to develop areas to house the low and middle income section of the city's population. The earlier plan of providing serviced lots and finished units for outright sale or as rental was finally implemented as comprising of mainly serviced lots and about 8.5 hectares reserved for construction of walk-up apartments.

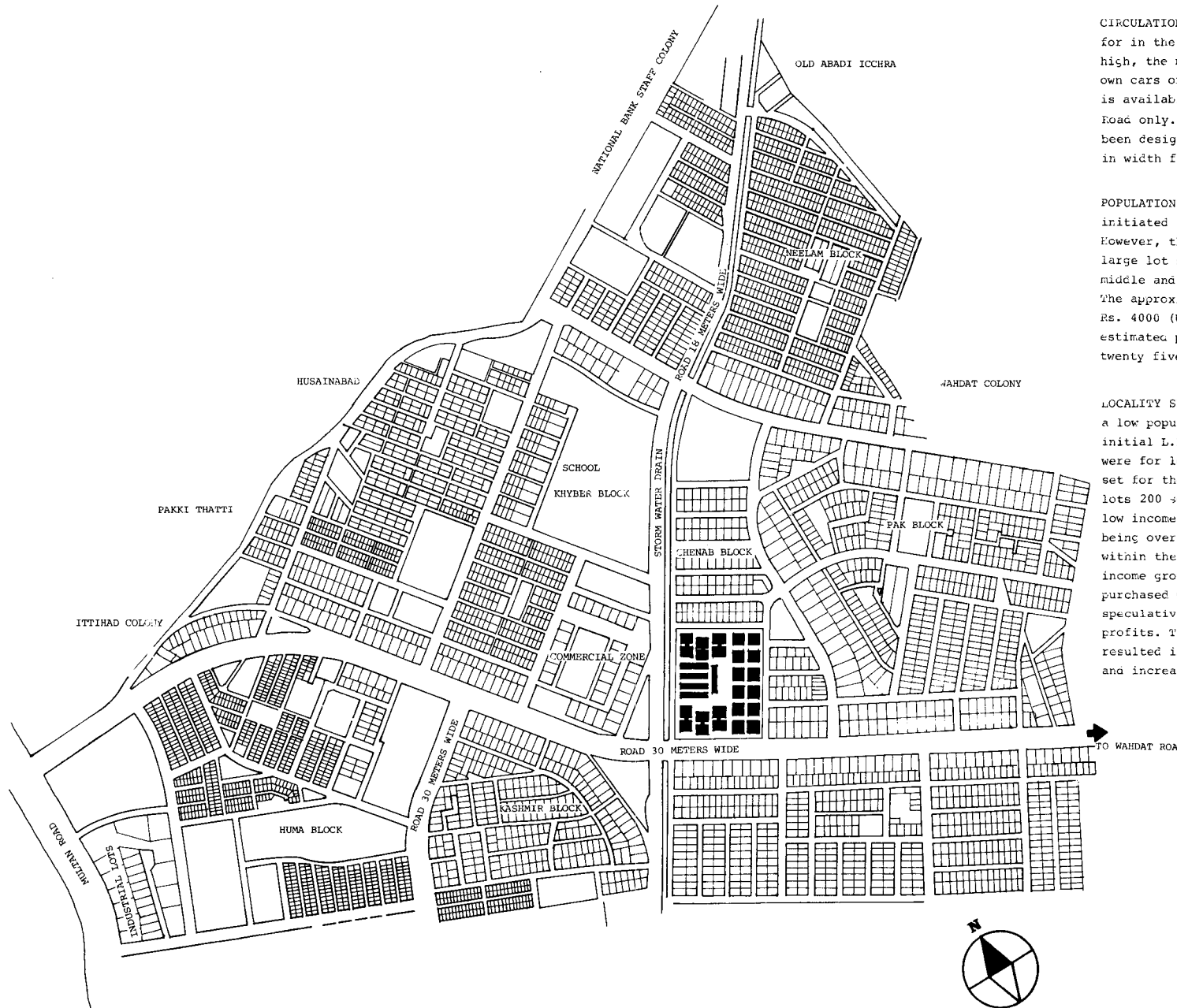
Although the scheme was initiated for low to middle income housing, large lot sizes were provided, resulting in 60% of the total area comprising of lots that were over 200sq.m. with 20% of these being over 400 sq. m. The outcome of this was that presently this locality houses only the high and very high income category. Moreover the lots that were purchased by the middle income sector were resold to higher income groups as land prices escalated due to the increasing shortage of serviced land in the city. Walk-up apartments were constructed by the Lahore Development but again the costs of these was beyond the range of the low income sector, resulting in the middle income sector purchasing them. Moreover the walk-ups did not prove to be very popular and a large number were left unsold. These apartments were purchased finally by various government organisations for housing their employees on rental basis.

LAYOUT: The site is extremely flat with a slight fall north to south. A large open storm water drain cuts the site into two segments. The overall layout is basically grid iron with streets curving occasionally resulting in excessive waste of land and tremendous increase of servicing and maintenance costs. The lot sizes is the basic dimension for intervals between streets with two lots back to back, which increases the circulation area amounting to 40% of the land being utilized as public land. The total design is based on auto-oriented wide streets and centralized commercial zones.

LAND USE: The locality is predominantly low density residential with large open spaces left for development of parks or public use. A large area in the centre of the site has been zoned for commercial development only. Along Multan road land has been reserved for industrial lots. Three blocks within the locality, totaling an area of 8.5 hectares, has been reserved for construction of apartments. The construction of the apartments was the responsibility of the Lahore Development Authority.

PHOTOGRAPH:
A view of the L.D.A. flats in Iqbal Town





CIRCULATION: Since the income group catered for in the locality ranges from middle to high, the majority of the people living here own cars or motor-cycles. Public transport is available from Multan Road and Wahdat Road only. The streets have predominantly been designed for vehicular traffic and vary in width from 7 meters to 40 meters.

POPULATION AND INCOME: The project was initiated for low to middle income groups. However, the high costs of land due to the large lot sizes has resulted in an upper middle and high income sector moving in. The approximate income ranges from Rs. 500-Rs. 4000 (US \$50-\$400) per month. The estimated population of the area is about twenty five thousand persons.

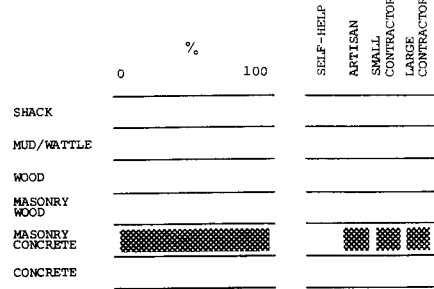
LOCALITY SEGMENT: The overall segment has a low population density. According to the initial L.D.A. Plan almost 80% of the lots were for low income groups, but the standards set for the lot sizes were such that all lots 200 sq. m. and less were classified for low income resulting in over 65% of the lots being over 100 sq. m. and therefore not within the purchase limits of the low income groups. Moreover the lots were purchased directly from L.D.A., held for speculative purposes and resold at enormous profits. The large lot sizes have also resulted in a high percentage of public area and increased costs of laying utilities.

LOCALITY PLAN



1:10000

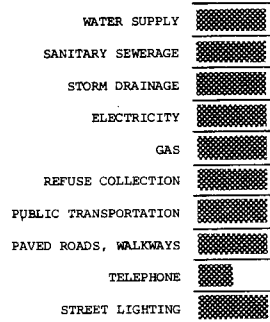
LOCALITY CONSTRUCTION TYPES



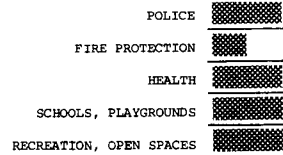
The chart shows (1) approximate percentage of each construction type within the total number of dwellings and (2) building group that generally produces each type.

Quality of information: Accurate

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: Accurate

400m

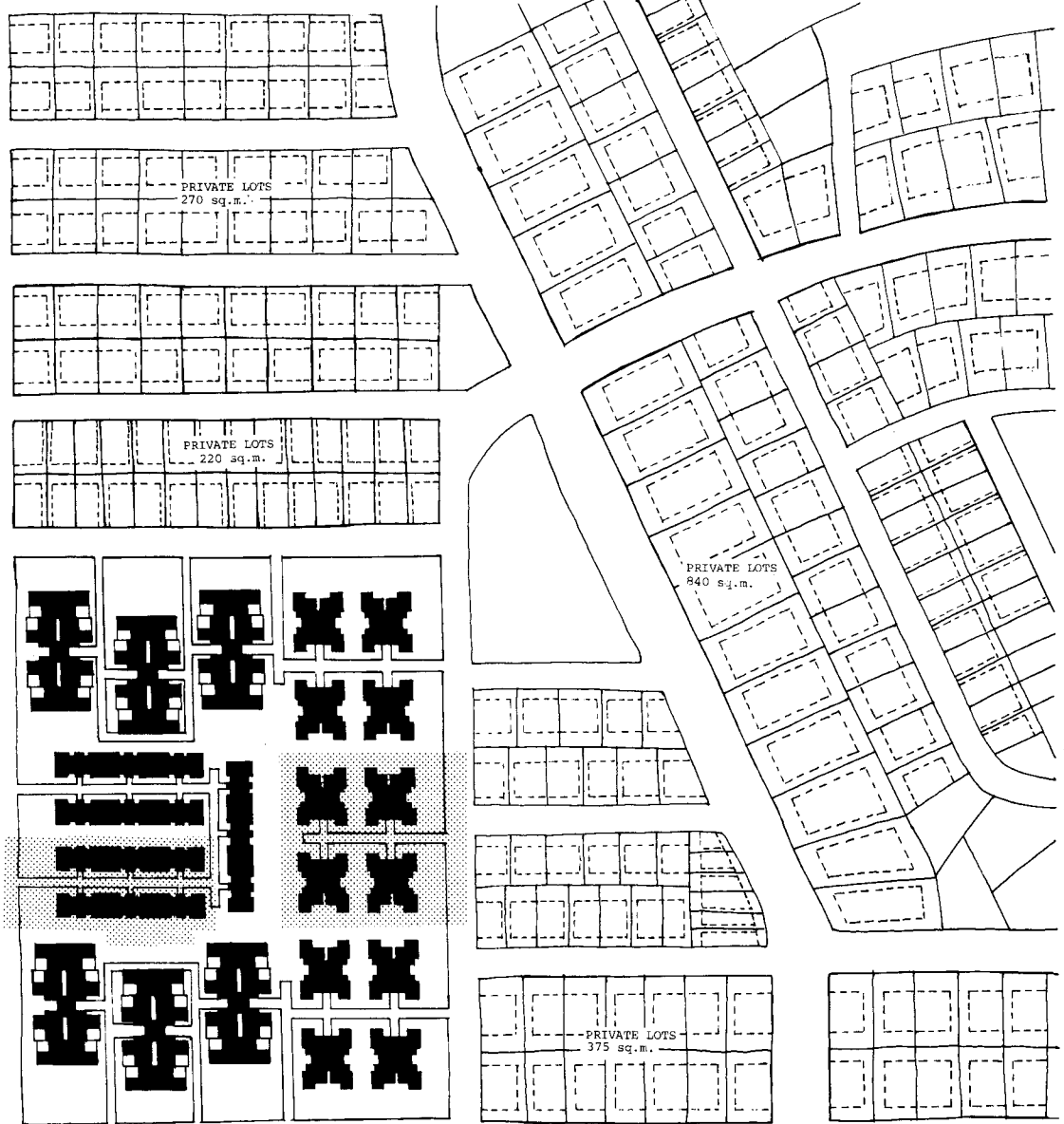
300m

200m

100m

0m

STORM WATER DRAIN



[Pattern] SELECTED BLOCK

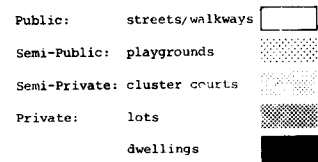
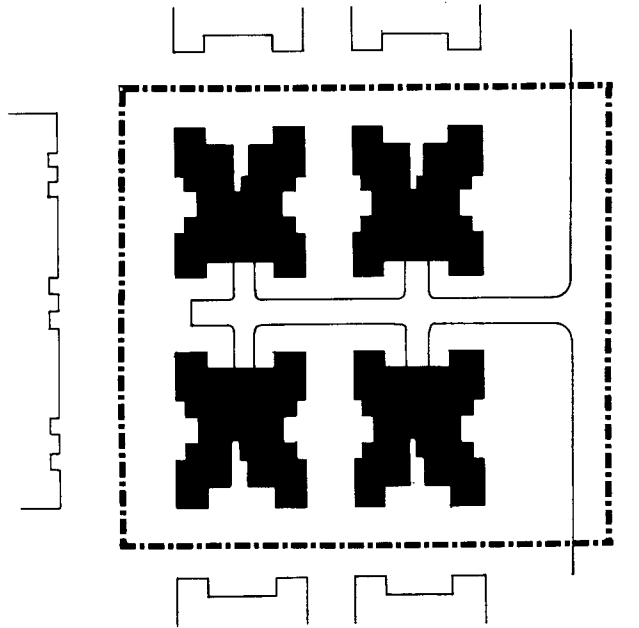
LOCALITY SEGMENT PLAN



1:2500



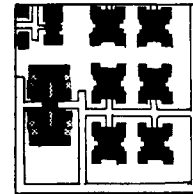
LAND UTILIZATION DIAGRAMS



1:1000

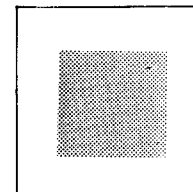
LOCALITY BLOCK PLAN

1 Hectare



PATTERN

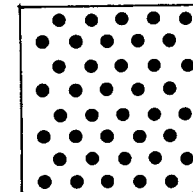
1 Hectare



PERCENTAGES

| | |
|------------------|------|
| Streets/Walkways | 68.5 |
| Playgrounds | |
| Cluster Courts | |
| Dwellings/Lots | 31.5 |

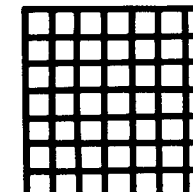
1 Hectare



DENSITY 820

● 20 Persons

16 Hectares



CIRCULATION EFFICIENCY
Meters/Hectare 366

LOCALITY BLOCK: These apartments were constructed by the Lahore Development Authority for sale to the private sector. Each block contains 16 units with four units per floor, served by a single stairwell. The design and construction of these units was the responsibility of a private contractor with LDA's approval. A total number of 12 blocks were constructed housing 192 families. Each unit contains two bedrooms, living room, kitchen, bath and toilet. Almost 70% of the area consists of open spaces and circulation with undefined responsibilities.

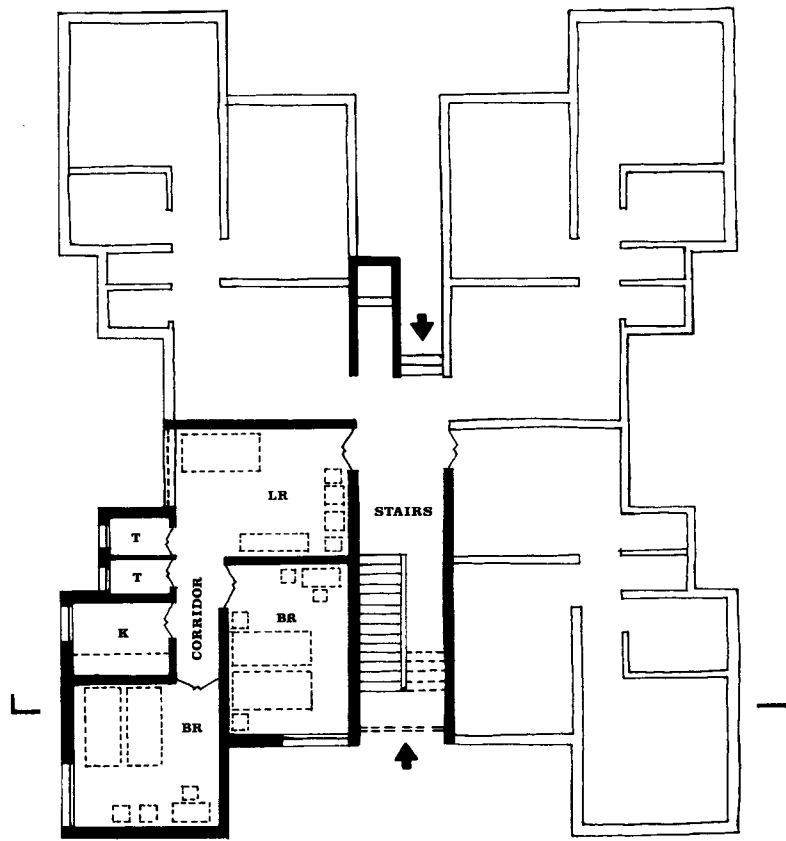
LOCALITY BLOCK LAND UTILIZATION DATA

| DENSITIES | Total Number | Area Hectares | Density N/Ha |
|----------------|--------------|---------------|--------------|
| LOTS | - | - | - |
| DWELLING UNITS | 64 | .39 | 164.1 |
| PEOPLE | 320 | .39 | 820.5 |

| AREAS | Hectares | Percentages |
|---|----------|-------------|
| PUBLIC (streets, walkways, open spaces) | .267 | 68.5 |
| SEMI-PUBLIC (open spaces, schools, community centers) | | |
| PRIVATE (dwellings, shops, factories, lots) | .122 | 31.5 |
| SEMI-PRIVATE (cluster courts) | | |
| TOTAL | .39 | 100 |

NETWORK EFFICIENCY

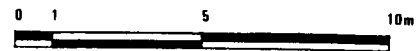
Network length (streets, walkways) = 366
Areas served (total area)



PLAN

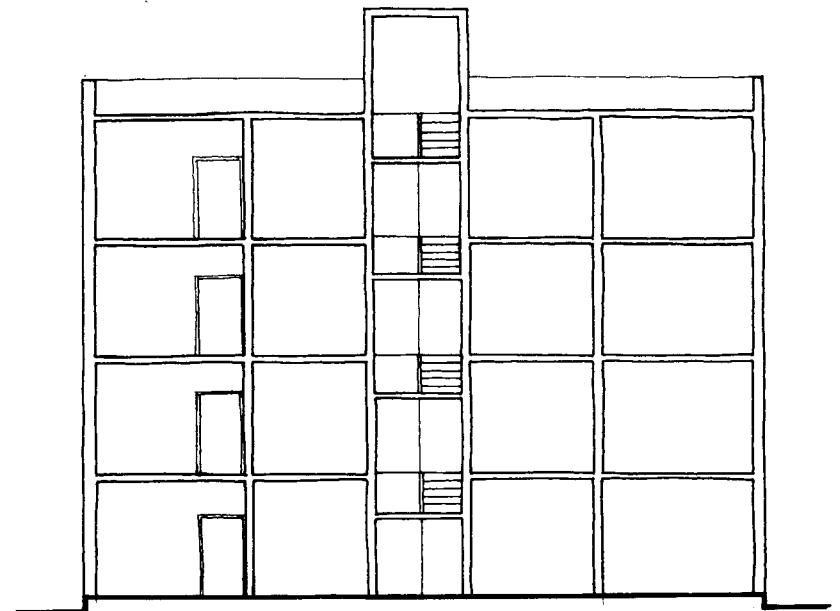
KEY

- LR Living Room
- BR Bedroom
- K Kitchen/Cooking Area
- T Toilet/Bathroom

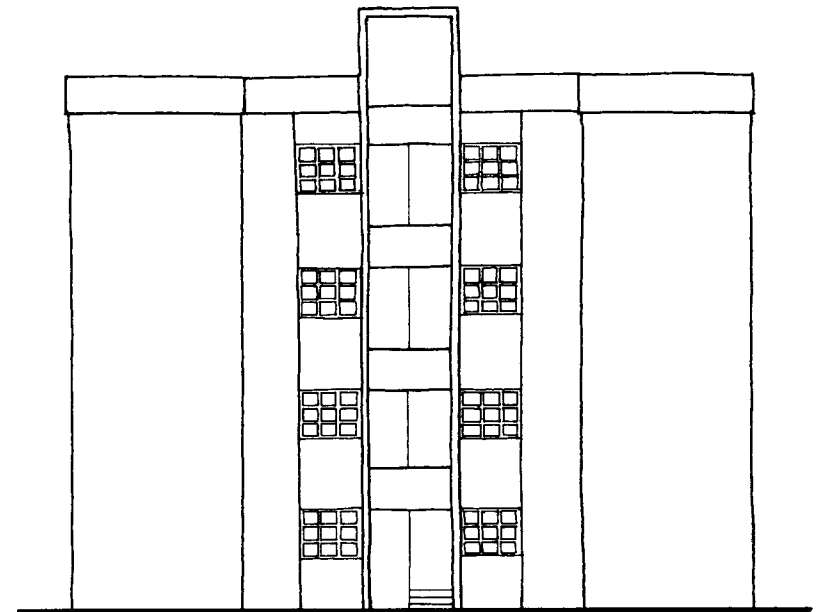


1:200

TYPICAL DWELLING



SECTION



ELEVATION

PHYSICAL DATA

(related to dwelling and land)

DWELLING UNIT

type: WALK-UP APARTMENT
 area (sq m): 70
 tenure: LEGAL OWNERSHIP

LAND/LOT

utilization: PUBLIC
 area (sq m): -
 tenure: CONDOMINIUM

DWELLING

location: PERIPHERY
 type: WALK-UP
 number of floors: FOUR
 utilization: SINGLE FAMILY
 physical state: GOOD

DWELLING DEVELOPMENT

mode: INSTANT
 developer: PUBLIC
 builder: LARGE CONTRACTOR
 construction type: MASONRY/CONCRETE
 year of construction: 1976

MATERIALS

foundation: BRICKS
 floors: CEMENT PLASTER
 walls: BRICK
 roof: REINFORCED CONCRETE

DWELLING FACILITIES

wc: 1
 shower: 1
 kitchen: 1
 rooms: 3
 other: -

SOCIO-ECONOMIC DATA

(related to user)

GENERAL: SOCIAL

user's ethnic origin: PUNJABI
 place of birth: LAHORE
 education level: COLLEGE

NUMBER OF USERS

married: 2
 single: -
 children: 1
 total: 3

MIGRATION PATTERN

number of moves: 2
 rural - urban:
 urban - urban: 1978
 urban - rural:

why came to urban area: EMPLOYMENT

GENERAL: ECONOMIC

user's income group: MIDDLE
 employment: CLERK
 distance to work: 5 KM.
 mode of travel: MOTORCYCLE

COSTS

dwelling unit: -
 land - market value: -

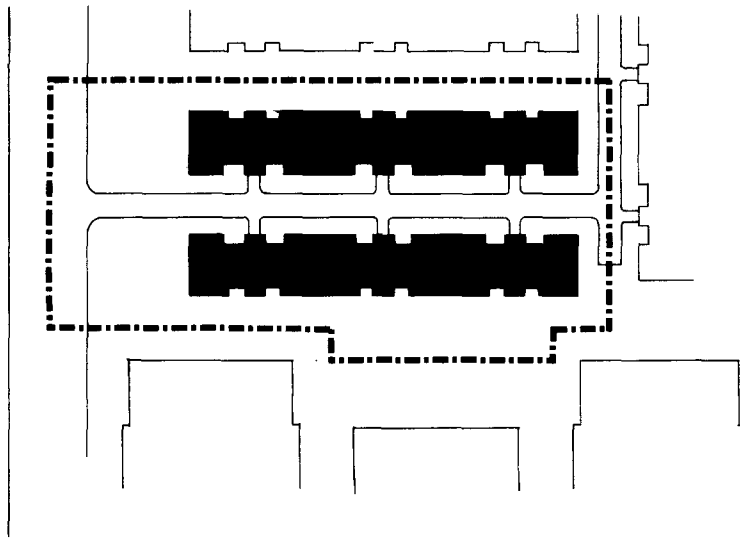
DWELLING UNIT PAYMENTS

financing:
 rent/mortgage: INSTALLMENTS
 % income for rent/mortgage:



PHOTOGRAPH:

(TOP) View of the walk-ups from the main road. Note the large open spaces around the apartment blocks.
 (BOTTOM) Side view of the same apartments.



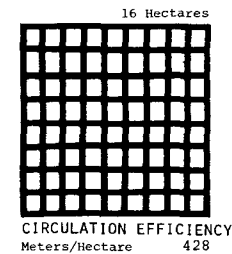
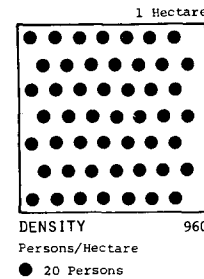
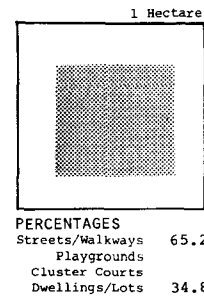
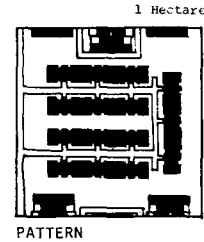
KEY

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



1:1000

LOCALITY BLOCK PLAN



LOCALITY BLOCK: These walk-ups were constructed by the Lahore Development Authority for sale to the private sector. However low quality construction and poorly defined responsibility resulted in most of them remaining unsold and eventually various government agencies bought them who presently house their employees on a rental basis.

Each block contains 24 units, each unit having two bedrooms, living room, kitchen, bath and toilet. A single stairwell serves two units per floor. A high proportion of density is attained but large open public land results in problems of maintenance and responsibility.

LOCALITY BLOCK LAND UTILIZATION DATA

| DENSITIES | Total Number | Area Hectares | Density N/Ha |
|---|--------------|---------------|--------------|
| LOTS | - | - | - |
| DWELLING UNITS | 48 | .25 | 192 |
| PEOPLE | 240 | .25 | 960 |
| AREAS | | | |
| | | Hectares | Percentages |
| PUBLIC (streets, walkways, open spaces) | | .163 | 65.2 |
| SEMI-PUBLIC (open spaces, schools, community centers) | | | |
| PRIVATE (dwellings, shops, factories, lots) | | .087 | 34.8 |
| SEMI-PRIVATE (cluster courts) | | | |
| TOTAL | | .25 | 100 |

NETWORK EFFICIENCY
 $\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 428$

PHYSICAL DATA
(related to dwelling and

LDA APARTMENTS

DWELLING UNIT
type: WALK-UP APARTMENTS
area (sq m): 65
tenure: RENTAL

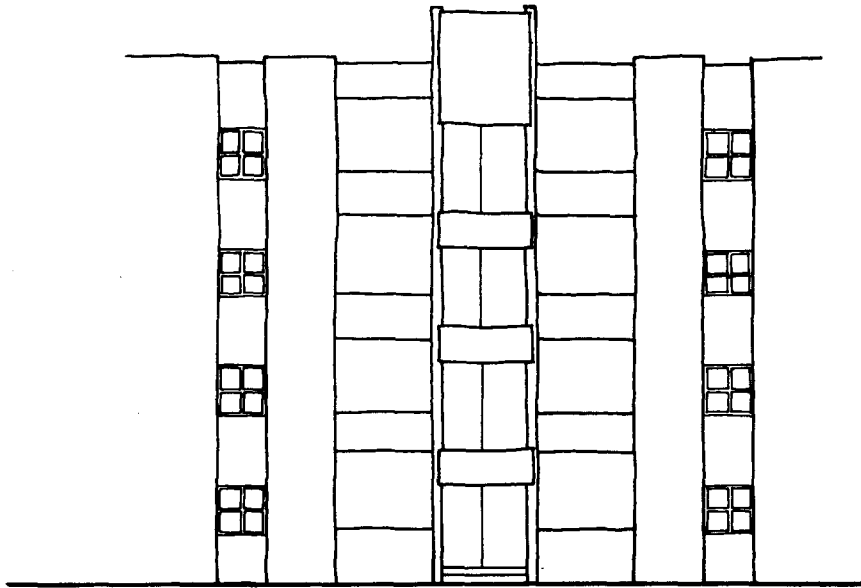
LAND/LOT
utilization: PUBLIC
area (sq m): -
tenure: CONDOMINIUM

DWELLING
location: PERIPHERY
type: WALK-UP
number of floors: FOUR
utilization: SINGLE FAMILY
physical state: GOOD

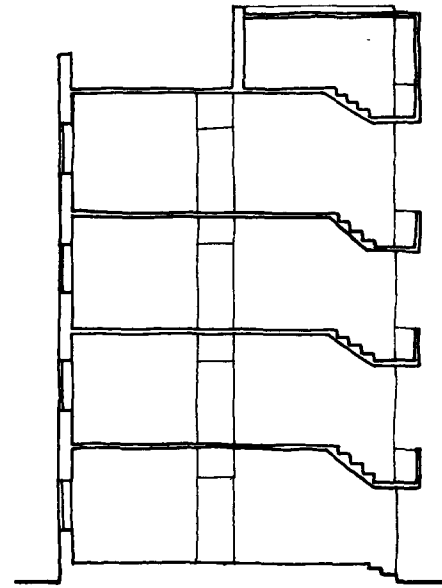
DWELLING DEVELOPMENT
mode: INSTANT
developer: PUBLIC
builder: LARGE CONTRACTOR
construction type: MASONRY/CONCRETE
year of construction: 1976

MATERIALS
foundations: BRICKS
floors: CEMENT PLASTER
walls: BRICK
roof: REINFORCED CONCRETE

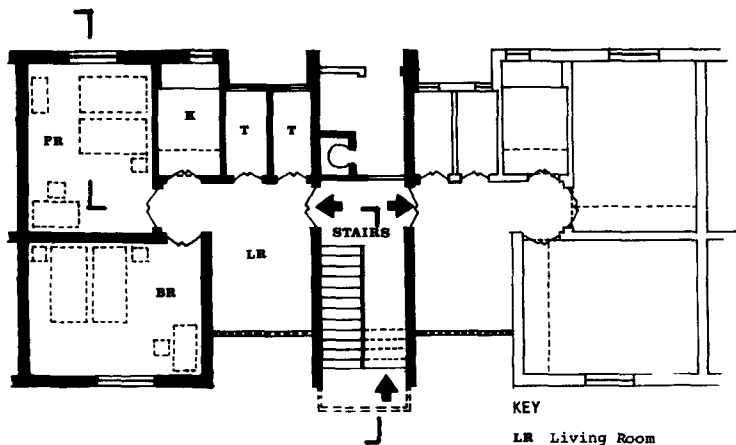
DWELLING FACILITIES
wc: 1
shower: 1
kitchen: 1
rooms: 3
other: -



ELEVATION



SECTION



PLAN

KEY
LR Living Room
BR Bedroom
K Kitchen/Cooking Area
T Toilet/Bathroom

TYPICAL DWELLING

SOCIO-ECONOMIC DATA
(related to user)

GENERAL: SOCIAL
user's ethnic origin: PUNJABI
place of birth: LAHORE
education level: TECHNICAL SCHOOL

NUMBER OF USERS
married: 4
single: -
children: -
total: 4

MIGRATION PATTERN
number of moves: 1
rural - urban:
urban - urban: 1978
urban - rural:

why came to urban area: EDUCATION/EMPLOYMENT

GENERAL: ECONOMIC
user's income group: MIDDLE
employment: DRAFTSPERSON
distance to work: 5 KM.
mode of travel: MOTORCYCLE

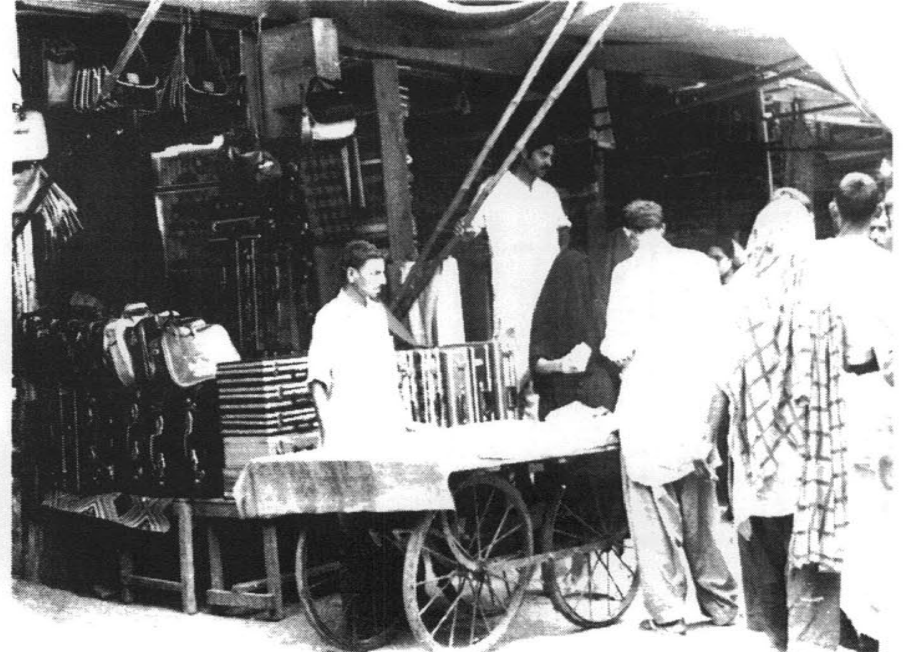
CASE STUDY SOURCES

Locality Plan : Survey Plan, Lahore Development Authority
Segment Plan : IBID
Block Plan : IBID
Typical Dwelling : Field Survey (1978-79)
Physical Data : (approximate) IBID
Photographs : The Author (1978-79)
Other Information : Field Survey (1978-79); Lahore Development Authority



COSTS
dwelling unit: -
land - market value: -

DWELLING UNIT PAYMENTS
financing: -
rent/mortgage: -
% income for rent/mortgage: 10%



EVALUATIONS

Existing dwelling systems are the most valuable sources of information in formulating urban land policies and housing programs. Existing dwelling environments provide a guide to general yet basic questions of land use ((for what?) land distribution (for whom?) and land subdivision (how to?). They also provide a guide to specific issues concerning population, densities, income ranges land utilization efficiency and different cultural and social values.

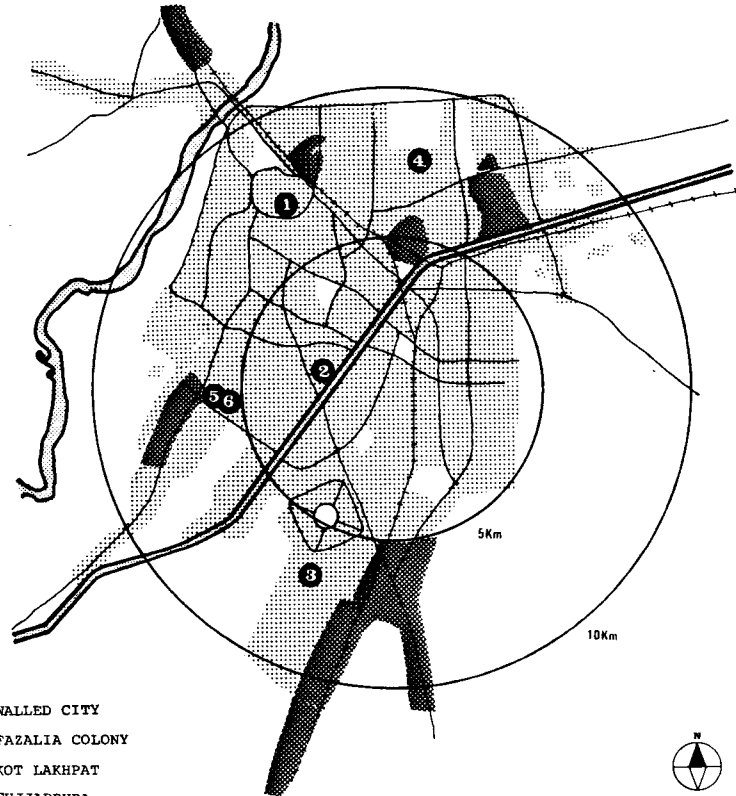
Five case studies have been evaluated each representing a basic dwelling type of the urban low income sector of Lahore. The evaluations represent a comparative view of the existing land utilization patterns, percentages, densities and circulation patterns.

Data from these evaluations help determine the existing trends of urbanization patterns. This data is then used to formulate a set of guidelines and policy decisions for future proposed schemes for urban development.

The diagrams on the following pages show a summary of the evaluations of the case studies, in a comparative manner.

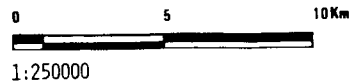
PHOTOGRAPHS: (OPPOSITE PAGE)
 Glimpses of the informal sector employment.
 (TOP LEFT) A vegetable shop in a squatter settlement.
 (BOTTOM LEFT) Shops such as these a common occurrence in all low income settlements in the city.
 (TOP RIGHT) A cobbler at work in the old city.
 (BOTTOM RIGHT) A clothing and general merchandise shop in the Old City. Note the vendor in front of the shop selling eatables.

**LAND UTILIZATION:
PATTERNS, PERCENTAGES,
DENSITIES, CIRCULATION**



- ① WALLED CITY
- ② FAZALIA COLONY
- ③ KOT LAKHPAT
- ④ GUJJARPURA
- ⑤ IQBAL TOWN
- ⑥ IQBAL TOWN

CASE STUDY LOCATIONS



CASE STUDIES

The case studies are examples of existing dwelling environments in Lahore. The criteria used in the evaluation of efficiency of physical layouts in the survey::

PATTERNS

Lot configurations, blocks and circulation patterns are primary indicators in determining infrastructure network lengths. For example, when certain layouts have excessive network lengths or are very complicated, this results in higher costs per person for the overall development.

PERCENTAGES

Proportion of public and private areas are indicators in determining maintenance, responsibility, user control and functional efficiency of a layout. For example, a large percentage of land for circulation results in high costs of installation per person and extensive maintenance for the public sector, indicating an inefficient layout.

DENSITY

The number of persons per hectare relates to both the number of lots and the types of dwellings per hectare. This determines the intensity of land use; low densities reflect higher development costs per person.

CIRCULATION EFFICIENCY

A relation between public circulation lengths and the area served indicates the network efficiency; a high ratio reflects a less efficient network in terms of direct capital investment and future maintenance costs.

1 WALLED CITY

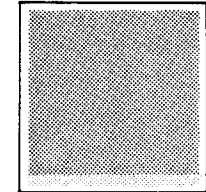
Traditional Housing
Private, Low income

Low percentage of land for streets; high percentage for lots. High population density; deteriorating standard of services due to layout pattern.



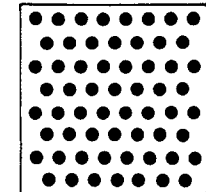
1 Hectare

1 Hectare



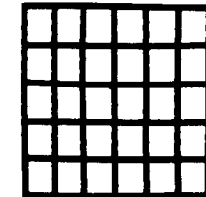
| | |
|------------------|----|
| Streets/Walkways | 13 |
| Playgrounds | 3 |
| Cluster Courts | 2 |
| Dwellings/Lots | 82 |

1 Hectare



Persons/Hectare 1200
● 20 Persons

16 Hectares



Meters/Hectare 283

2 FAZALIA COLONY

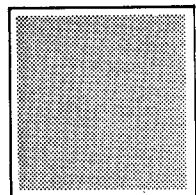
Squatter settlement
Popular, Very low/low income

High density; low percentage of dwelling area; extra-legality of land/lot tenure the issue.

1 Hectare

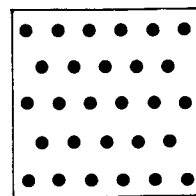


1 Hectare



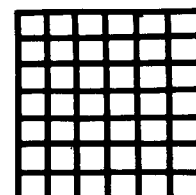
| | |
|------------------|----|
| Streets/Walkways | 12 |
| Playgrounds | 3 |
| Cluster Courts | - |
| Dwellings/Lots | 85 |

1 Hectare



| | |
|-----------------|-----|
| Persons/Hectare | 570 |
| ● 20 Persons | |

16 Hectares

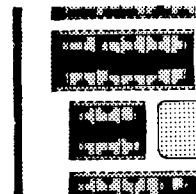


| | |
|----------------|-----|
| Meters/Hectare | 333 |
|----------------|-----|

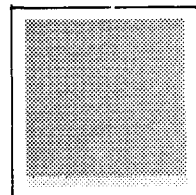
3 KOT LAKHPAT

Public Housing Scheme
Middle income

Very high percentage of land for streets; low density; poor layout with undefined responsibilities results in excessive public land

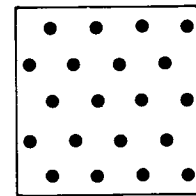


1 Hectare



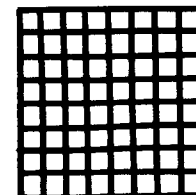
| | |
|------------------|----|
| Streets/Walkways | 30 |
| Playgrounds | 7 |
| Cluster Courts | - |
| Dwellings/Lots | 63 |

1 Hectare



| | |
|-----------------|-----|
| Persons/Hectare | 403 |
| ● 20 Persons | |

16 Hectares

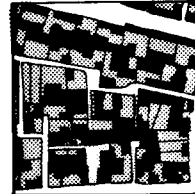


| | |
|----------------|-----|
| Meters/Hectare | 400 |
|----------------|-----|

4 GUJJARPURA

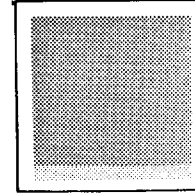
Squatters, private houses
Low, middle income

Low percentage of area for streets; lack of utilities result in unhygienic living conditions.



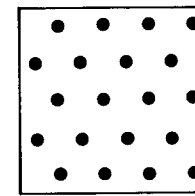
1 Hectare

1 Hectare



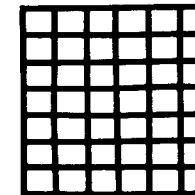
| | |
|------------------|----|
| Streets/Walkways | 21 |
| Playgrounds | 4 |
| Cluster Courts | 4 |
| Dwellings/Lots | 71 |

1 Hectare



| | |
|-----------------|-----|
| Persons/Hectare | 376 |
| ● 20 Persons | |

16 Hectares

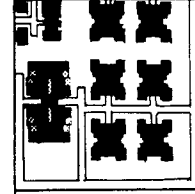


| | |
|----------------|-----|
| Meters/Hectare | 324 |
|----------------|-----|

5 IQBAL TOWN

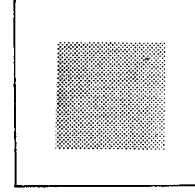
Public housing, walk-ups
Middle income

Large open spaces with undefined responsibility creates a heavy burden on the municipality.



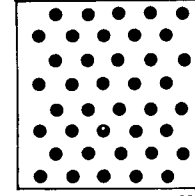
1 Hectare

1 Hectare



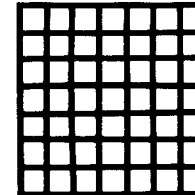
| | |
|------------------|----|
| Streets/Walkways | 69 |
| Playgrounds | - |
| Cluster Courts | - |
| Dwellings/Lots | 31 |

1 Hectare



| | |
|-----------------|-----|
| Persons/Hectare | 820 |
| ● 20 Persons | |

16 Hectares

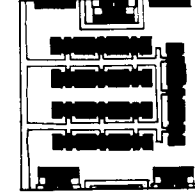


| | |
|----------------|-----|
| Meters/Hectare | 366 |
|----------------|-----|

6 IQBAL TOWN

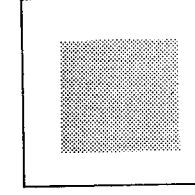
Public housing, walk-ups
Middle income

Large area per unit results in high costs making it unfeasible for low income groups;



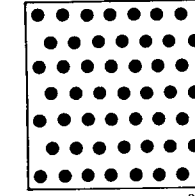
1 Hectare

1 Hectare



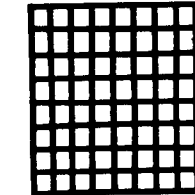
| | |
|------------------|----|
| Streets/Walkways | 65 |
| Playgrounds | - |
| Cluster Courts | - |
| Dwellings/Lots | 35 |

1 Hectare



| | |
|-----------------|-----|
| Persons/Hectare | 960 |
| ● 20 Persons | |

16 Hectares



| | |
|----------------|-----|
| Meters/Hectare | 428 |
|----------------|-----|

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)

ALTERNATING 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 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 (m²) 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 responsibility. *PUBLIC* (streets, walkways, open spaces): user -anyone/unlimited; physical controls -minimum; responsibility -public sector. *SEMI-PUBLIC* (open spaces, playgrounds, schools): user -limited group of people; physical controls -partial or complete; responsibility -public sector and user. *PRIVATE* (dwellings, lots): user -owner or tenant or squatter; physical controls -complete; responsibility -user. *SEMI-PRIVATE* (cluster courts): user -group of owners and/or tenants; physical controls -partial or complete; responsibility -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/OPTIMIZE. 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 FACILITIES. 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 thoroughfare which one may lawfully use, the strip of land devoted to or over which is built a public road, the land

occupied by a railroad, the land used by a public 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-, water-, 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)

VIENS. 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 horsepower 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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EXPLANATORY NOTES

QUALITY OF INFORMATION

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

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

QUALITY OF SERVICES, FACILITIES AND UTILITIES

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

METRIC SYSTEM EQUIVALENTS

Linear Measures

| | | |
|--------------|----|---|
| 1 centimeter | = | 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 | = | 0.3048 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/mortgate data have been expressed in terms of U.S. Equivalent:
1 US Dollar = 9.90 Rupees (May)