URBAN SETTLEMENT MODEL

Comparative Study of a Site and Services Project, Dhaka, Bangladesh

MAYEEDUR RAHMAN
B.Arch. Bangladesh University of Engineering and Technology
Dhaka, Bangladesh
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Signature of author _____
Mayeedur Rahman, Department of Architecture, May 1983

Certified by _____
Horacio Caminos, Prof. of Architecture, Thesis Supervisor

Accepted by _____
N. John Habraken, Chairman, Departmental Committee for Graduate Students

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by
Mayeedur Rahman

Submitted to the Department of Architecture in partial fulfillment of the requirements for the degree of Master of Science in Architecture Studies.

ABSTRACT

The study proposes an alternative design approach for low income urban settlements, based upon a comparative study of a Site and Services project.

Most of the existing and proposed settlements have considerable problems in Land Utilization, circulation efficiency and infrastucture layout. Despite narrow streets, a large percentage of land is allotted for public circulation due to gridiron layouts having small blocks. As for walkup developments, waste of land, utilities and services are common characteristics. Moreover, "instant" housing developments require extensive capital investment and discourages the utilization of individual resources.

The focus of the study is on optimisation of costs by efficient Land Subdivision, Land Utilization and Circulation system. The study proposes a grid layout and progressive housing development with minimization of public land, costs and institutional participation on one hand and maximization of private land and user's participation on the other.

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

ACKNOWLEDGEMENT

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I sincerely appreciate the friendship, suggestions and assistance of Reinhard Goethert who has never failed me in times of need. I also appreciate the companionship and pertinent comments from the members of my class: Humberto, Navroz, Faieda and Trevor, the class of 1980-82 and the class of 1982-84.

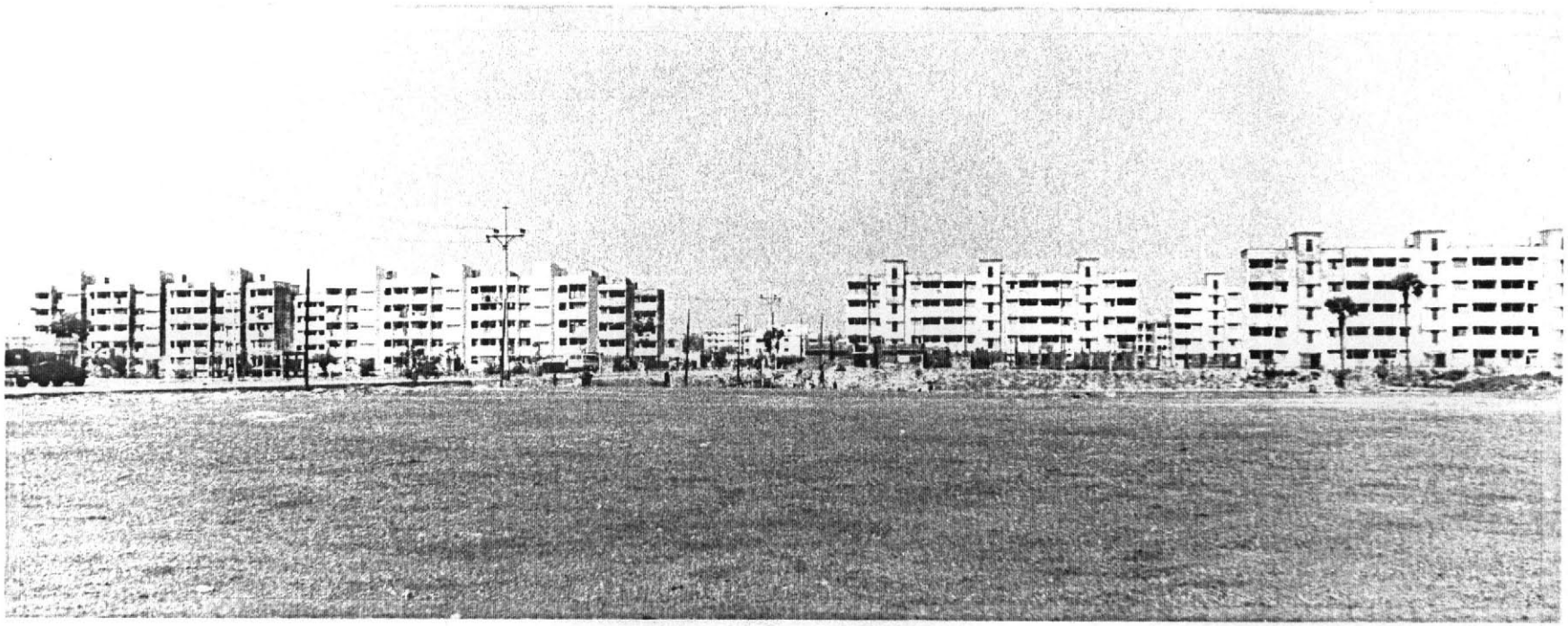
I wish to extend my thanks to Professor Abdul Hasnath of the Engineering University, Dhaka, to my friends A.S.M. Ismail, Salimullah and Amin Khan for supplying the much needed reference material and data.

Finally I extend my thanks and deepest gratitude to my parents for their loving support and encouragement, that are beyond the means of expression and to my wife Disha whose patience, support and efforts helped me in producing this work.

M.R.

CONTENTS

NOTE : Spelling of 'Dacca' has been officially changed to 'Dhaka'.



Public housing : One of the housing systems for low income groups in Dhaka. Photo : A.S.M. Ismail.

INTRODUCTION

Bangladesh is one of the least urbanized countries of the world with only 11.16% of its population living in urban areas. The total population continues to grow at an annual rate of 3.0%. Some of the larger cities are growing at an annual rates of between 4% to 7.5%. Dhaka, the Capital is affected the most. This rapid population growth in the urban areas has resulted in uncontrolled land development and a high demand for dwellings, land, utilities and services. This rapid demand has led to a shortage of resources, particularly in housing for low income groups.

The consequences of the absence of a rational national policy for physical development and housing is also responsible for the haphazard, unplanned urban sprawl. Low lands in and around the city are being filled and built upon without adequate provision for infrastructure. Narrow roads, traffic congestion, inadequate drainage, no potable water nor community facilities and over crowded transport services have become characteristic of these settlements. Inevitably, when infrastructure is incorporated in these settlements, it is very difficult and consequently becomes very expensive to the city as well as for the users.

Although the private sector is the major contributor of housing in Bangladesh, it is limited to mainly the middle and high income groups. The role of public sector is limited to the provision of housing for the government employees and developing housing estates for the urban high income. Most of these developments are wasteful of land, utilities and services.

The basic weakness in the government approach is its piece-meal solution to immediate needs and problems rather than approaching the fundamental issues and considering long-range implications. However, the government must efficiently utilize its scarce resources: land and finance. It is not only a matter of providing housing but also the process and the overall framework within which they are provided , which is particularly important.

Unquestionably the low income population desperately needs support in a number of areas. However, none are more important to the immediate improvement in the quality of life than the provision of clean water, sanitation, electricity and basic services. These services are things that the public sector is best able to provide. On the other hand, the people themselves constitute the major resources in the improvement of their dwellings as well as their settlements. The provision of shelter for the majority of the people cannot be accomplished without fully utilising self-help programmes and other forms of popular participation. The key element is a piece of land with secured tenancy.

The government should give priority in utilizing their resources for the benefit of the low income group, realizing that a smaller quantum of improvement in the qual-

ity of life of the many is more equitable than a larger quantum of improvement for the few.

Within the social, economic and political context of Bangladesh, this study is focused on the physical aspects of the provision of shelter for the lower income groups. A model is therefore proposed for the design and analysis of urban settlements for the lower income groups. The following issues are dealt with in the model:

a. Land Utilization - Maximization of private areas (taxable) and minimization of public areas (non-taxable).

b. Circulation Systems - A crucial factor, which determines urban patterns, structures of social grouping, land values and commercial potential. It affects significantly the cost of infrastructure layout.

c. Infrastucture - Efficient layout for water supply, sewage disposal, storm drainage, electricity and street lighting.

d. Block layouts & Subdivisions - Use of grid layout as opposed to grid-iron, as means of reducing costs and facilitating social grouping. Optimum sizes of lots and percentages of public, private and semi-private areas.

These issues are illustrated by means of a design for a specific site in Dhaka, which is compared with another design proposed by a British consulting firm for the same site. The latter design called 'proposed design' in the thesis, consists of a Master Plan for 526 Ha and detailed design for a Site and Services component which is to be the first phase of the project. A comparative design called 'Revised design' also consists of a Master Plan and a Site and Services component with a similar area as that of the proposed one.

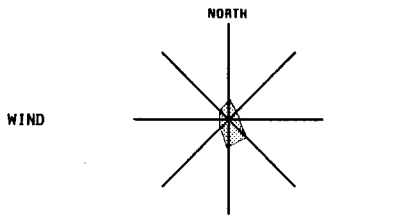
URBAN CONTEXT

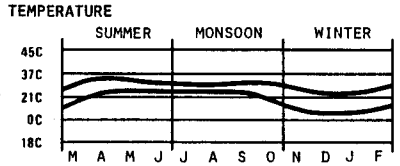
DHAKA, BANGLADESH

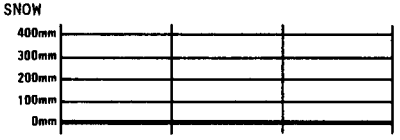
PRIMARY INFORMATION: Dhaka is located at 24° north latitude, 90° east longitude. It has an area of 324 square kilometers, and a population of 4.0 million. Its main seasons are: winter, from November to February; summer, from March to June; and the monsoon, from July to October. Winter temperatures are generally temperate, ranging from 52°F to 84°F. The summer is warm, with temperatures between 70°F and 94°F. Rainfall during the monsoon varies from 47" to 136". Humidity ranges from 36% to 99%.

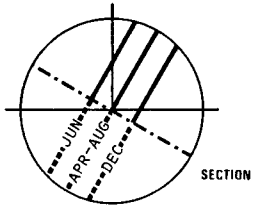
HISTORY: Dhaka existed as a trading town as far back as the third century. It first came into prominence when it became the seat of government of the province of Bengal under the Mughal Dynasty. The city at that time covered a very large area, with a population of one million. Dhaka's expansion and development was seriously interrupted when the capital of Bengal was transferred to Murshidabad in 1717. As a result the population shrank drastically to a quarter of a million.

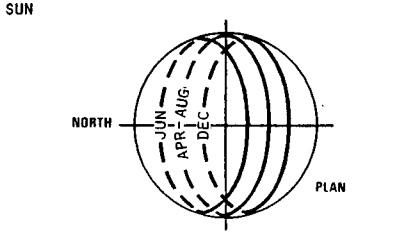
Under British colonial rule, Dhaka again experienced a period of growth, but declined again when the capital of Bengal was removed to Chittagong. After the partition of India in 1947, Dhaka became the seat of the provincial government and experienced rapid expansion. Muslim migrants from India were resettled in Dhaka by the government.

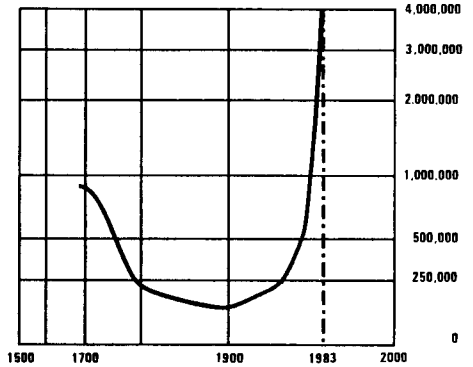




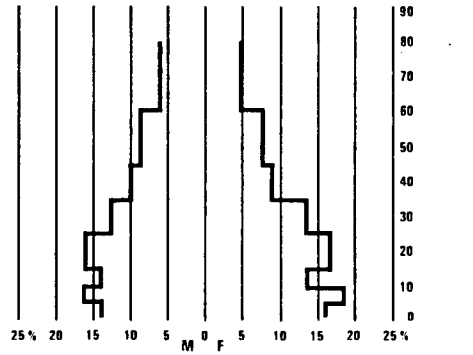




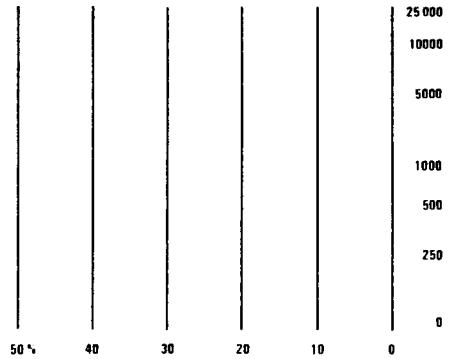




URBAN POPULATION GROWTH
horizontal: dates vertical: population
Source: Aminul H. Khan, S.M.Arch.S. Thesis, 1982, MIT.



URBAN POPULATION DISTRIBUTION
horizontal: percentages vertical: ages
males: M females: F
Source: Statistical Yearbook of Bangladesh 1979.



URBAN ANNUAL INCOME DISTRIBUTION
horizontal: percentages vertical: dollars
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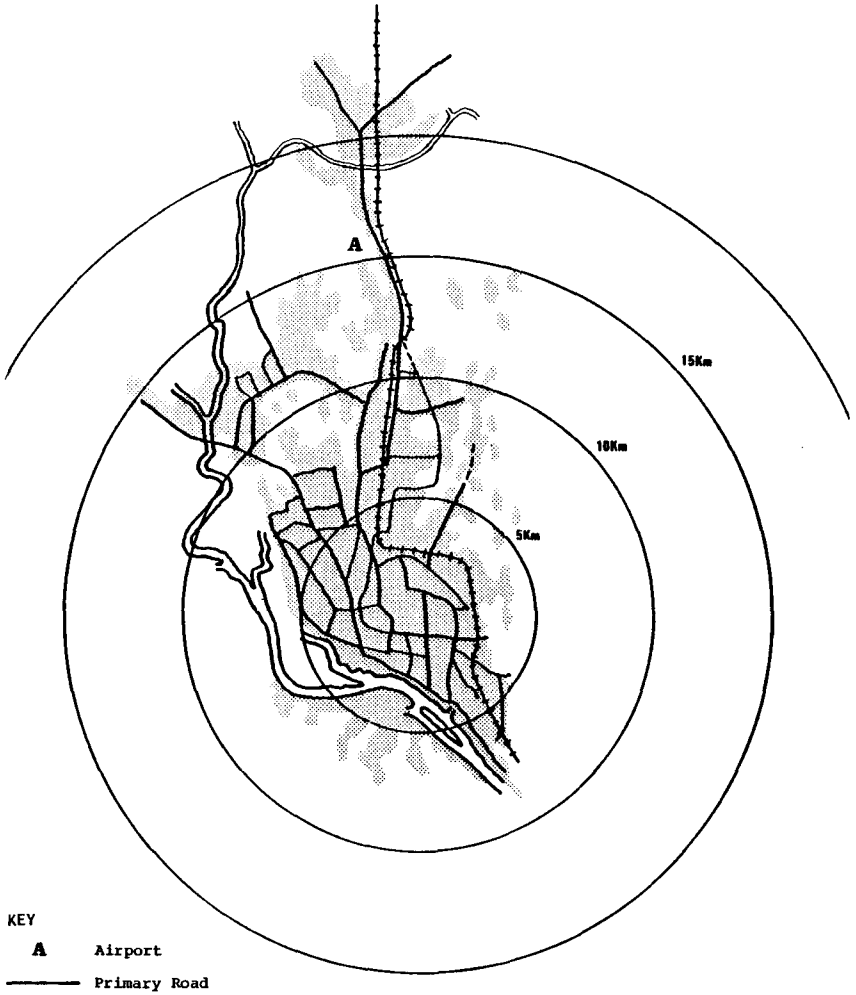

KEY

A Airport

Primary Road

Railroad

Built-up Area

URBAN TOPOGRAPHY AND CIRCULATION

AREAS

RESIDENTIAL

COMMERCIAL

INDUSTRIAL

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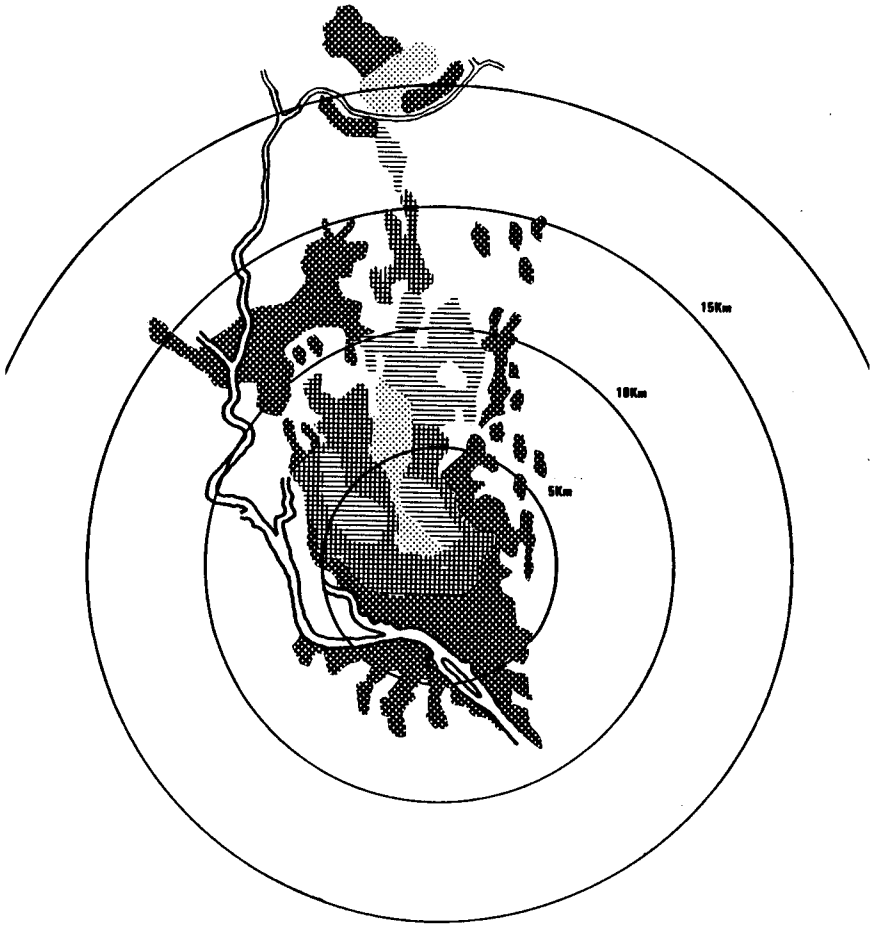
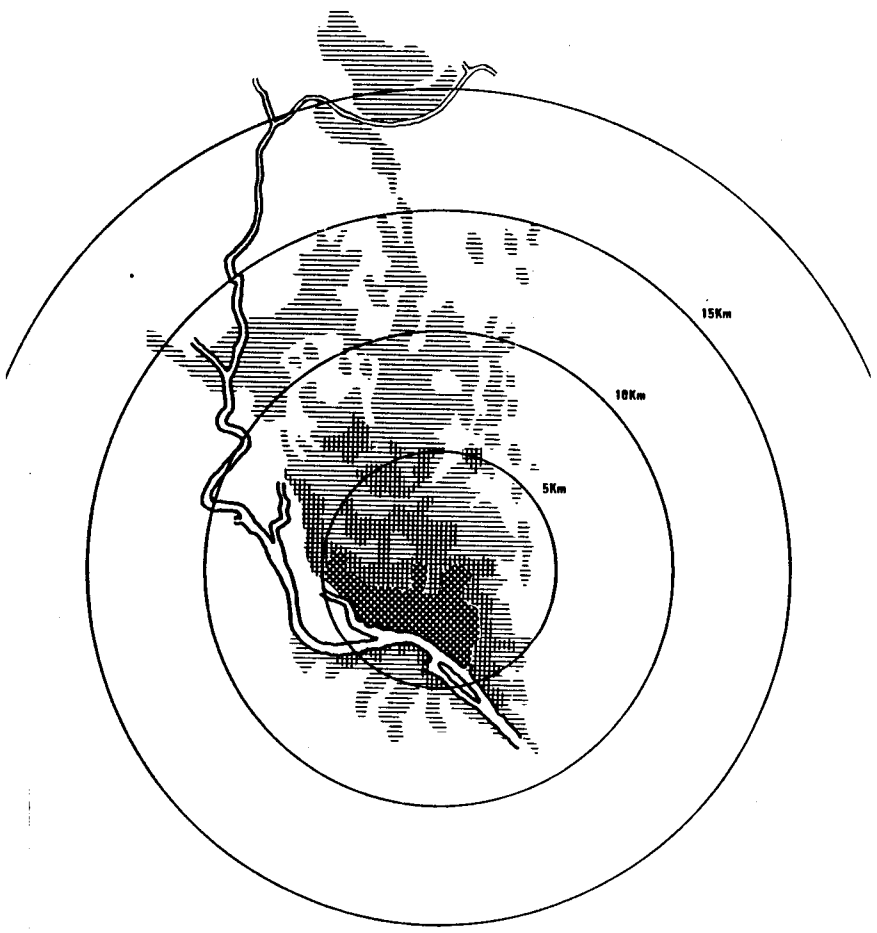
1:250000

URBAN LAND USE PATTERN



URBAN INCOME PATTERN



URBAN GROWTH PATTERN

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When Bangladesh achieved independence in 1971, Dhaka became the capital of the country. Since then, the city has experienced its greatest expansion. The population nearly doubled with the past decade. Many new areas were developed and previously developed areas became more dense, seriously overtaxing the capacity of the city's infrastructure.

ADMINISTRATION: Urban growth in Dhaka is shaped by the activities of a number of independent organizations having jurisdiction over land development, the supply of infrastructure, and the operation of municipal services.

The Municipal Corporation, headed by an elected mayor, executes the functions related to property taxation, urban transportation systems, limited public works, refuse collection, and limited health care and public education. The Dhaka Improvement Trust is responsible for developing, administering, and maintaining new housing and commercial areas. Other municipal bodies include the Department of Roads and Highways, Public Works Department, Water and Sewerage Authority, Directorate of Public Health Engineering, Urban Development Directorate, Dhaka Metropolitan Police, and Postal Department. In addition, there is the Housing and Settlement Directorate, which was originally established to house the massive influx of refugees from India.

ECONOMY: The capital city accommodates most of the contry's administrative machinery, including the headquarters of all government organizations, housing for government employees, and the military bases, which occupy a large area of the city. It is also the major industrial and commercial center of the country and a major inland port, handling much of the internal wholesale trade. The headquarters of most private sector industries and trading organizations are also located in Dhaka, as are almost all of the private professional services available in the country.

The main industries in Dhaka are tanneries, metal products, glass, pharmaceuticals, textiles, tobacco processing, chemicals, steel re-rolling, ceramics, machine tools, and specialized industries.

DEMOGRAPHY: The population of Dhaka in 1951 was 418,000; in 1961 it rose to 560,000; in 1971 it was 1,201,000; and now it is estimated to be about 4 million. Of this population, 57.7% are male and 42.3% female. Between 1961 and 1974, the rural population of the country experienced an increase of 44%, while the urban population increased by 165%. This increase was concentrated mainly in the four big cities: Dhaka grew by 320%, Chittagong by 695%, Khulna by 341%, and Rajshahi by 233%.

The population of Dhaka is largely homogeneous ethnically, composed of people who come from all parts of the country and speak various local dialects. A large number of original residents, called "kuttis," live in the old section of the city. In a different section lives a substantial population of migrants from India who came after the partition. The old city and the migrant area have their own distinct expressions of the living pattern, clearly discernible in their use of space - verandahs, front and back yards - and decorative motifs. Another distinct section includes the very high income areas of Gulshan and Banani, where all diplomatic missions are located.

Most of the high income population groups in the country are located in urban areas. Nevertheless, low income groups form the vast majority of urban populations.

In 1972, it was estimated that 25% of the total population

of Dhaka city was living as squatters, with an average monthly income of $15 to $20 per family. According to 1976-77 data, 13% of urban households had an income of less than $200 per year, and were classified as very low income; 31.1% were low income households, with earnings of $200 to $320 per year; 35.5% were moderate income households with earnings of $600 to $1,600; and 5.5% as very high income households with incomes above $1,600 per year.

HOUSING: Until the late 1960's, the government addressed housing needs in terms of population categories (industrial workers, government employees, displaced persons), undertaking isolated projects to solve the specific housing problems of these different population groups without a comprehensive policy framework.

Improvement trusts were created whose purpose was largely the development of land for resale to upper-middle level government employees and other higher income beneficiaries. To help make available mortgage money for home building in the private sector, the government established in 1952 the House Building Finance Corporation, with the power to make direct loans to home owners up to 80% of the house value. Here again, the beneficiaries of the program were the middle and upper income groups.

With the influx of refugees from India, government responsibility in housing expanded. In 1958, a special housing and settlement office was created, which in 1970 was raised to the Directorate level. This organization constructed about 26,000 core houses and provided 10,000 buildable plots for refugees. Following independence in 1971, the government has constructed 4,500 dwellings for the urban poor. This number is insignificant in relation to a shortage of over 175 million housing units.

Until recently, therefore, the role of the public sector was limited mostly to the provision of housing for government employees and developing residential estates for the richer segments of the urban population. Plots are, characteristically, large, building materials are of high quality, and densities are very low in comparison to the older districts in the city.

As far as the private sector is concerned, apart from a few palatial houses built by wealthy businessmen and professionals, houses in the city are generally quite modest. They are mostly single or two-storied, with the exception of a few multi-story flats put up by private developers.

Unlike the public sector housing, these dwellings use a wide variety of construction materials, depending on the economic resources and personal preferences of the individual consumer.

A majority of the dwellings of lower income households have one room, which is used for almost all the household activities. A recent survey revealed that economic considerations alone did not dictate this multiple use of space. Cultural tradition and family living patterns are other determinant factors. In rural areas, the concept of dividing a structure into rooms for different uses is not followed. If needed, separate rooms are built as separate structures. Even among upper income households, in larger dwellings multi-use of spaces is common.

Public housing for low income groups in Dhaka. Note the abundance of left over spaces and wide streets without specific utilization, which is a waste of land and multiplies problems of control, maintenance and operation of public spaces. Photo : A.S.M. Ismail

MODEL

INTRODUCTION

With a population growth rate of 7.5%, Dhaka city is spreading very rapidly. Vacant land within the city & agricultural fields (lowlands) on the periphery are urbanizing at an accelerated rate. The physical development is arbitrary and piece-meal in nature resulting in difficulties in the long run. An absence of realistic planning policies for comprehensive development is also responsible for the adhoc growth taking place in and around the city. Consequently when infrastructure is incorporated in these areas the task is not only more difficult but also involves enormous extra expenses for both the Government & the users. As for public housing projects and other housing cooperatives inefficient layout has become a characteristic feature resulting in wasteful utilization of land and resources, thus increasing the cost of infrastructure. The public sector can only provide limited services with its limited resources.

Therefore the problem requires a solution in terms of a development covering a wider range of issues and a longer time span. It is necessary to anticipate a variety of land use functions initially and allow for other land uses in the future, based on new priorities.

The proposed model is an attempt at the following:

- A process of urbanization focussing on physical layout, land subdivision, land utilization, land use allocation and circulation.
- An alternative method of residential development reinforcing the positive and improving upon the negative aspects of existing housing systems.
- An approach to the problem of low income housing, recognizing the limited resources of the low income groups and the public sector; Minimizing public responsibility of operation/maintenance and maximizing private (user's) responsibility, initiative & participation.

The model is a study of a long term residential development scheme for which an area of 526 Ha has already been identified by a British consulting firm. A Master plan for the project area and a detailed design for a Site & Services project(45 Ha) within the project area has been proposed by the same firm. The possibility of a comparative anlysis has been the main reason for selecting this site; data was available.

A revised Master Plan has been proposed in this study for this same project area. Also a revised design of a Site & Services project is compared with an equivalent area as that of the proposed Site & Services project. The comparison is made in terms of Land subdivision, Land Utilization, Circulation & Block layout.

The model is intended to serve as a reference and to provide a tentative set of guidelines for those involved in planning and designing of urban settlements and the formulation of housing policy for the low income groups.

PLANNING POLICIES/GOALS

PRIMARY USE: RESIDENTIAL

- The project is primarily intended for residential use.
- Required supporting landuses will include commercial and community facilities, schools, playgrounds,, health center and community center. These facilities will also be shared by the surrounding existing settlements.

TARGET INCOME GROUPS: PREDOMINANTLY LOW INCOME GROUPS

- Development will aim at providing for a community of low and lower middle and some high income groups.

INTENSITY OF LAND USE: MEDIUM/HIGH DENSITY

- The range of gross densities planned for is 500 - 600 persons per hectare assuming one storey construction.
- In course of time at the saturation stage of development densities are expected to be at least 100% higher as a result expansion to two or more stories and higher room occupancies due to subletting.

LAND TENURE: PRIVATE/COOPERATIVE OWNERSHIP, RENTAL

- Horizontal cluster condominiums will be provided
- The cluster condominium will allow flexibility in land subdivision.
- Rental options will be provided for the very low income sector, which will gradually be converted into clusters of ownership property.

FINANCING: PUBLIC AND PRIVATE

- The magnitude of the project calls for both public and private financing. Public subsidies should be kept at a minimum level and be confined to land development and providing infrastructure network.
- The private sector cooperative financing will be encouraged in the construction of dwellings.

CIRCULATION: INTERNAL EXTERNAL COORDINATION

- Internal and external circulation networks will provide the primary framework for development of the site.
- The internal network will be connected to the external network by connecting three on-site primary roads to the Dhaka - Tongi road on the west and to the proposed potential future highway on the East that parallels the 132 KV power line.

UTILITIES: CONNECTION TO THE CITY NETWORK

- Initially water supply and waste disposal will be by internal private or cooperative handpumps and septic tanks as generally practiced in Dhaka.
- Eventually all utility network will be incorporated into the city network.

DEVELOPMENT MODE: INCREMENTAL GROWTH

- The site will be developed incrementally.
- Implementation will be staged into:
  1. Planning and design.
  2. Allocation of lots, construction.
  3. Habitation.
  4. Evaluation and revision.
- The cycle should be repeated till the saturation of the project area is reached.

DESIGN HEURISTICS

Basic, physical-economic patterns of a project should be considered in order to anticipate physical economic effects. Patterns should be identified in terms of circulation, Land Utilization, Commercial potential, Land value & Land demand. They will provide tools for decisions affecting policies as well as physical designs.

This section is a very crude attempt at recognizing these physical-economic pattern through a heuristic process. Nevertheless their purpose is twofold:

1. To recognize or anticipate the effect of the above mentioned forces on the model.
2. To incorporate in the model the proper physical configuration that will take advantage of these forces.

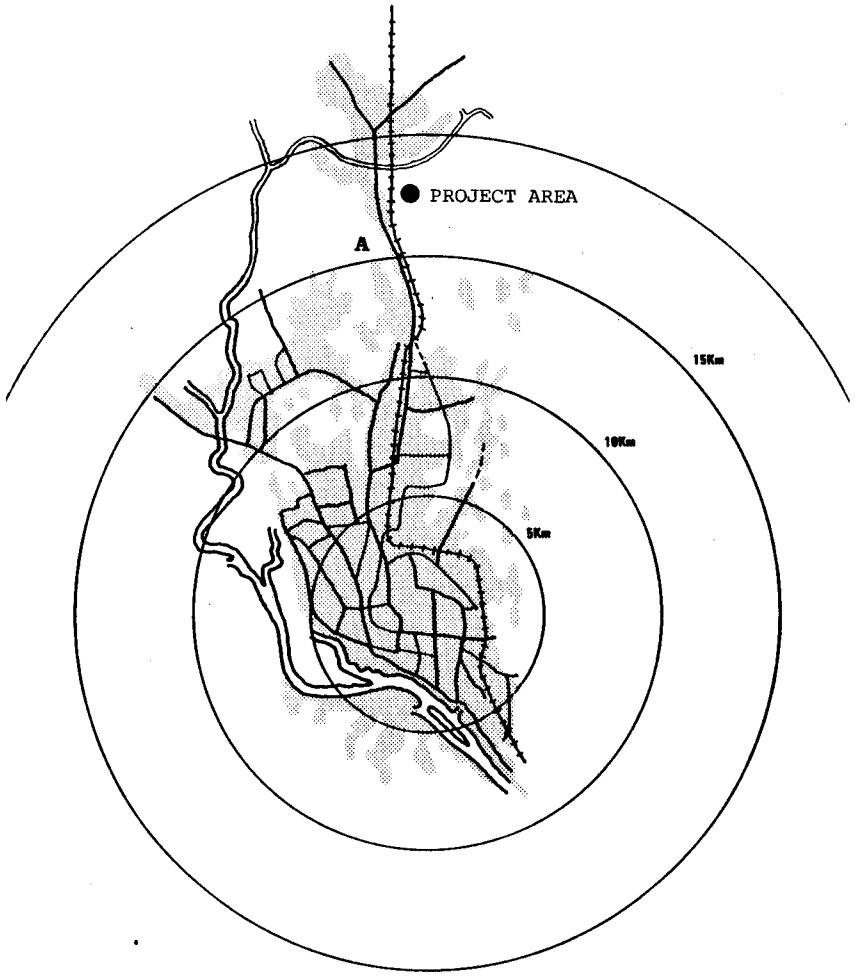
In addition, the diagram will help to project an image of the possible process of development. The diagrams only indicates zones in a schematic form. It must be clear that within these zones there will be penetration of other spot zones or subzones, such as intersections or corners of the private land across from the semi-public land. The heuristic method is explained in stages.

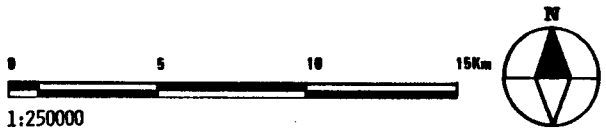
STAGE 1 TENTATIVE PROGRAM

The Data are projected from the Revised Site & Services project.

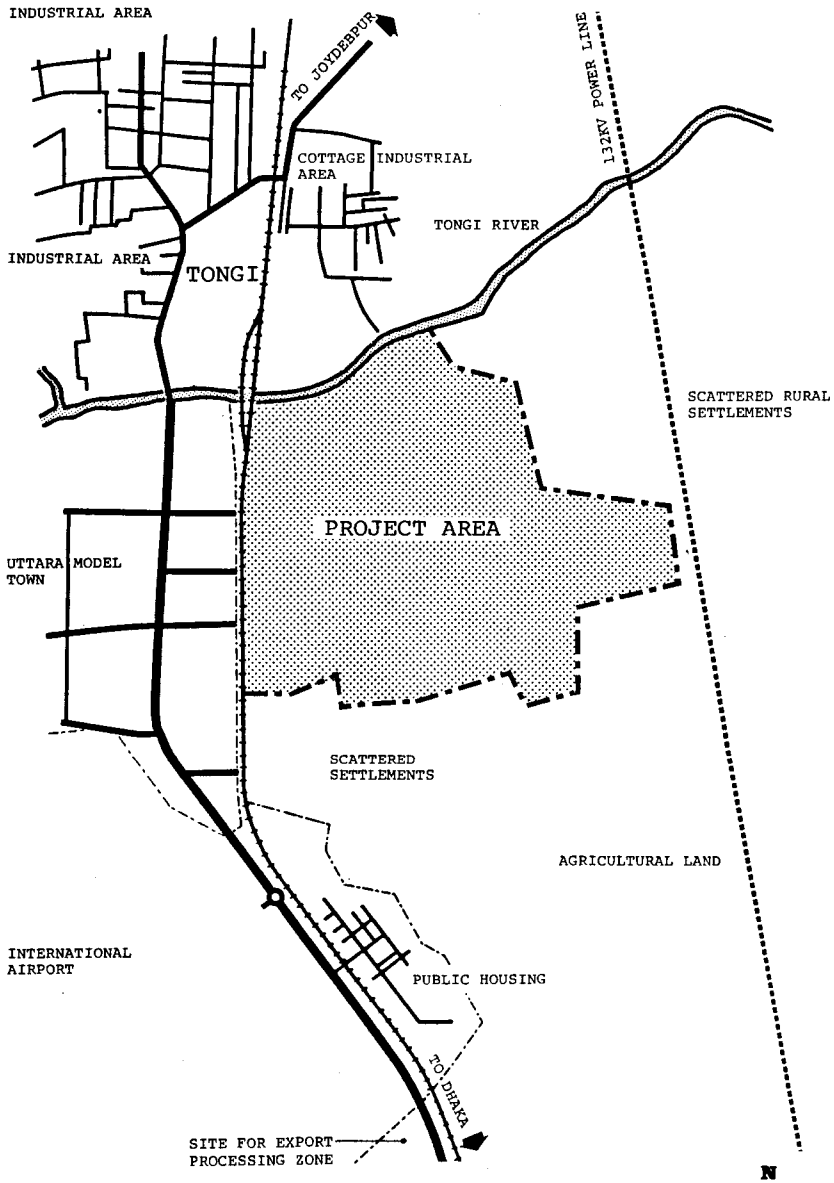
COUNTRY	Bangladesh	
CITY	Dhaka	
PROJECT NAME	Uttara East Integrated Urban Development	
POPULATION	265,492	
GROSS DENSITY	505 Persons/Hectare	
TARGET INCOME GROUPS	Low, Moderately Low, Middle and High	
SITE GROSS AREA	526 Ha	
SITE CONDITION	Irregular, Mostly Flat, Intrusion of some lowlands	
URBAN LAYOUT TYPE	Grid	
TOTAL NUMBER OF LOTS	37,927	
NUMBER OF LOTS/CONDOMINIUM	23	
DEVELOPMENT	Progressive (in stages)	
LEVEL OF SERVICES	Standard	
PROJECT COSTS	Tk 1500 Million	
CURRENCY CONVERSION	US $ 1 = Tk 21.00	
DESIGNER	Thesis Proposal	
LAND UTILIZATION (Ha - %)		
PUBLIC	76.32 Ha	14.50 %
SEMI-PUBLIC	99.46 "	18.90 %
SEMI-PRIVATE/PRIVATE	350.22 "	66.50 %
UNIT CIRCULATION LENGTH	114 m/Ha	
NUMBER OF SCHOOLS	33 Primary Schools 8 Secondary Schools (2 shifts)	

STAGE 2 : URBAN PARAMETERS



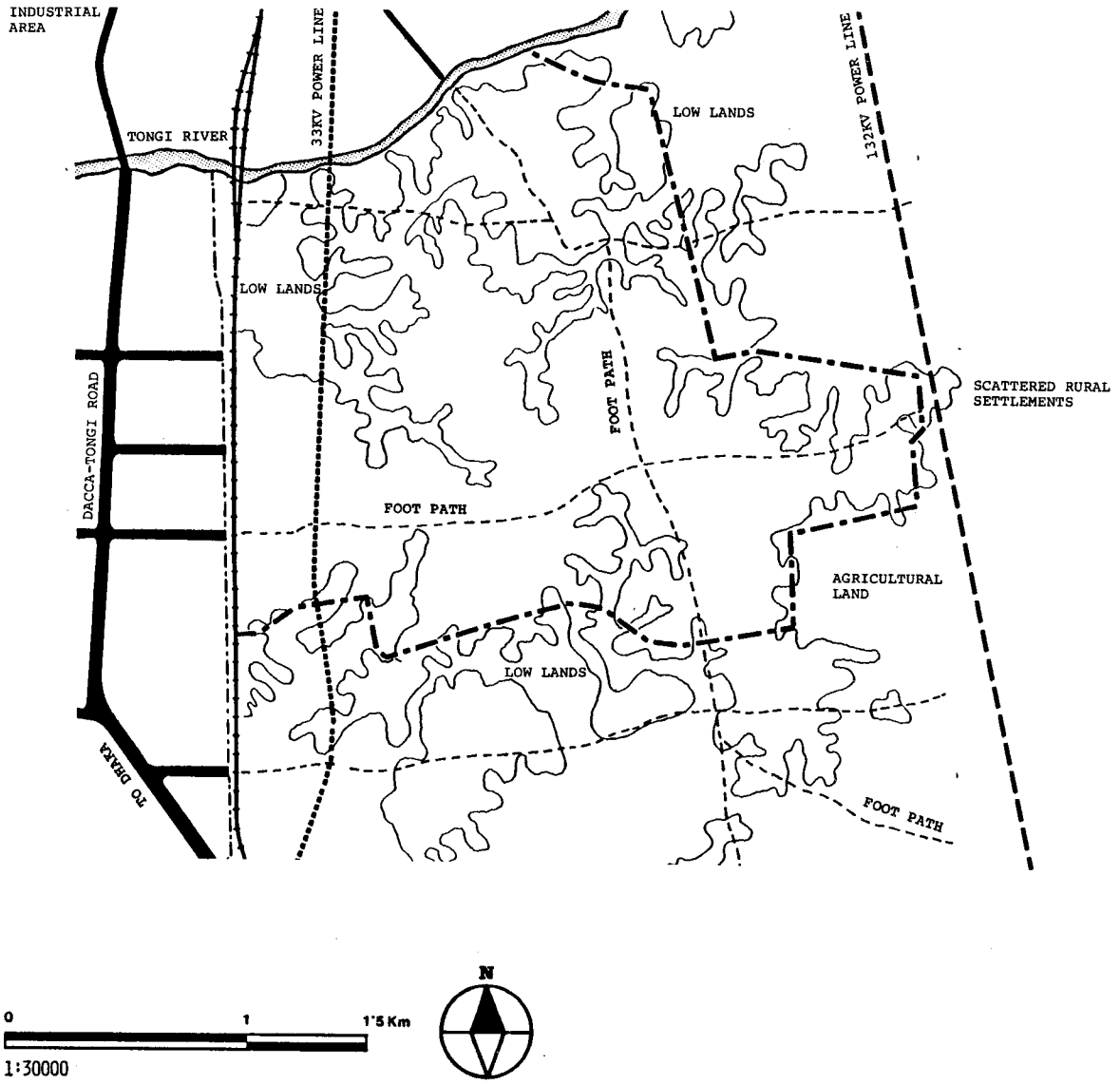


DHAKA CITY 1:250000



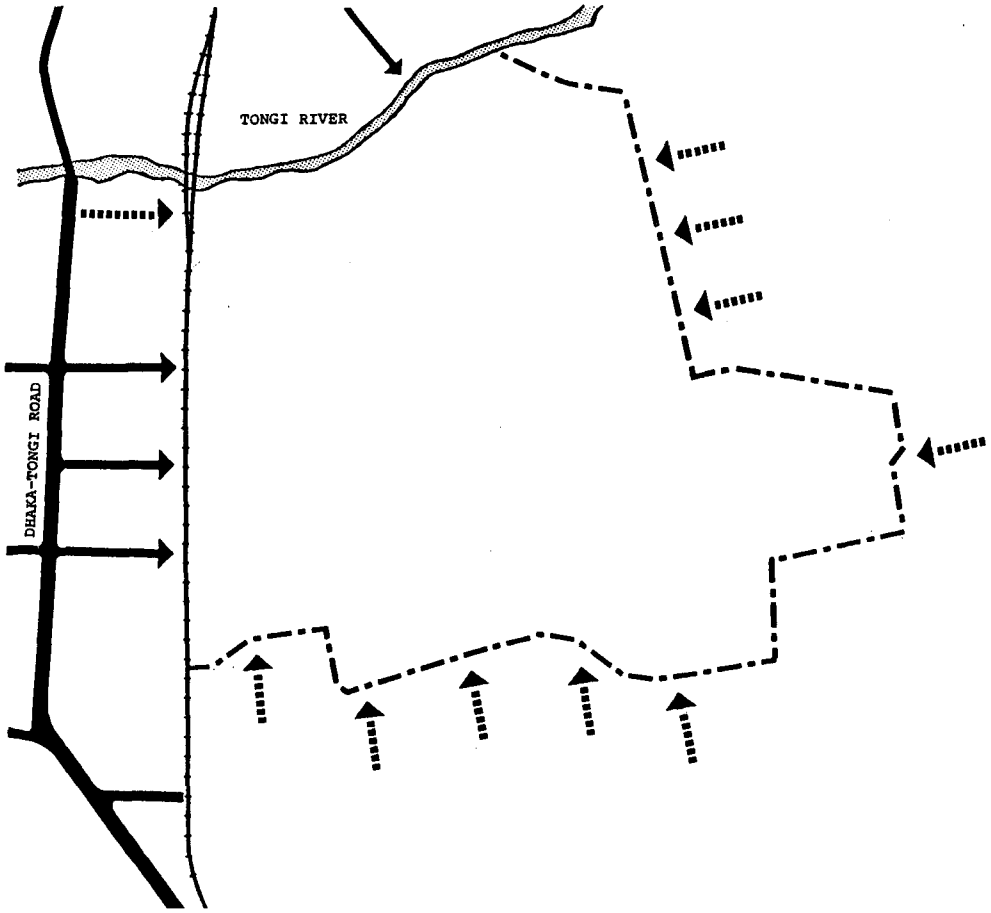
PROJECT AREA SURROUNDINGS 1:50000

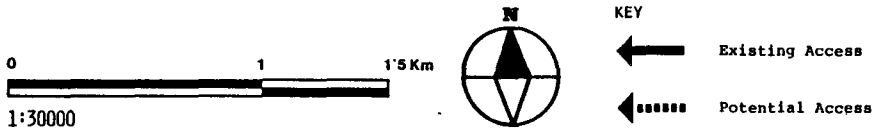
STAGE 3 : SITE PARAMETERS



LOCATION	The site is approximately 16 km north of Dhaka city center, about 2 km from the International airport and 1/2 km east from the Dhaka-Tongi road.
AREA	Total Project: 526 Ha Site & Services, 1st Phase: 45 Ha
SHAPE	Irregular; average length & width 2300 m
BOUNDARIES	North - Tongi River; carries a moderate amount of river traffic. South - Scattered existing settlements. East - Low agricultural lands. A 132 KV power line passes on a north-south axis near the extreme eastern property line. West - Clearly defined railway tracks, to the west of which is the Uttara Model town for higher and upper middle income groups.
APPROACHES/ ACCESSES	Dhaka-Tongi radial road, with three accesses. Additional access is from across the river from the Tongi Industrial area.
TOPOGRAPHY	Generally flat; some fingerlike intrusions of floodplains. Terrain can be divided in 3 zones: - Areas 21'-0" above flood level. - Areas between the 15' & 20' contours that are irregularly terraced. - Areas below the 15' contours with intrusions from the flood plain.
INFRASTRUCTURE	Water Supply: No existing piped water system; considered feasible by WASA Sewage Disposal: Not available; considered feasible by WASA Storm Drainage: Natural course towards Tongi River Refuse Disposal: Feasible, by Municipality Electricity: Available, by PDB
COMMUNITY FACILITIES	No facilities on site; some will be available in adjacent Uttara Model Town. The project because of its size would require some community facilities.
EMPLOYMENT	Nearby Tongi Industrial Area, International Airport, Export processing zone, and in the Uttara Model Town. The project itself will generate a considerable number of jobs.
TRANSPORTATION	Buses operate along Dhaka-Tongi road; the Tongi Railway station is about 3 kms from the site. A new railway station has been proposed by the DIT within the site of Uttara Civic Center.
LAND TENURE	Currently under fragmented private ownership; in the process of acquisition.
LAND COST	TK 2,960,00/Ha ($148,000/Ha)

STAGE 4 : MAIN URBAN CIRCULATION NETWORK AND ACCESSES AFFECTING THE SITE



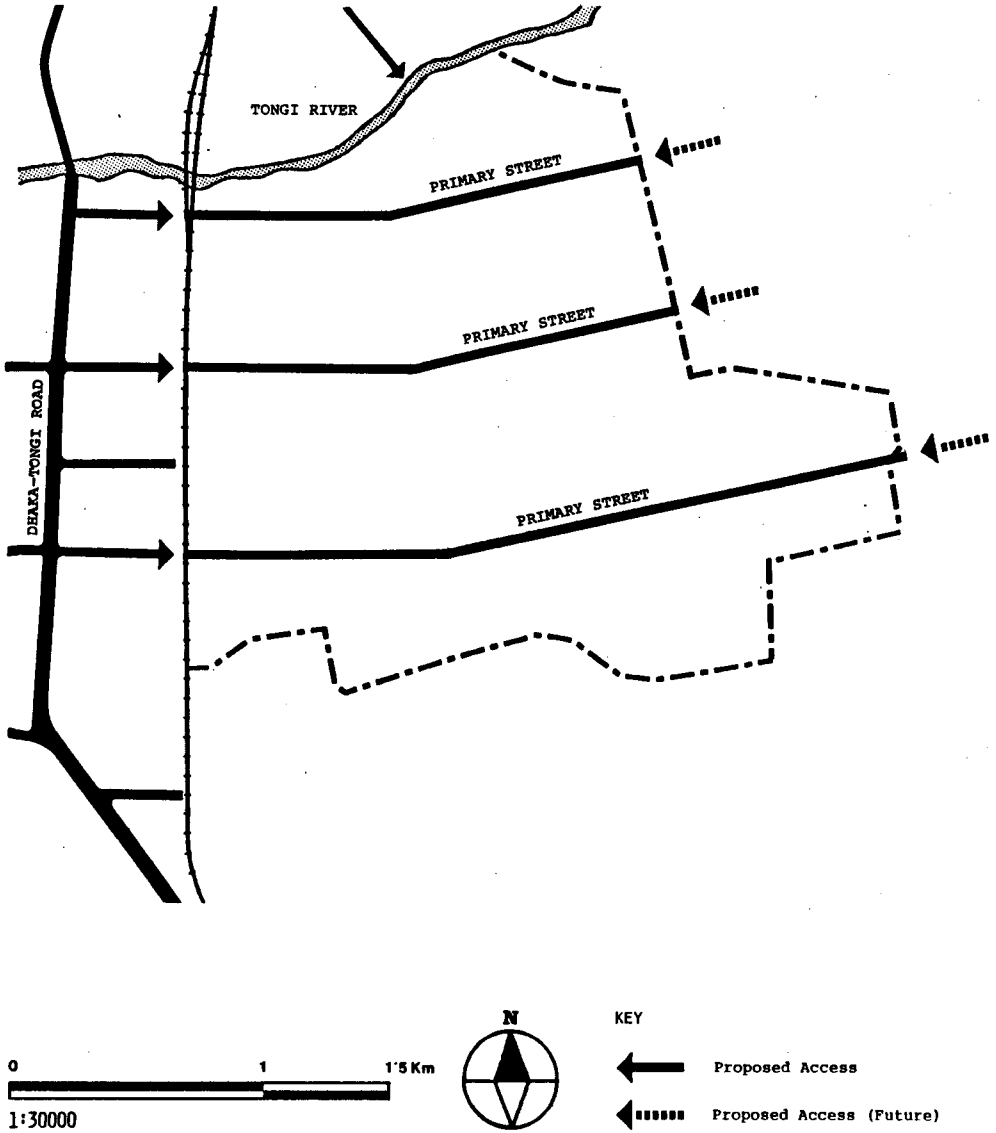


The main circulation network is the system of main roads that provides circulation through the whole urban area.

The only approach to the site is by the Dhaka-Tongi radial road. This has unlimited access, although vehicles dominate over pedestrians. Buses operate along this road. The project area is 1/2 km East of this road. There are three existing accesses from this road that are parallel. Another access is from the Tongi Cottage Industrial area across the river. Other potential accesses are along the existing footpaths.

Existing and future potential accesses affecting the site are illustrated.

STAGE 5: PRIMARY SITE CIRCULATION



The Primary Circulation is the principal road on the site that links accesses from/to the site to/from the urban circulation network.

Primary Circulation in a site is determined by a set of requirements that are not always the same and do not have the same priority. The following priorities were established in determining the primary site circulation for the project area:

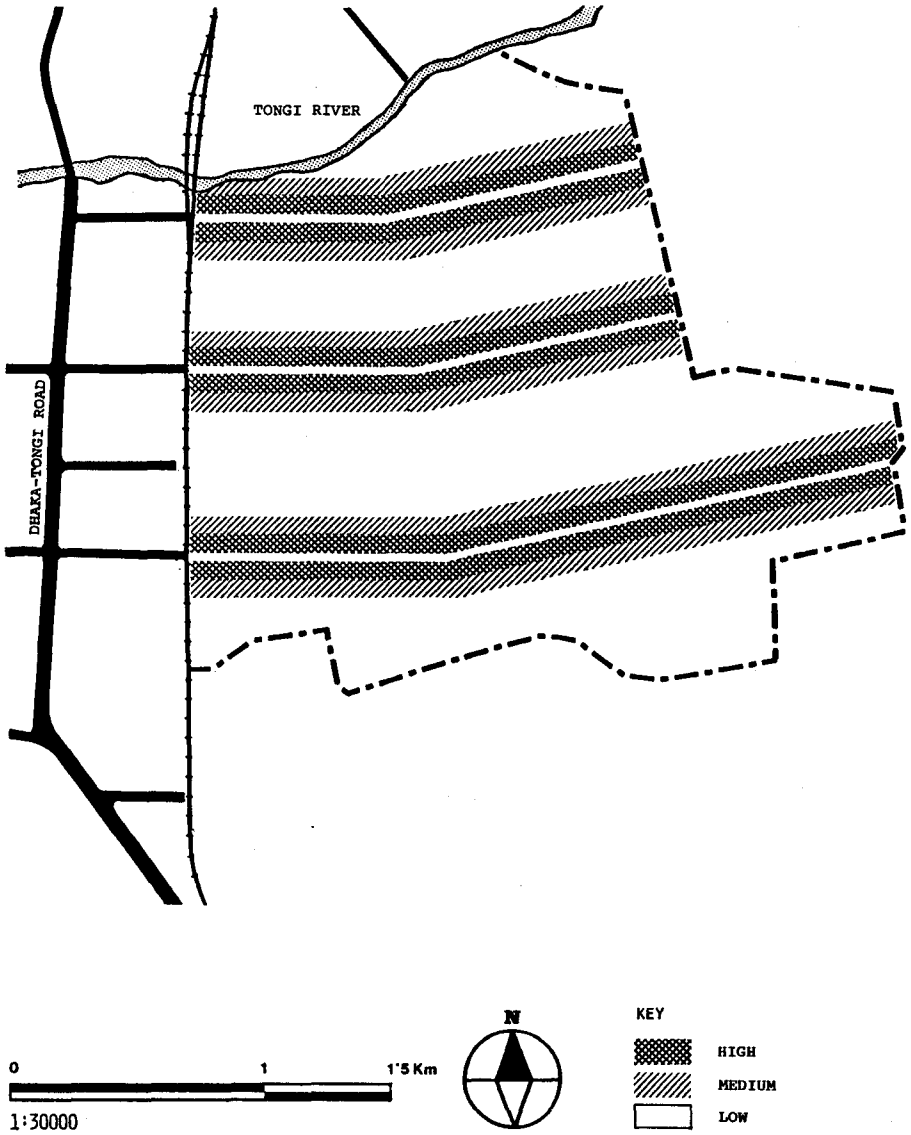
1. Accesses
2. Size & Shape
3. Main Urban Circulation
4. Boundary

Policies adopted are:

1. Coverage from Primary Circulation.
   Minimum Distance 100m
   Maximum Distance 1000m
2. Linking accesses in a convenient manner.
3. Shortest distance.

Three primary roads have been proposed, all of which run in an West-East direction linking the Dhaka-Tongi road and the existing access point(foot paths) along the eastern boundary of the project area. These could be extended in the future beyond the project area limits to serve the existing settlements when incorporated in the Master Plan & would also serve as a ring road.

STAGE 6: AREAS OF MAJOR COMMERCIAL POTENTIAL/LAND VALUES



Areas of commercial potential are those that have the potentiallty of being developed for commercial use.

The value of the land in a site is not uniform even before it is being developed, because of different factors. The most important is generally accessibility. But development introduces new physical factors and consequently new land values. The most important are the lines of primary circulation, which may canalize the traffic of buses rickshaws, tempos etc. This means stops, concentration of people, more activity, resulting in higher commercial potantial, demand for land & land values.

Some very small scale stores might develop throughout the neighborhood. This scattered commercial activity is usually the first form of commerce to spontaneously develop within the community. Eventually a ribbon or strip commercial area will consolidate along the major circulation routes.

All these commercial activity are generated by private capital and are generally under private ownership. They are an essential source of primary or supplemental income for the families. Therefore their existence should not be threatened by zoning restrictions.

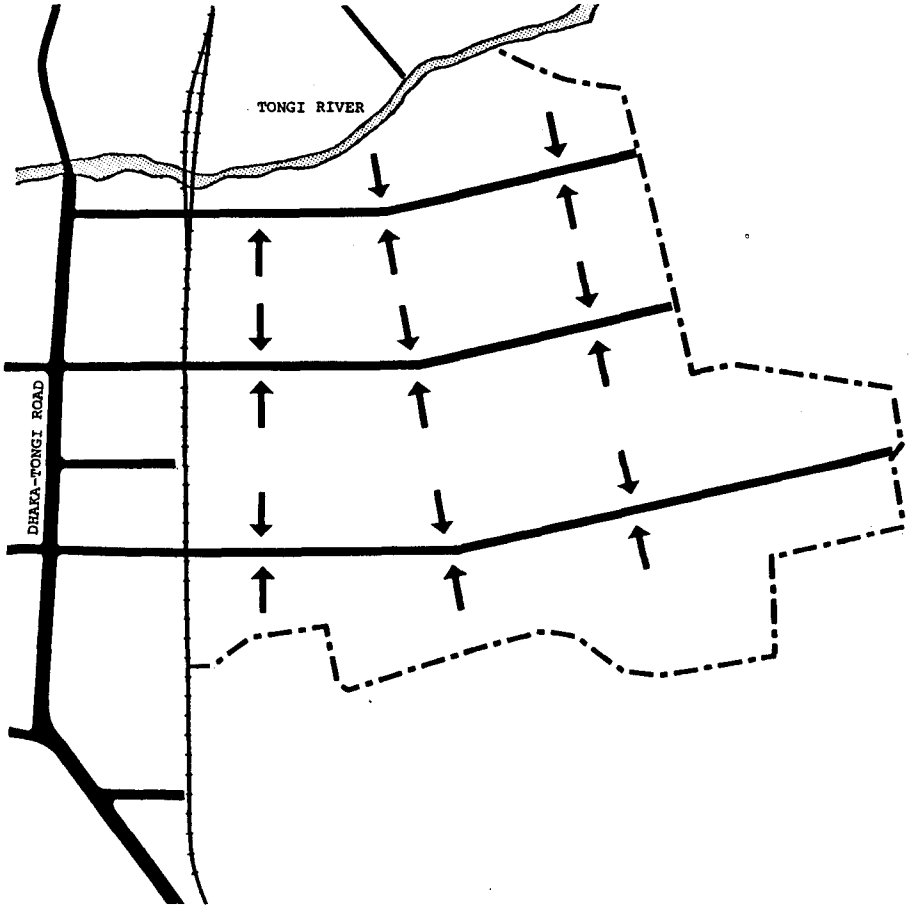
STAGE 7: AREAS FOR MAJOR COMMERCIAL AREAS (PRIVATE LAND) SCHOOLS, PLAYGROUNDS, MARKETS (SEMIPUBLIC LAND);

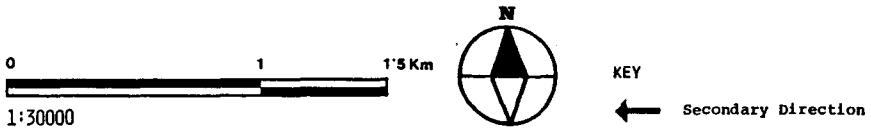
It is assumed that:

1. Higher land values parallel the location of shops, commercial areas (private land), plazas markets (semi-public land).
2. Lower land values parallel the location of schools, playgrounds, parks (semi-public land) which are non-taxable.

Based upon the concept presented in stage 6 & 7, a basic location diagram of the semi-public and private areas are illustrated.

STAGE 8 : DIRECTIONS OF SECONDARY CIRCULATION





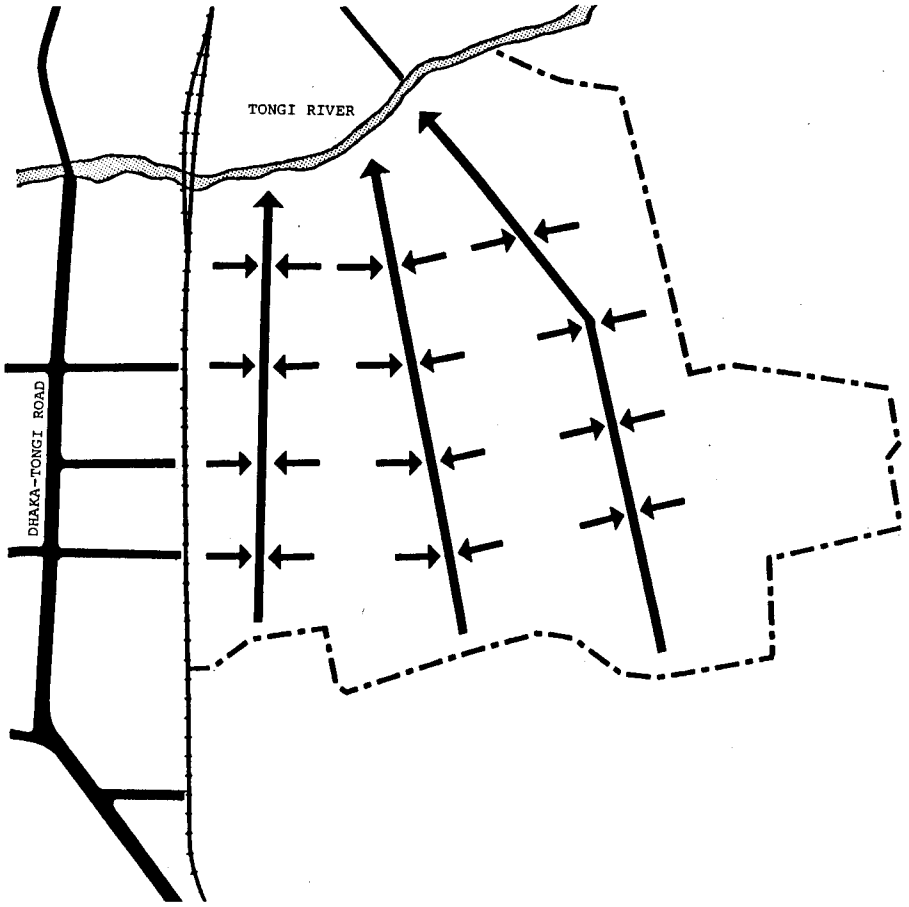
Primary circulation links major commercial areas, markets, plazas etc. Secondary circulation links residential areas with the primary circulation and also with the areas of schools, playgrounds etc.

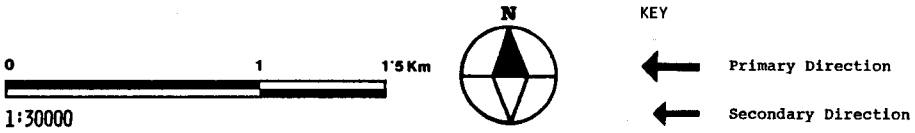
Policies considered are:

1. Hierarchy of circulation linkage (defined in the first paragraph).
2. Pedestrians have priority over vehicles in the secondary circulation.

The direction of secondary circulation is illustrated for the project area, to the left.

STAGE 9: PRIMARY DRAINAGE DIRECTIONS



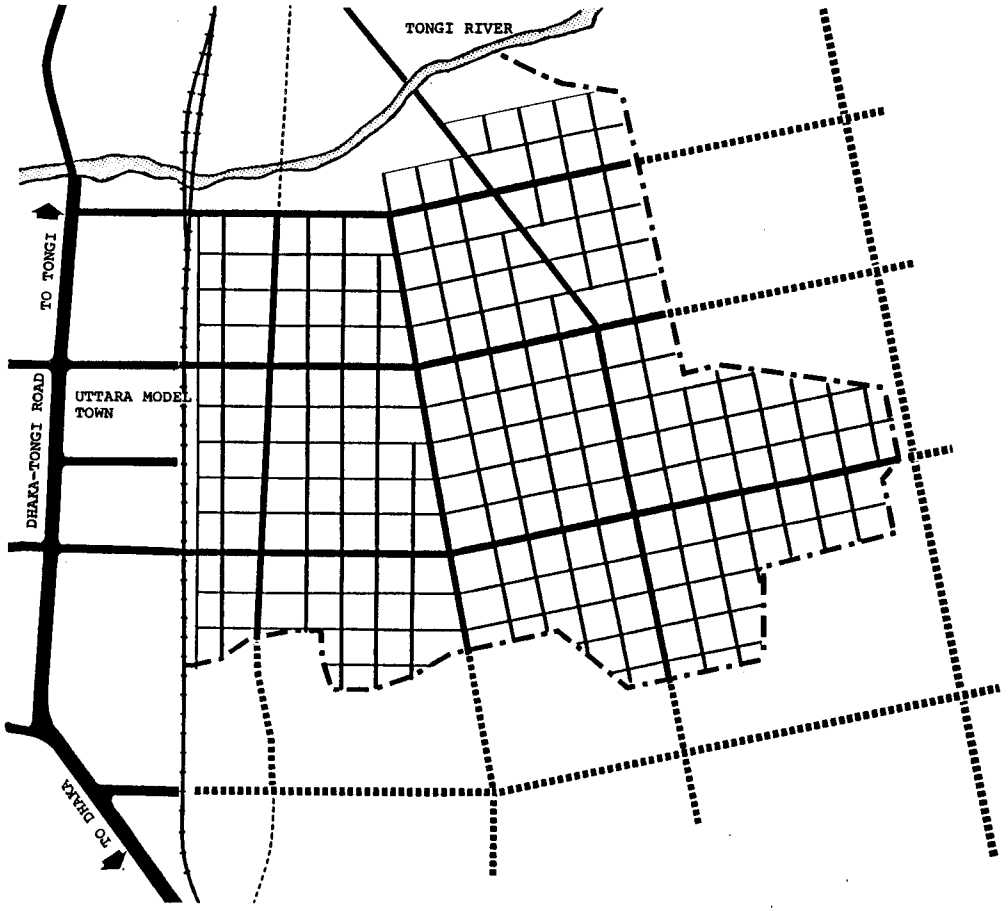


Drainage is the interception and removal of ground water or surface water by artificial or natural means. In a layout, drainage is the critical problem in flat sites with 10% or less slope.

The project area is generally flat except for some finger like intrusions of low lands (flood plains). There is a natural drainage course toward the Tongi river and the primary direction of drainage will follow the natural slope of the site.

The primary & secondary drainage directions for the project area are illustrated to the left.

STAGE 10 : COMPLETE PROJECT



The synthesis of the preceeding 9 stages and their juxtaposition on prevailing site conditions, give rise to this stage, i.e the complete project. This also takes into consideration expected growth and possible future conditions. A full description and discussion of the complete project has been made with the Revised Master Plan (page 30).

PROJECT COMPARISON

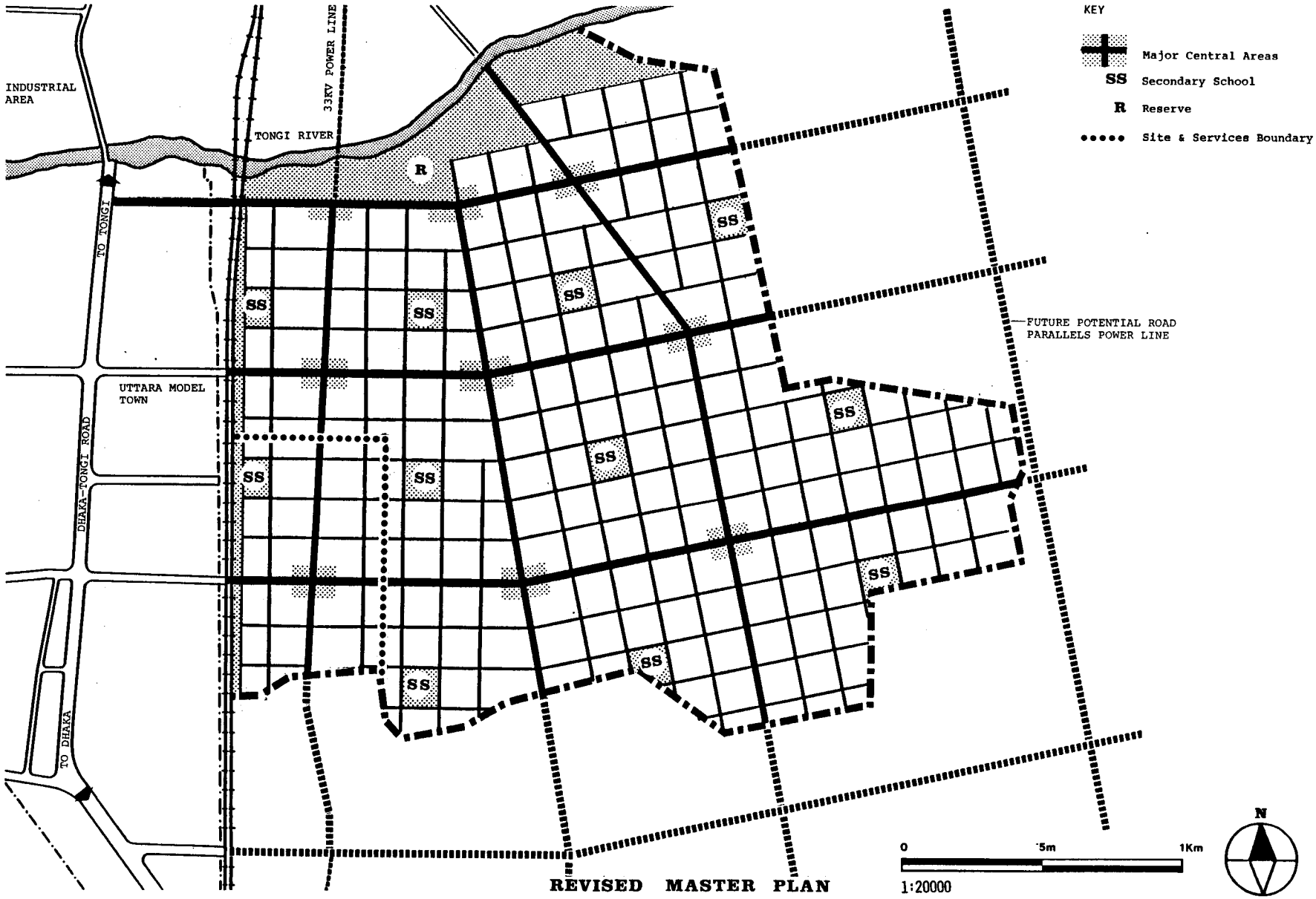
In the following section the Master Plan and Site and Services project proposed by Shankland and Cox partnership for Uttara East, Dhaka, termed as "Proposed Project" is compared with a "Revised Project" to illustrate the issues of concern in the thesis. The text and graphics are organised such that complete revised project is illustrated first and is followed by the proposed project in a similar format. Both are then compared in terms of land utilization percentages, population density, circulation efficiency in terms of unit circulation length and finally the project program of each.

REVISED MASTER PLAN

The layout is based on considerations of ease of access, clarity and efficiency of circulation. Existing circulation and future extensions of the system is a major determinant. Only three road sizes of 30m, 20m & 9m are used and are laid out in response to the shape, size and existing access points of the site. The layout is prepared considering the fact that eventually all the lowlands have to be filled. Ponds that are not big enough and are not in use or maintained should also be filled up and used for housing and other land uses. Lowlands could be put on sale to middle & high income groups with the purpose of cross subsidization. The initial development would concentrate on readily available buildable land and would proceed by stages.

Separated industrial or commercial areas have not been provided. Different lot sizes and their location would provide the diverse needs of the residents. It has been observed and is expected that commercial and light industries (cottage industry) would develop along the major collector roads.

Low value lands provide semi-public land for schools, playgrounds and community centers. A strip of land along the railway line has been reserved to act as buffer. Another patch of reserve land is set aside along the Tongi river. This would give a visual and psychological relief from the built land. Some unanticipated community function could be inluded later on according to needs & demand after the whole project area is developed, built, inhabited and evaluated.



REVISED MASTER PLAN

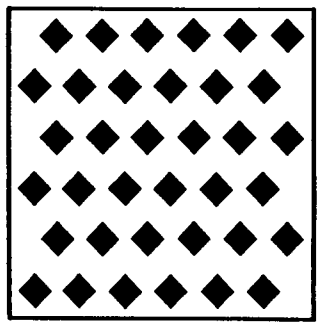
REVISED LAND SUBDIVISION

The land subdivision for the project is based on the following policies:

Minimisation of: Public land(non-taxable) for circulation and lengths of infrastructure per area served (electricity water, sewerage, street lights, garbage collection). The results are savings for the government in construction, maintenance and operation.

Maximisation of: Private land that is taxable. User's responsibility, initiative and participation. The results are social and economic benefits.

A grid layout is adopted because it provides flexibility in land subdivision for future changes.



LOTS DENSITY
Lot/Hectare

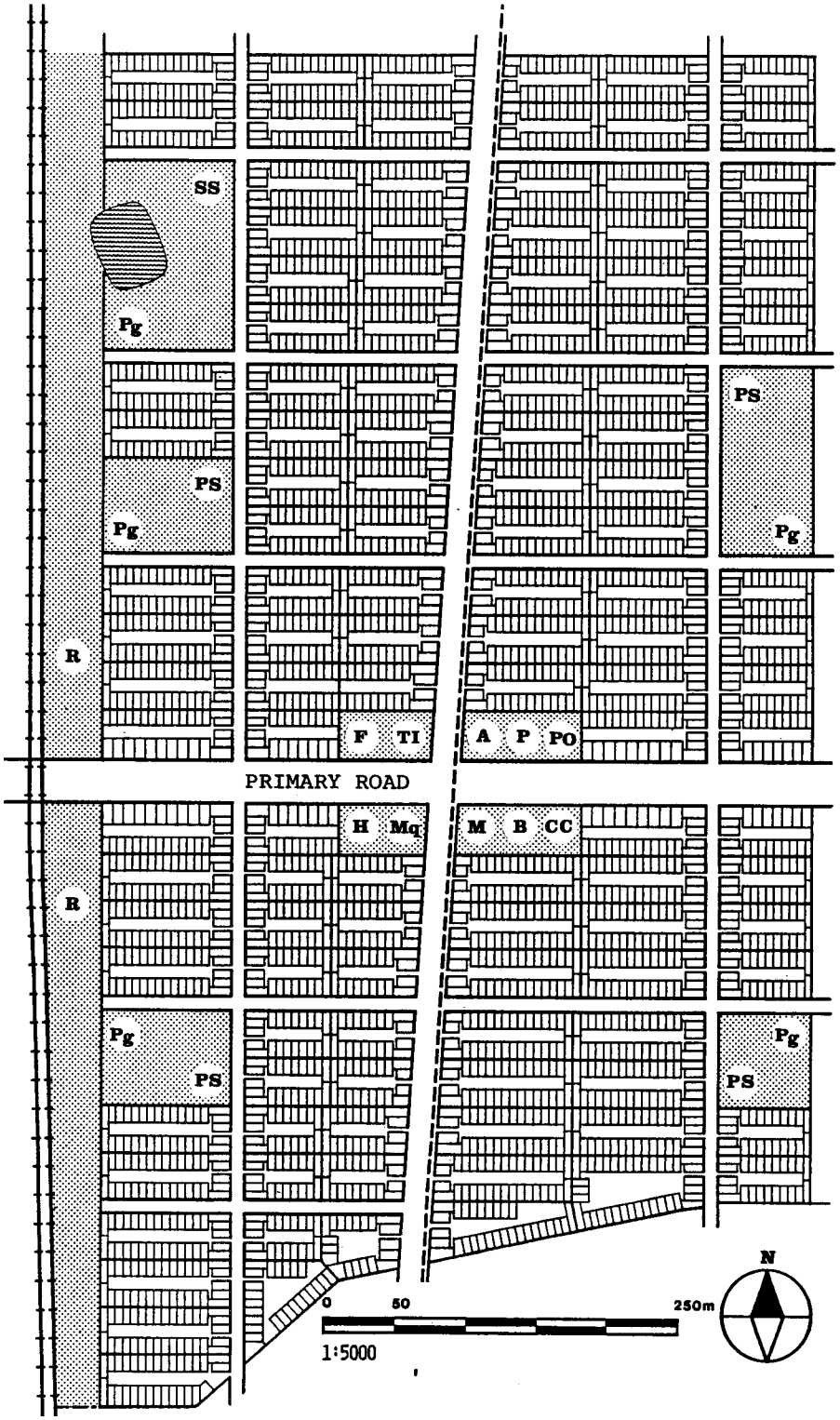
◆ 2 Lots

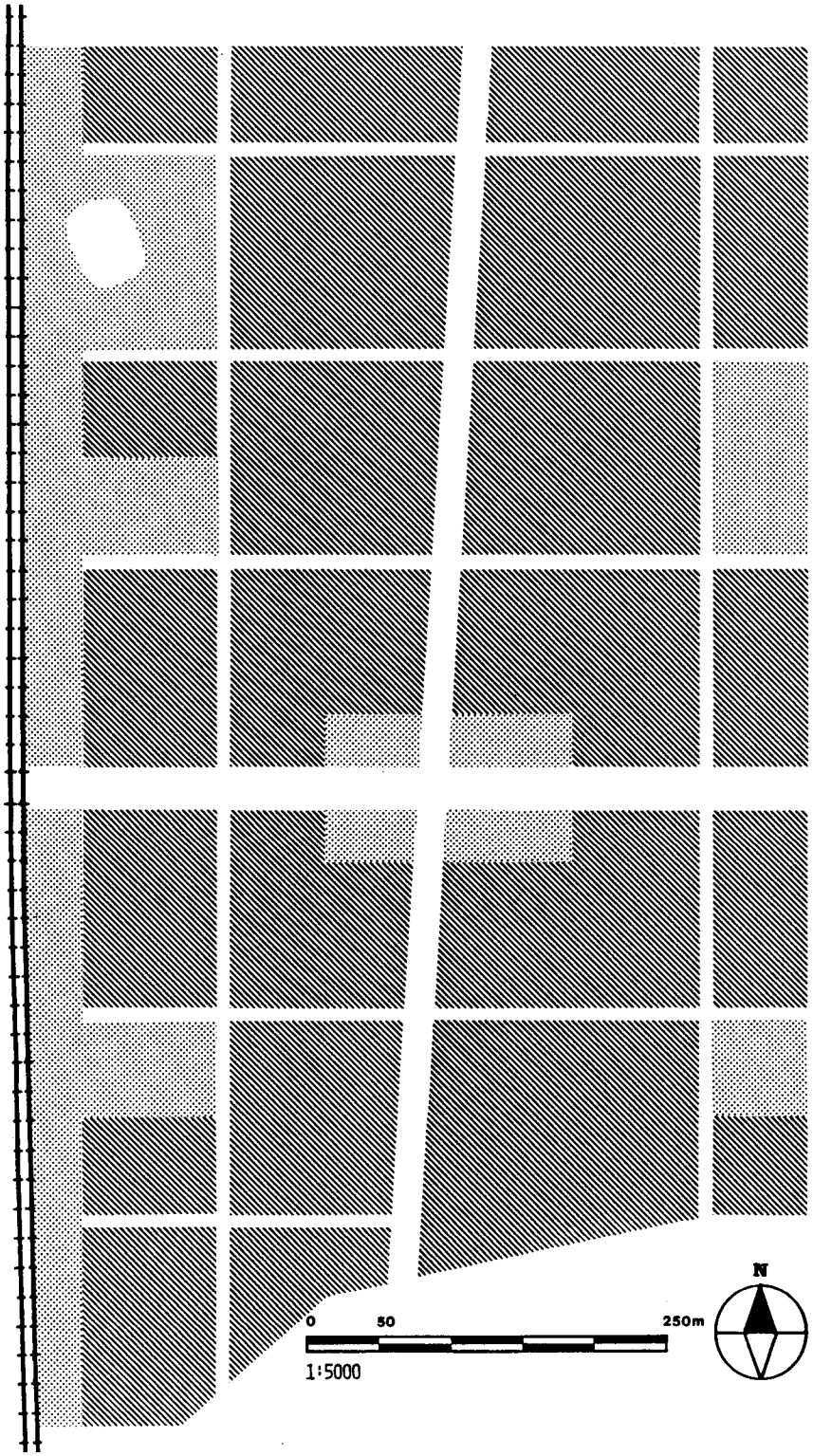
DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	3245	44.97	72.2

LOTS
Average area, dimensions = 66 sqm

KEY

A	Administration	**F**	Fire Station Department
SS	Secondary School	**CC**	Comunity Center
PS	Primary School	**B**	Bank
H	Health Center	**M**	Market
Mq	Mosque	**TI**	Transport Interchange
PO	Post Office	**R**	Reserve
P	Police		





REVISED LAND UTILIZATION

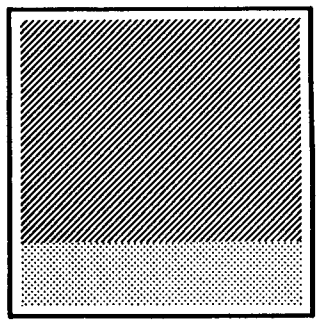
Public land that is not taxable has been reduced by 2/5th of the proposed one. This minimizes the circulation length per area, public responsibility, capital investment on infrastructure and offers more land for private use that is taxable. This has been achieved by replacing the grid-iron layout by a grid layout and the small public open spaces by semi-private courts. The private land is designed to maximise private use, responsibility, and participation by allocating lots in a condominium layout. This layout will foster a coherent relationship between users, responsible agents and physical controls.

LOCALITY LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	3245	44.97	72.2
DWELLING UNITS	3245	44.97	72.2
PEOPLE	22715	44.97	505.0

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	6.53	14.52
SEMI-PUBLIC (open spaces, schools, community centers)	8.51	18.92
PRIVATE (dwellings, shops, factories, lots)	29.93	66.56
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	44.97	100.00

1 Hectare



KEY

Public

Semi-Public

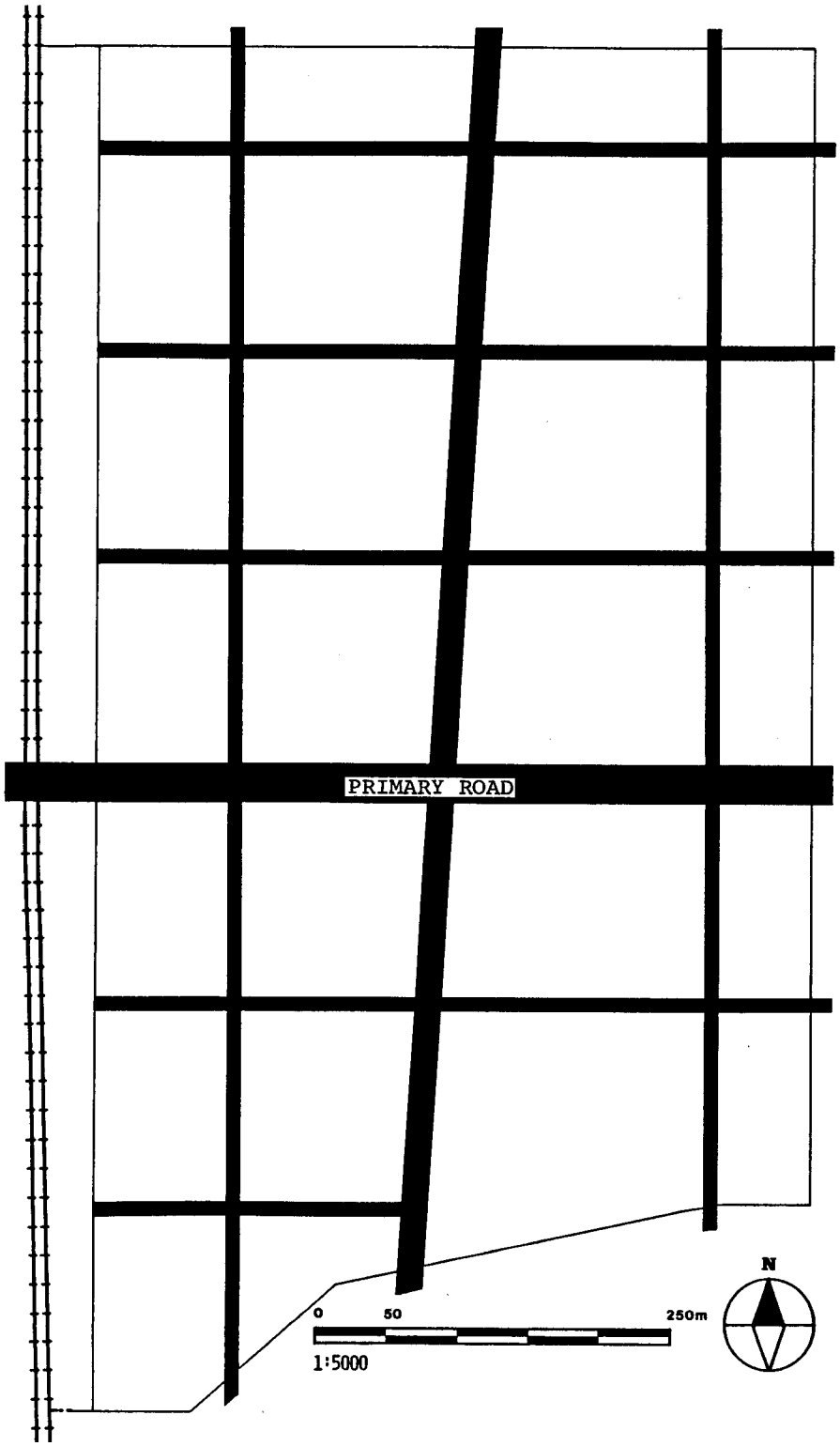
Private

REVISED CIRCULATION

The circulation network is based on a "grid" system. The intervals between the lines of transit are 132m, small enough to facilitate pedestrian circulation among the various community elements: shops, services, dwellings and large enough to minimize circulation areas public cost of construction, maintenance and operation of utilities and services. The lines of access and lines of transit are considered separately.

One of the primary streets runs through the center of the site (first phase). Some of the community facilities are located in this road to create a focus of activities. The secondary streets are perpendicular to the primary street providing entrances to all clusters and giving a clear dierction to the residents for access to the central activities and other activities along the boundary. The following circulation modes are considered in the design:

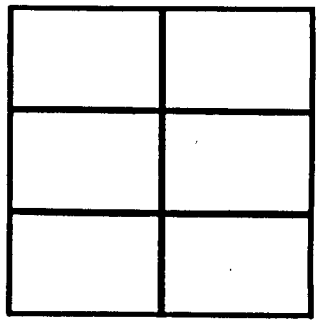
- MODE 1: Exclusive use by pedestrians.
  Example: Pedestrian walkways, cluster courts, parks.
- MODE 2: Pedestrian & vehicle mixed: Pedestrians dominate over the vehicles; control of traffic frequency, character & speed are mainly established by the street layout and use. Example: Secondary roads.
- MODE 3: Pedestrians and vehicles mixed: Vehicles dominate but do not control circulation; Controls are eshtablished for the protection of pedestrians, crosswalks, traffic lights. Example: Primary & main inter-community roads.



NETWORK EFFICIENCY

$$\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 114 \text{ m/Ha}$$

16 Hectare



CIRCULATION EFFICIENCY

Meter/Hectare 114

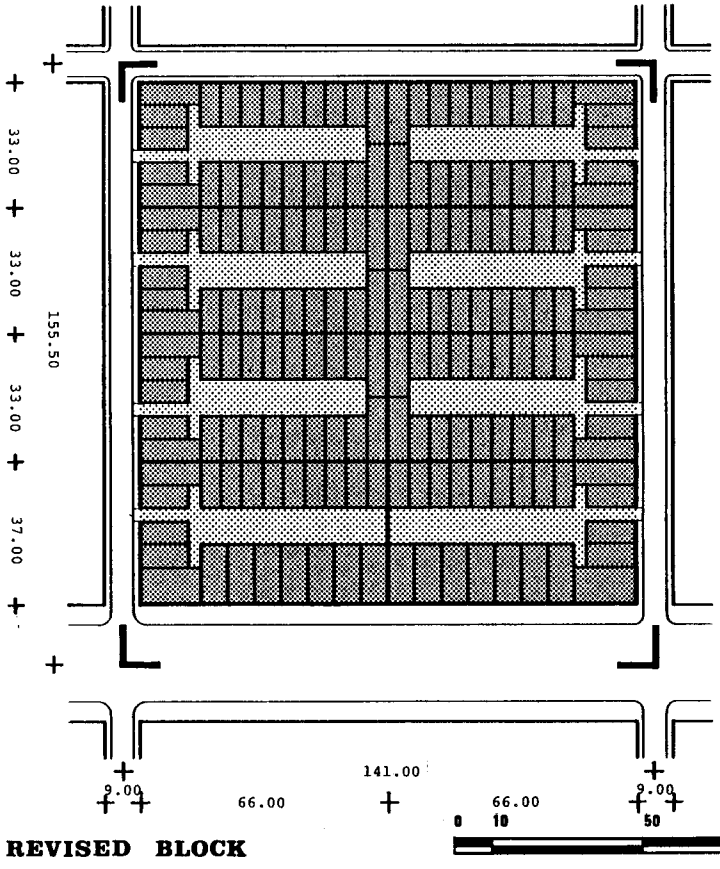
REVISED CIRCULATION

REVISED BLOCK

The revised block layout is designed to illustrate land subdivision which allows minimization of circulation area (public land), length of infrastructure network, minimization fo public ownership, responsibility & maintenance, and maximization of private ownership of land, private participation and responsibility.

Blocks are laid out in a standard grid of 132m x 132m except where site conditions impose restrictions. The size of the block is a compromise between cost limitations and access limitations. The block plan shows a typical layout with lots grouped around a semi-private common courtyard. Land saved from public circulation is gained for this semi-private common courtyard. Access to the lots is provided through the courtyard owned in condominium. The socio-cultural characteristics regarding crowding, privacy as well as other factors like management and control have been a major determinant in deciding the number of lots (20-25) per cluster. This courtyard is very useful considering the small size of the lots as they serve as children's play areas which offers the advantage of better physical and visual control from the dwellings around the courtyard and as a passive social gathering for the older age groups as well as other community activities. This encourages more social interaction and provides a supportive environment. Shared services necessary for reducing costs at initial stage (e.g. hand pumps) will be provided in this court.

The layout also provides flexibility in lot subivision. The different demands for land in terms of potential, costs, utilization and lot sizes are recognized by providing larger lots along principal streets & at intersections and smaller lots in the middle of the blocks. This approach has the added advantage of facilitating cross subsidization of smaller lots.



REVISED BLOCK

1:2000

KEY

Public: streets/walkways

Semi-Private: cluster courts

Private: lots

LOCALITY BLOCK LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	180	2.18	82.5
DWELLING UNITS	180	2.18	82.5
PEOPLE	1260	2.18	578.0

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	.39	17.89
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	1.39	63.77
SEMI-PRIVATE (cluster courts)	.40	18.34
TOTAL	2.18	100.00

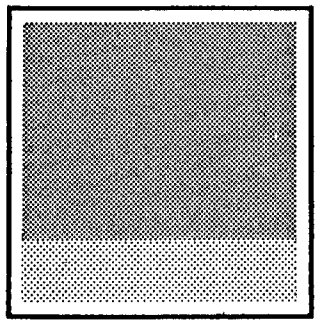
NETWORK EFFICIENCY

$\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}}$ = 135 m/Ha

LOTS

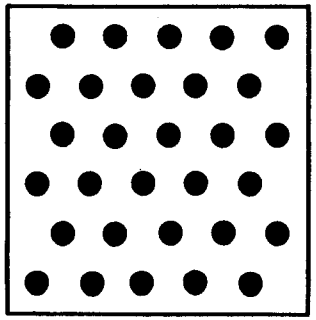
Average area, dimensions = 66 sqm

1 Hectare



PERCENTAGES
Streets/Walkways 17.89
Playgrounds
Cluster Courts 18.34
Dwellings/Lots 63.77

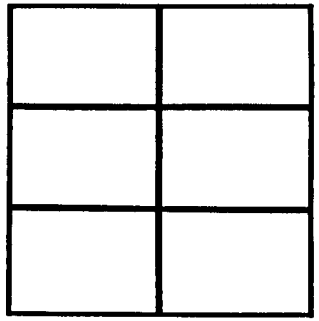
1 Hectare



DENSITY Persons/Hectare

● 20 Persons

16 Hectare



CIRCULATION EFFICIENCY

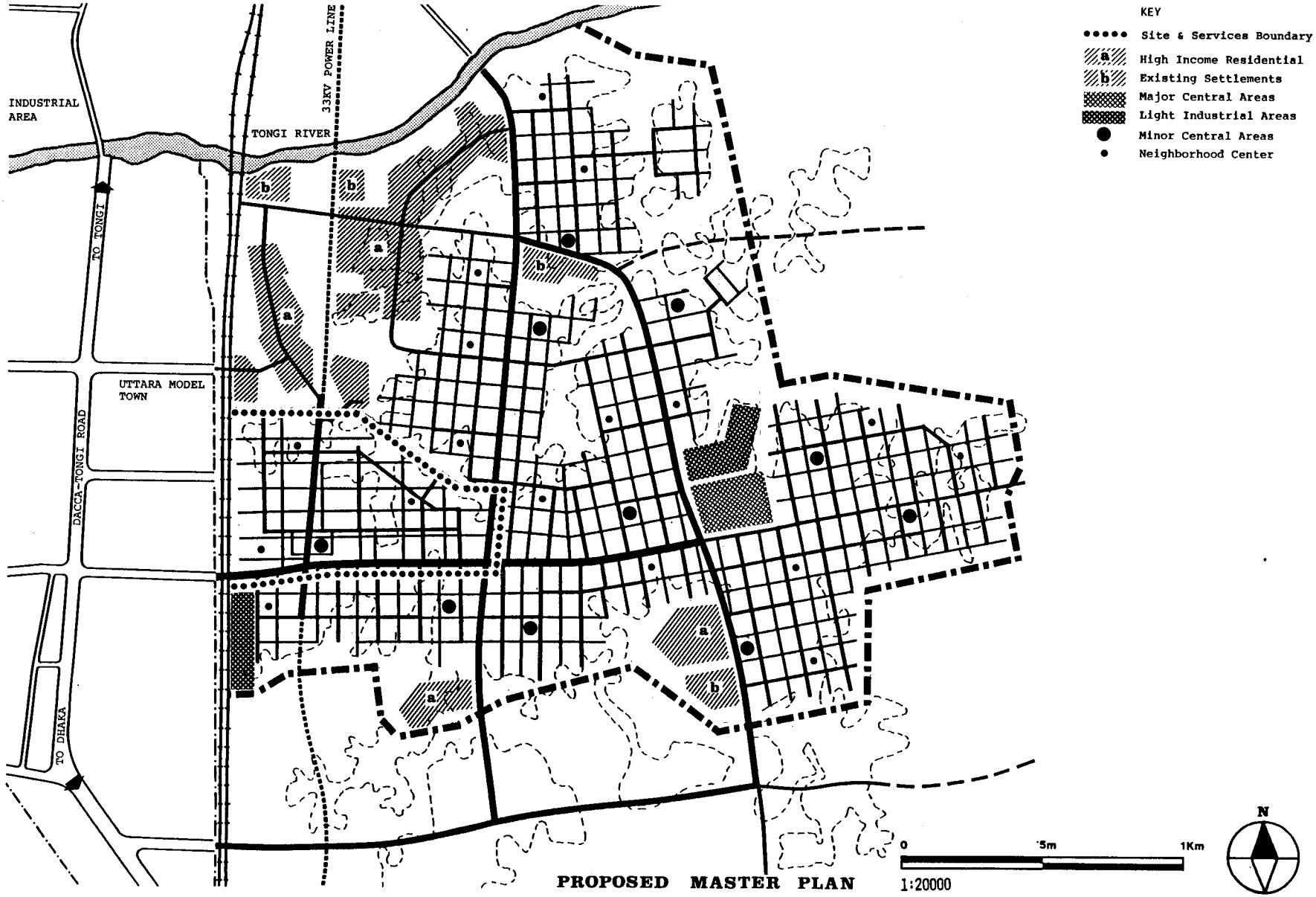
Meter/Hectare 135

PROPOSED MASTER PLAN

Basic physical and economic effects were not anticipated in the proposed master plan in terms of land utilization, commercial potential, land values and resultant demand on land. Industrial and commercial lots are separated into groups which in reality is not a normal development pattern.

The Master plan does not have a clarity of circulation in terms of hierarchy. Too many road sizes (30m, 22m, 16m, 6m, 3m) with too many junctions have made the project layout complicated, increasing the circulation area and length of utilities.

Low land in the project area was not considered for future uses. Eventually when the buildable land within the project area will be totally built and occupied, the low-lands will have a potential of being developed and will be in high demand. It will be very difficult and expensive to incorporate infrastructure in these areas at a later stage.



PROPOSED MASTER PLAN 1:20000

PROPOSED LAND SUBDIVISION

A gridiron pattern has been adopted for the block layout. The block width is determined by the lot depth with 2 lots back to back and accordingly this sets the distances or intervals between lines of circulation. Small lots made the block size too small thereby increasing the public area in terms of land percentages and length of utilities. Thus increasing the cost of Infrastructure. In addition this type of subdivision did not facilitate grouping.

The commercial of the lots/land fronting a main road is always very high, but this important aspect was not considered. Two secondary schools, a primary school & other community facilities are grouped in one place by the main road, where the land value is very high, resulting in loss of revenue. Inclusion of a primary school within such a busy and crowded area could also affect the psychology and safety of these small children. Secondly, standard lot sizes have been retained for the lots fronting the main road. Also the land to the south of the main road was not considered for development although the road will be built in the first phase.

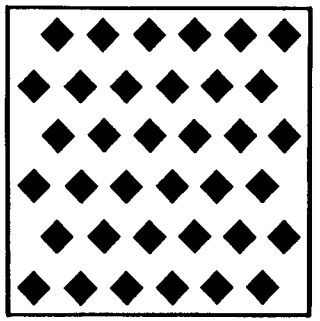
KEY

A	Administration	**W**	Workshop
SS	Secondary School	**M**	Market
PS	Primary School	**TI**	Transport Interchange
H	Health Center	**Pg**	Playground
Mq	Mosque		

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	3317	45.02	73.6

LOTS
Average area, dimensions = 65.27 sqm

1 Hectare



LOTS DENSITY
Lot/Hectare
2 Lots

PROPOSED LAND SUBDIVISION

1:5000

PROPOSED LAND UTILIZATION

The proposed layout has a deficient land utilization. Public land is 2/5ths more than the proposed one. This leads to high construction cost of infrastucture and utilities in addition to high maintenance cost. Small play areas (public land) scatterd throughout the site do not give a clear definition of users, responsible agents and physical controls. The layout does not provide any oppurtunity for private participation in self help and community activities.

KEY

Public

Semi-Public

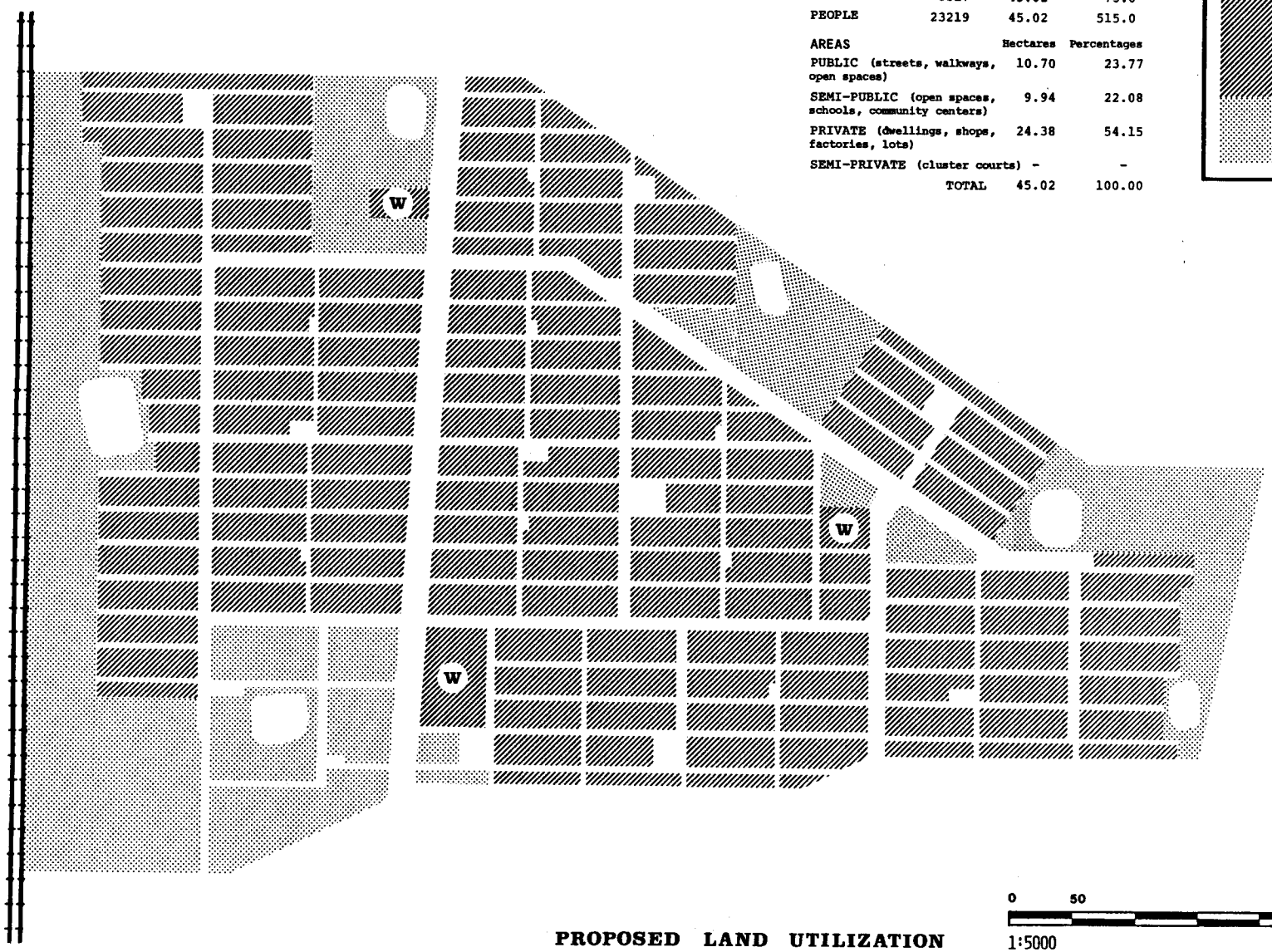
Private

LOCALITY LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	3317	45.02	73.6
DWELLING UNITS	3317	45.02	73.6
PEOPLE	23219	45.02	515.0

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	10.70	23.77
SEMI-PUBLIC (open spaces, schools, community centers)	9.94	22.08
PRIVATE (dwellings, shops, factories, lots)	24.38	54.15
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	45.02	100.00

1 Hectare



0 50 250m

1:5000

N

PROPOSED LAND UTILIZATION

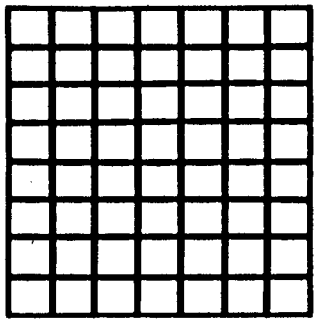
PROPOSED CIRCULATION

The circulation network is based on a "gridiron" system. The distance or intervals between the lines of circulation are determined by the lot depth with two lots back to back. Consequently increasing the public area in terms of land percentages and length of utilities increases the cost fo infrastructure and maintenance. There are too many junctions and some of the roads too narrow when compared to the areas served. The directional character and hierarchy is also not clear. Line of access and lines of transit are not diffrentiated. Finally the layout does not contribute towards social grouping.

16 Hectare

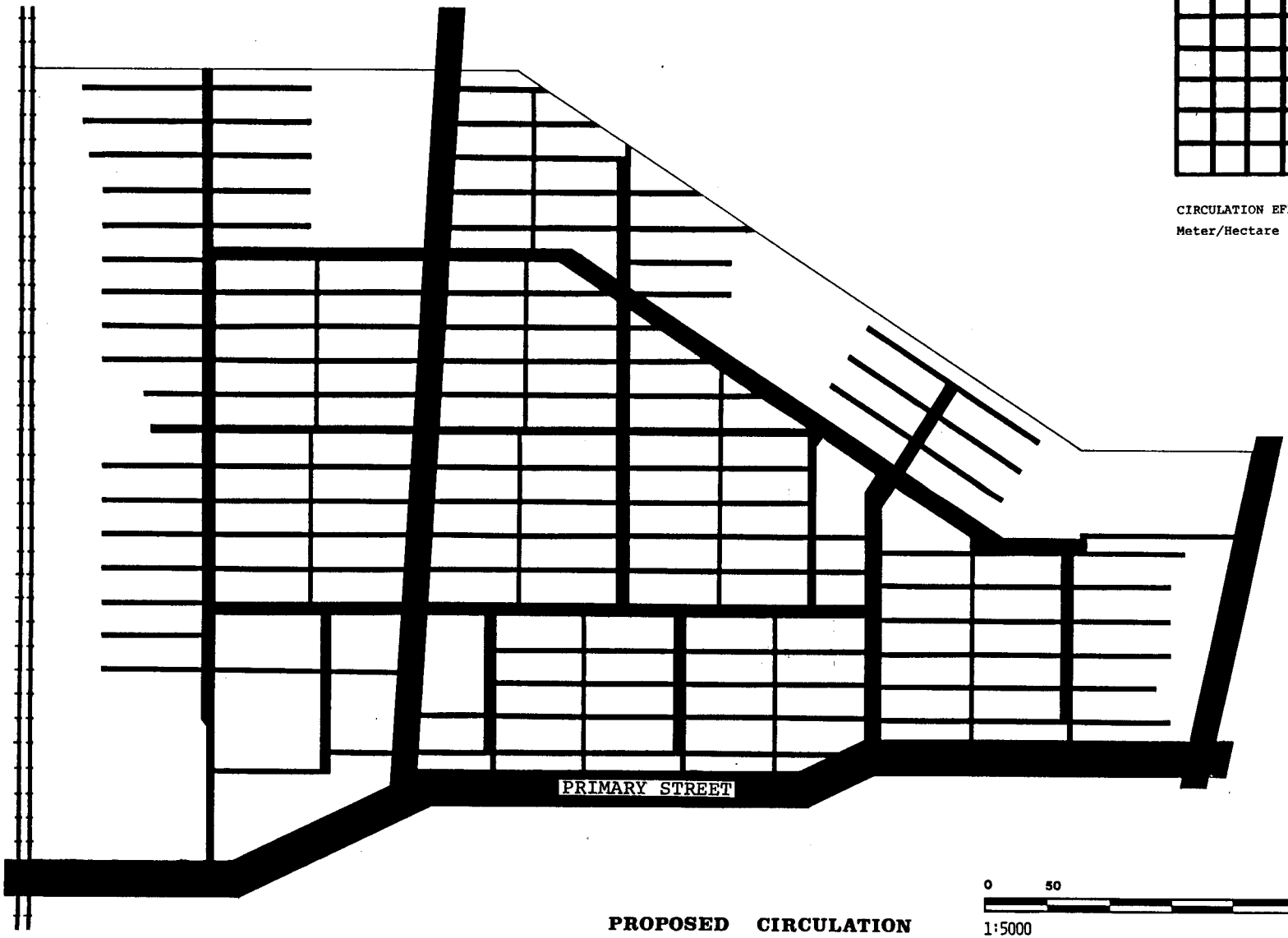
NETWORK EFFICIENCY

$$\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 382 \text{ m/Ha}$$



CIRCULATION EFFICIENCY

Meter/Hectare 382



PROPOSED CIRCULATION

0 50 250m

1:5000

N

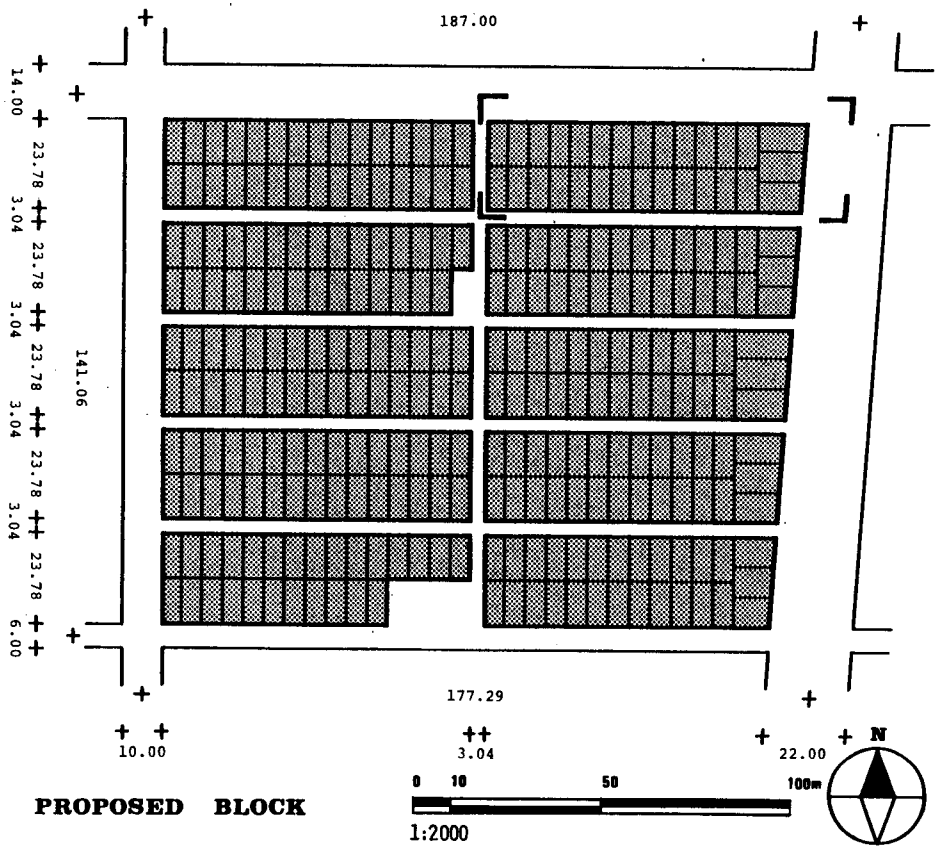
PROPOSED BLOCK

The layout does not achieve a minimization of: Land servicing (non-taxable), institutional participation and a maximisation of: Land serviced (taxable) and users participation.

The plan shows typical layout of blocks surrounded by public circulation that provides direct access to the lots. For comparison and evaluation purposes a group of blocks that are surrounded by wider roads are shown. As a result of individual lots having direct access to public circulation, the length of circulation per area served is much greater than that of the revised one. This implies higher public construction costs for infrastructure and is a heavy burden for the government in maintenance.

Small play areas within blocks are provided by taking out one or four lots which could result in uses by other than children. Only the lots around or fronting the play area have an added advantage but the majority of the lots cannot directly benefit from it. Using previous examples, these play spaces will most likely turn into garbage dumps, since there will be no physical and social means to direct/control the use, operation and maintenance of these spaces.

The layout does not encourage social interaction and decreases the private responsibility and participation in the community.



PROPOSED BLOCK

KEY

Public: streets/walkways

Semi-Private: cluster courts

Private: lots

LOCALITY BLOCK LAND UTILIZATION DATA

DENSITIES	Total Number	Area Hectares	Density N/Ha
LOTS	284	2.57	110.0
DWELLING UNITS	284	2.57	110.0
PEOPLE	1988	2.57	773.0

AREAS	Hectares	Percentages
PUBLIC (streets, walkways, open spaces)	.68	26.46
SEMI-PUBLIC (open spaces, schools, community centers)	-	-
PRIVATE (dwellings, shops, factories, lots)	1.89	73.54
SEMI-PRIVATE (cluster courts)	-	-
TOTAL	2.57	100.00

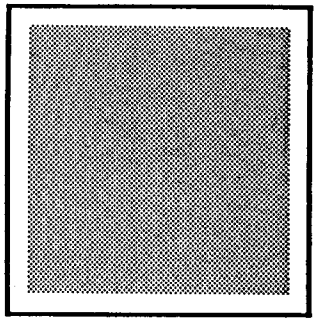
NETWORK EFFICIENCY

$$\frac{\text{Network length (streets, walkways)}}{\text{Areas served (total area)}} = 459 \text{ m/Ha}$$

LOTS

Average area, dimensions = 65.27 sqm

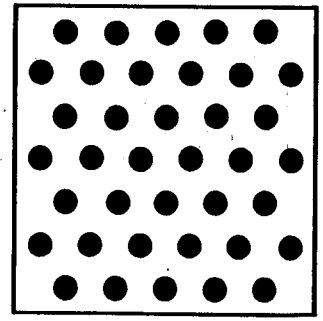
1 Hectare



PERCENTAGES

Streets/Walkways	26.46
Playgrounds	-
Cluster Courts	-
Dwellings/Lots	73.54

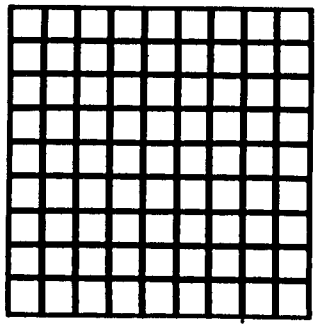
1 Hectare



DENSITY Persons/Hectare 773

● 20 Persons

16 Hectare



CIRCULATION EFFICIENCY

Meter/Hectare 459

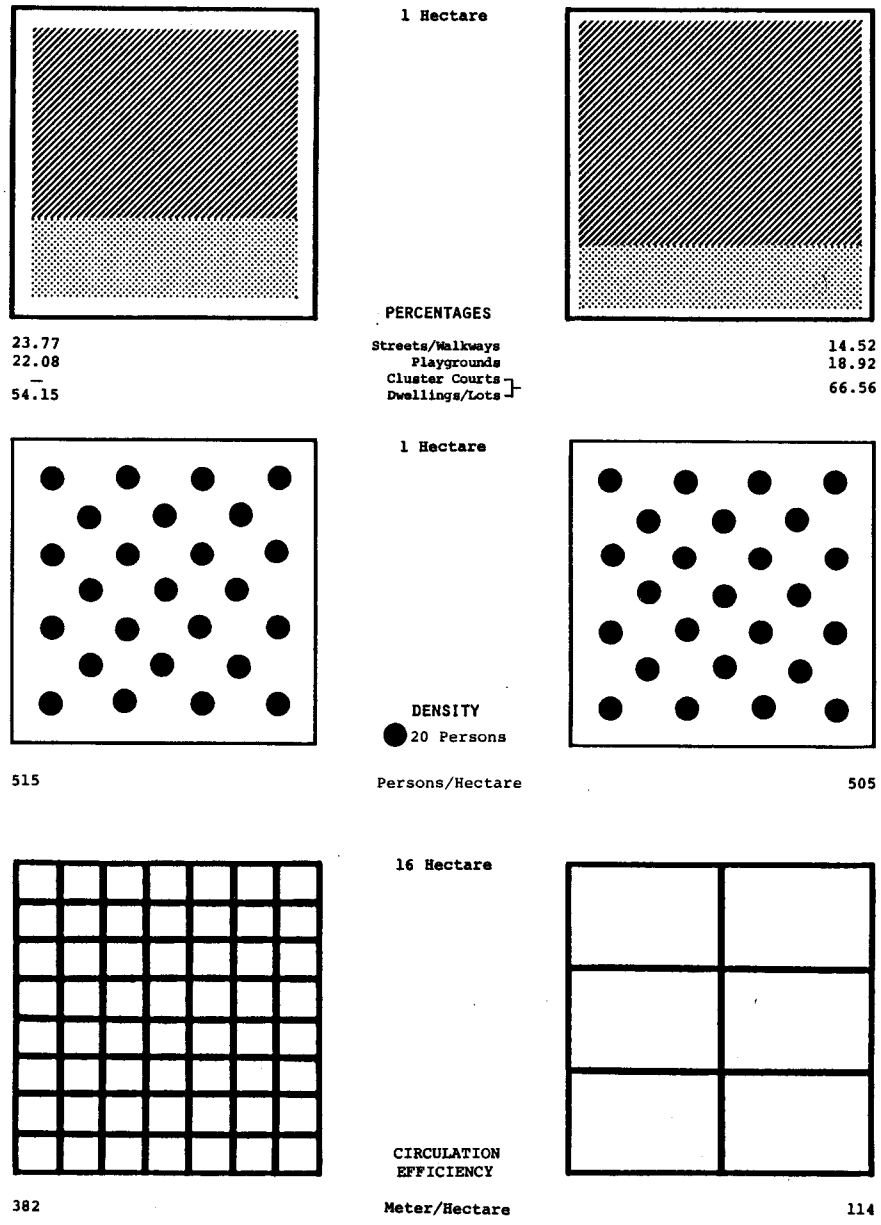
COMPARATIVE SUMMARY

Both the revised and proposed Site and Services projects are represented here with diagrams in terms of land utilization percentages, density and circulation efficiency.

LAND UTILIZATION PERCENTAGES : Proportion of public and private areas: they determine maintenance responsibility, user control and functional efficiency of a layout; e.g. the higher the percentage of private and semi-private land the higher the land utilization efficiency. The higher the percentage of land for circulation, higher are the costs of installation per person and extensive maintenance for the public sector, indicating an efficient layout.

DENSITY : The number of persons per hectare. This determines the intensity of land use; e.g., low densities mean higher costs of development per person. Again very high density may represent excessive load on land and services and also deteriorates the quality of environment.

CIRCULATION EFFICIENCY : A ratio between public circulation lengths and the area served indicating the network efficiency; a high ratio reflects a less efficient network in terms of direct investment and maintenance costs per unit area.



PROJECT PROGRAM

PROJECT NAME: Uttara East, Site & Services	PROPOSED		REVISED	
TOTAL AREA	45.02 Ha		44.97 Ha	
GROSS DENSITY	515 P/Ha		505 P/Ha	
NET DENSITY	952 P/Ha		759 P/Ha	
POPULATION	23,219		22,715	
HOUSEHOLD SIZE	7 Persons		7 Persons	
LAND UTILIZATION				
Public (Streets, Open Spaces)	10.70 Ha	23.77%	6.53 Ha	14.53%
Semi-Public (Open Spaces, Schools, Community facilities)	9.94 Ha	22.08%	8.51 Ha	18.92%
Private & Semi-Private (Dwellings, Shops, Workshops, Lots & Cluster courts)	24.38 Ha	54.15%	29.93 Ha	66.55%
TOTAL	45.02 Ha	100.00%	44.97 Ha	100.00%
RESIDENTIAL AREAS				
Number of Lots	3317		3245	
Dimension of Lots (m x m)	5.48 x 11.89 7.93 x 10.98		5.5 x 12.0 7.5 x 16.0	
Average Lot Area (m^2)	65.20 m^2		66 m^2	
COMMUNITY FACILITIES				
Primary School	4		4	
Secondary School	2 (1 boys, 1 girls)		1 (two shifts)	
Health Center, Mosque	1 each		1 each	
Site Administration, Police, Post Office	1 each		1 each	
Fire Station, Community Center, Bank			1 each	
Market	3		1	
Transport Interchange (Bus Stop, Rickshaw Rank etc.)	1		1	
DEVELOPMENT MODE	Progressive		Progressive	
URBAN LAYOUT TYPE	Gridiron		Grid	
TARGET INCOME GROUP	Low Income		Low Income	
DESIGNER	Shankland Cox Partnership		Thesis Proposal	

Typical picture of the Dhaka city; population increase and the increase of striking contrast of the different income groups reflected in the mode of transport: pedal rickshaws and latest model imported cars.
Photo : Aminul H Khan.

CONCLUSIONS

CONCLUSIONS:

Most existing and proposed settlements have significant problems in Land Utilization and Circulation Efficiency. Despite narrow streets, a large percentage of land is allocated for public circulation due to small blocks having gridiron layouts. AS for walkup developments waste of land and services are common characteristics. Moreover "instant" housing requires extensive capital investment, discourages social interaction and utilization of individual resources.

Therefore a good physical design should satisfy the Social Economic and Political requirements of a project. Land Utilization should be efficient. Users participation should be maximized. Institutional participation and cost of land, infrastructure, services, maintenance and operation should be minimized.

In the design of a efficient layout, two principal components to be considered at the planning stage are land utilization and circulation, the characteristics of which are as follows:

LAND UTILIZATION: A layout with adequate percentages of land utilization, unit circulation lengths and density may not necessarily be efficient. The efficiency is evaluated qualitatively in terms of a distinct coherent relationship between user's responsibility and physical control which is ignored in the proposed project and was a major consideration in the revised design. The following relationship is recognized:

LAND UTILIZATION	USER	RESPONSIBLE AGENT	PHYSICAL CONTROLS
PRIVATE (dwelling, lots)	Family	User/owner	Complete
SEMI-PRIVATE (CLUSTER COURTS)	Group of families	User/owner	Partial/ Complete
SEMI-PUBLIC (schools, playgrounds, open spaces	Community, Limited group of people	Community/ Public sector	Partial
PUBLIC (streets, walkways, open spaces)	Unlimited	Public sector	Minimum

CIRCULATION: The revised circulation illustrates a more efficient layout than the proposed one in terms of circulation length per area served and ratio of public to private area. Also the lines of access and lines of transit are differentiated in the revised design.

LINES OF TRANSIT (streets, walkways)	LINES OF ACCESS (dead end streets or loops for pedestrians, vehicles or both)
- Serve through circulation and provide direct access to lots on their sides.	- Never serve through traffic; serves only abuttors by providing direct access to the lots on their sides.
- Unlimited number of users	- Limited number of users
- On public land	- On semi-public land
- Long and genersllly connected at both ends with different lines of transit.	- Short & generally connected at one or both ends to the same line of transit.
	- Limited to a maximum length of 100m for reason of safety.

APPENDIX

GLOSSARY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DWELLING UNIT TYPE. Four types of dwelling units are considered: *ROOM:* A SINGLE SPACE usually bounded by partitions and specifically used for living; for example, a living room, a dining room, a bedroom, but not a bath/toilet, kitchen, laundry, or storage room. SEVERAL ROOM UNITS are contained in a building/shelter and share the use of the parcel of land on which they are built (open spaces) as well as common facilities (circulation, toilets, kitchens). *APARTMENT:* A MULTIPLE SPACE (room/set of rooms with bath, kitchen, etc.) SEVERAL APARTMENT UNITS are contained in a building and share the use of the parcel of land on which they are built (open spaces) as well as the facilities available. *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)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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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, 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	= 0.397 inches
1 meter = 100 centimeter	= 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 meteres
1 acre	= 0.4087 hectares

All income, cost and rent/mortgage data have been expressed in terms of the U.S. equivalent; 1 US Dollar = Tk 21.00(1982)