URBAN SETTLEMENT MODEL
Comparative Study of a Site and Services Project, Dhaka, Bangladesh

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OF TECHNOLOGY
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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 infrastructure 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.
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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.
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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 utilizing 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. Infrastructure - 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 SETTLEMENT MODEL

URBAN TOPOGRAPHY AND CIRCULATION

URBAN LAND USE PATTERN

KEY

A Airport

- Primary Road

- Railroad

- Built-up Area

AREAS

- Residential

- Commercial

- Industrial
INCOMES DATES
LOW 1850
MEDIUM 1950
HIGH 1980

URBAN INCOME PATTERN

URBAN GROWTH PATTERN
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 country'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 analysis 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

DESIGN HEURISTICS

19
STAGE 3: SITE PARAMETERS

INDUSTRIAL AREA
TONGI RIVER
LOW LANDS
FOOT PATH
AGRICULTURAL LAND
SCATTERED RURAL SETTLEMENTS

0 1 1.5Km
1:300000
<table>
<thead>
<tr>
<th>LOCATION</th>
<th>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.</th>
</tr>
</thead>
</table>
| 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. |

<table>
<thead>
<tr>
<th>APPROACHES/ACCESS</th>
<th>Dhaka-Tongi radial road, with three accesses. Additional access is from across the river from the Tongi Industrial area.</th>
</tr>
</thead>
</table>
| 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. |

| 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 |
<table>
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<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNITY FACILITIES</td>
<td>No facilities on site; some will be available in adjacent Uttara Model Town. The project because of its size would require some community facilities.</td>
</tr>
<tr>
<td>EMPLOYMENT</td>
<td>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.</td>
</tr>
<tr>
<td>TRANSPORTATION</td>
<td>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.</td>
</tr>
<tr>
<td>LAND TENURE</td>
<td>Currently under fragmented private ownership; in the process of acquisition.</td>
</tr>
<tr>
<td>LAND COST</td>
<td>TK 2,960,00/Ha ($148,000/Ha)</td>
</tr>
</tbody>
</table>
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.


Three primary roads have been proposed, all of which run in a 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.
Areas of commercial potential are those that have the potentiality 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 accessiblility. 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 potential, 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.
It is assumed that:

1. Higher land values parallel the location of shops, commercial areas (private land), plazas, and 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.
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.
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.
The synthesis of the preceding 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 included later on according to needs & demand after the whole project area is developed, built, inhabited and evaluated.
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.

<table>
<thead>
<tr>
<th>LOTS</th>
<th>DENSITY</th>
<th>Number</th>
<th>Area Hectares</th>
<th>Density LOTS/Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>3245</td>
<td>44.97</td>
<td></td>
<td></td>
<td>72.2</td>
</tr>
</tbody>
</table>

| LOTS | Average area, dimensions | 66 sqm |

DENSITIES

KEY

A Administration  F Fire Station Department
SS Secondary School  CC Community Center
PS Primary School  B Bank
H Health Center  M Market
Mq Mosque  TI Transport Interchange
PO Post Office  R Reserve
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.
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 direction 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 established for the protection of pedestrians, crosswalks, traffic lights. Example: Primary & main inter-community roads.
PROJECT COMPARISON

NETWORK EFFICIENCY

Network length (streets, walkways) = 114 m/Ha
Areas served (total area) = 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 of 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 subdivision. 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.
LOCALITY BLOCK LAND UTILIZATION DATA

<table>
<thead>
<tr>
<th>DENSITIES</th>
<th>Total</th>
<th>Area</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOTS</td>
<td>180</td>
<td>2.18</td>
<td>82.5</td>
</tr>
<tr>
<td>DWELLING UNITS</td>
<td>180</td>
<td>2.18</td>
<td>82.5</td>
</tr>
<tr>
<td>PEOPLE</td>
<td>1260</td>
<td>2.18</td>
<td>578.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREAS</th>
<th>Hectares</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways, open spaces)</td>
<td>.39</td>
<td>17.89</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces, schools, community centers)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PRIVATE (dwellings, shops, factories, lots)</td>
<td>1.39</td>
<td>63.77</td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>.40</td>
<td>18.34</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2.18</td>
<td>100.00</td>
</tr>
</tbody>
</table>

NETWORK EFFICIENCY
- Network length (streets, walkways) = 135 m/Ha
- Areas served (total area)

LOTS
- Average area, dimensions = 66 sqm

KEY
- Public: streets/walkways
- Semi-Private: cluster courts
- Private: lots

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

DENSITY
- Persons/Hectare
- 20 Persons

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.
PROJECT COMPARISON

<table>
<thead>
<tr>
<th>KEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site &amp; Services Boundary</td>
</tr>
<tr>
<td>High Income Residential</td>
</tr>
<tr>
<td>Existing Settlements</td>
</tr>
<tr>
<td>Major Central Areas</td>
</tr>
<tr>
<td>Light Industrial Areas</td>
</tr>
<tr>
<td>Minor Central Areas</td>
</tr>
<tr>
<td>Neighborhood Center</td>
</tr>
</tbody>
</table>

**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.
PROJECT COMPARISON

KEY

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

DENSITIES
LOTs 3317 45.02 73.6

LOTS
Average area, dimensions = 65.27 sqm

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 infrastructure and utilities in addition to high maintenance cost. Small play areas (public land) scattered throughout the site do not give a clear definition of users, responsible agents and physical controls. The layout does not provide any opportunity for private participation in self help and community activities.
**LOCALITY LAND UTILIZATION DATA**

<table>
<thead>
<tr>
<th>DENSITIES</th>
<th>Total Number</th>
<th>Area (Hectares)</th>
<th>Density (N/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOTS</td>
<td>3317</td>
<td>45.02</td>
<td>73.6</td>
</tr>
<tr>
<td>DWELLING UNITS</td>
<td>3317</td>
<td>45.02</td>
<td>73.6</td>
</tr>
<tr>
<td>PEOPLE</td>
<td>23219</td>
<td>45.02</td>
<td>515.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREAS</th>
<th>Hectares</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways, open spaces)</td>
<td>10.70</td>
<td>23.77</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces, schools, community centers)</td>
<td>9.94</td>
<td>22.08</td>
</tr>
<tr>
<td>PRIVATE (dwellings, shops, factories, lots)</td>
<td>24.38</td>
<td>54.15</td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>45.02</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**PROPOSED LAND UTILIZATION**

**KEY**
- Public
- Semi-Public
- Private

1 Hectare

**SCALE**
- 1:5000
- 0 to 250 meters

**NORTH**
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 of 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 differentiated. Finally the layout does not contribute towards social grouping.
### Network Efficiency

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network length (streets, walkways)</td>
<td>382 m/Ha</td>
</tr>
<tr>
<td>Areas served (total area)</td>
<td>16 Hectare</td>
</tr>
</tbody>
</table>

### Circulation Efficiency

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter/Hectare</td>
<td>382</td>
</tr>
</tbody>
</table>
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.
LOCALITY BLOCK LAND UTILIZATION DATA

<table>
<thead>
<tr>
<th>DENSITIES</th>
<th>Total Area</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOTS 284</td>
<td>2.57</td>
<td>110.0</td>
</tr>
<tr>
<td>DWELLING UNITS 284</td>
<td>2.57</td>
<td>110.0</td>
</tr>
<tr>
<td>PEOPLE 1988</td>
<td>2.57</td>
<td>773.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREAS</th>
<th>Hectares</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC (streets, walkways, open spaces)</td>
<td>0.68</td>
<td>26.46</td>
</tr>
<tr>
<td>SEMI-PUBLIC (open spaces, schools, community centers)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PRIVATE (dwellings, shops, factories, lots)</td>
<td>1.89</td>
<td>73.54</td>
</tr>
<tr>
<td>SEMI-PRIVATE (cluster courts)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2.57</td>
<td>100.0</td>
</tr>
</tbody>
</table>

NETWORK EFFICIENCY

- Network length (streets, walkways) = 459 m/Ha
- Areas served (total area) =
- LOTS
- Average area, dimensions = 65.27 sqm
- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

PROPOSED BLOCK

- 1 Hectare
- 16 Hectare
- 20 Persons

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

DENSITY Persons/Hectare 773

CIRCULATION EFFICIENCY

- Meter/Hectare 459

KEY

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

<table>
<thead>
<tr>
<th></th>
<th>Proposed</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Area</strong></td>
<td>45.02 Ha</td>
<td>44.97 Ha</td>
</tr>
<tr>
<td><strong>Gross Density</strong></td>
<td>515 P/Ha</td>
<td>505 P/Ha</td>
</tr>
<tr>
<td><strong>Net Density</strong></td>
<td>952 P/Ha</td>
<td>759 P/Ha</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td>23,219</td>
<td>22,715</td>
</tr>
<tr>
<td><strong>Household Size</strong></td>
<td>7 Persons</td>
<td>7 Persons</td>
</tr>
<tr>
<td><strong>Land Utilization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public (Streets, Open Spaces)</td>
<td>10.70 Ha</td>
<td>6.53 Ha</td>
</tr>
<tr>
<td>Semi-Public (Open Spaces, Schools, Community facilities)</td>
<td>9.94 Ha</td>
<td>8.51 Ha</td>
</tr>
<tr>
<td>Private &amp; Semi-Private (Dwellings, Shops, Workshops, Lots &amp; Cluster courts)</td>
<td>24.38 Ha</td>
<td>29.93 Ha</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>45.02 Ha</td>
<td>44.97 Ha</td>
</tr>
</tbody>
</table>

**Residential Areas**

<table>
<thead>
<tr>
<th></th>
<th>Proposed</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Lots</td>
<td>3317</td>
<td>3245</td>
</tr>
<tr>
<td>Dimension of Lots (m x m)</td>
<td>5.48 x 11.89</td>
<td>5.5 x 12.0</td>
</tr>
<tr>
<td></td>
<td>7.93 x 10.98</td>
<td>7.5 x 16.0</td>
</tr>
<tr>
<td>Average Lot Area (m²)</td>
<td>65.20 m²</td>
<td>66 m²</td>
</tr>
</tbody>
</table>

**Community Facilities**

<table>
<thead>
<tr>
<th></th>
<th>Proposed</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary School</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Secondary School</td>
<td>2 (1 boys, 1 girls)</td>
<td>1 (two shifts)</td>
</tr>
<tr>
<td>Health Center, Mosque</td>
<td>1 each</td>
<td>1 each</td>
</tr>
<tr>
<td>Site Administration, Police, Post Office</td>
<td>1 each</td>
<td>1 each</td>
</tr>
<tr>
<td>Fire Station, Community Center, Bank</td>
<td>1 each</td>
<td>1 each</td>
</tr>
<tr>
<td>Market</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Transport Interchange</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Development Mode**

<table>
<thead>
<tr>
<th>Proposed</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progressive</td>
<td>Progressive</td>
</tr>
</tbody>
</table>

**Urban Layout Type**

<table>
<thead>
<tr>
<th>Proposed</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gridiron</td>
<td>Grid</td>
</tr>
</tbody>
</table>

**Target Income Group**

<table>
<thead>
<tr>
<th>Proposed</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Income</td>
<td>Low Income</td>
</tr>
</tbody>
</table>

**Designer**

<table>
<thead>
<tr>
<th>Proposed</th>
<th>Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shankland Cox Partnership</td>
<td>Thesis Proposal</td>
</tr>
</tbody>
</table>
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

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 an 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:

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

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.

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

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


-SECOND PREFERENCE: definitions from technical dictionaries, books, or reference manuals.

-THIRD PREFERENCE: definitions from the Urban Renewal Design Program (U.S.D.P.) Files. They are not always existing sources were not quite as satisfactory.

Terms included for specificity and to focus on a particular context are indicated in parenthesis. Terms not indicated in parenthesis are defined in standard dictionaries. (See also: REFERENCES.)

ACCESS. 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, airports, 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 DISTURBANCES. The act or process of destroying (through noise, smell, tranquility, or settled state of the site) by the annoyance of airport noise, vibration, hazards, etc.) (Merriam-Webster, 1971)

AIRPORT EMISSION RESTRICTIONS. The regulation of the smoke, odors, noise emissions in the path of moving aircraft. (Abrams, 1971)

ALTERNATING CURRENT (A.C.) (an electric current) that varies its direction of flow at regular intervals. (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)

APPEASE. Tr. To make the rate of flow of water from any source or natural drainage system smaller or comparable to the rate of flow of water (quantity/time). A steady current produced by use volt applied across a resistance of one ohm. (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. (Kyes, 1971)

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

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

BACKFILL. Earth or other material used to replace material removed during construction, such as in culverts, sewers, basements and behind bridge abutments and retaining walls or between an old structure and a new lining. (Derina, 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, 1971)

BEDSETMENT (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). (Derina, 1972)

BITEMISCH. A coating of or containing bitumen; as asphalt or tar. (Derina, 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, quality of materials, use and occupancy, location and maintenance of the facilities, and structures within the city, and certain equipment specifically regulated therein. (MCA, 1967)

BUILDING DRAIN. Lowest horizontal piping of the building drainage system for the discharge of water, soil, wastes, and other drainage pipes. It is connected to the principal sewer 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. (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, etc.) (Merriam-Webster, 1971)

CLAY. A lustreless colloidal substance, plastic when moist (firing) grains less than 0.002 millimeter 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. (ST 45-7, 1953)

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

COLLECTION SYSTEM. The system of pipes in a sewage network, consisting of the source collection, collection lines, manholes, laterals, mains. (U.S.D.P.)

COMBINED SEWER. A sewer that carries both storm water and sanitary or industrial wastes. (Derina, 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, hospitals, police, fire, public transportation, community centers, etc. (U.S.D.P.)

COMMUNITY RECREATION FACILITIES. Facilities for activities voluntarily undertaken for pleasure, fun, relaxation, exercise, etc. It includes from boredom, worry, or tension. (U.S.D.P.)

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

CONCENTRATION. A system of direct ownership of a single unit in a multi-unit building. The individual owns the unit in such a 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 concentrations are recognized: HORIZONTAL: detached, semi-detached, row/grouped dwelling types; VERTICAL: walk-up, high-rise dwelling units. (Merriam-Webster, 1971)

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

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

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

CONSERVATION AREA. A zone of large urban communities where towns, etc. have grown beyond their administrative boundaries. (AS. Hornby, A.P. Cowie, J. Hornby, A.P. Cowie, J. 1971)

CONSUMPTION. An aggregation or continuous network of urban communities. (Merriam-Webster, 1961)

CORPORATION COCK/CORPORATION. A corporation by which utility-company employees control or disconnect service lines to a consumer. (Merriam-Webster, 1971)

COSTS OF URBANIZATION. Include the following: CAPITAL: cost of land, buildings, cost of administrative, maintenance, etc.: DIRECT: capital and operating costs; INDIRECT: include environmental factors, and social costs.

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, or the production of light, color, etc. (Derina, 1972)

CUTOUT. A pipe or other opening, buried or above ground, for conveying hydraulic traffic, pipelines, cables, or other utilities. (U.S.D.P.)

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

DEPRECIATION. The decrease in the value of an asset. (Merriam-Webster, 1971)

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 available to anyone (paths of travel). (Merriam-Webster, 1971)

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

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

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

DUTY/DUT. Fines for polished surfaces of earth, glass, 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 units. (U.S.D.P.)

DWELLING BUILDING. Four groups are considered: SELF-HELP BUILT: where the dwelling unit is directly built by the users or occupant; the dwelling unit is totally or partially built by skilled craftsman hired by the user or occupant; PAYMENT can be munificence in an extraneous capacity. SMALL CONTRACTOR BUILT: where the dwelling unit is totally or partially built by a small contractor. "Small" is somewhat comparable to the scale of operations, financially and materially; the scale being limited to the construction of a few dwelling units or single complex. LARGER CONTRACTOR BUILT: where the dwelling unit is totally constructed by a large organization hired by a developer to develop a "large" contractor. Large contractor. "Larger" is comparable to the scale of operations, financially and materially; the scale reflects more comprehensive and larger size of operations encompassing the building of large quantities of similar units, or a similarly 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 the dwelling unit (excluding lots, streets). Net density is the density designed to occur within an area (ex. including only lots). (U.S.D.P.)

DWELLING DEVELOPER. Three sectors are considered in the supply of dwellings: PRIVATE 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-
the circuit with the voltage dropping to zero twice in
specifically used for living; for
FLOW
METER.
A
device to measure flow
involvd
roar,
a dining room, a bedroom, but
bath/toilet,
laundry,
circuit with the power never dropping to zero.
process (promotion, financing, construction, operation) is carried out
(U.S.D.P.)

FLOW METER. Toilet with storage tank
bowl. (U.S.D.P.)

EMBANKMENT
is contained in a
bank of
earth,
wind.

EMBANKMENT
indicated
a
culvert or sewer. (DePina,
1953)

GRIDIRON LAYOUTS. The urban layouts with gridiron
indicated
a
culvert or sewer. (DePina,
1953)

FACETS (also TAP). A fixture for drawing
water
above any plane
at
low velocity.

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

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

FLEXIBLE PAWTOWSEP. A pavement structure which main-
tains intimate contact with and distributes loads to the
subgrade and depends upon aggregate interlock,
particle cohesion, 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.)

FLICKER PRINCE. The floodplain area
inland
land.

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

FOOT CANDLE. A unit of illumination on a surface that
is one lumen per square foot. (Merrill-Webster,
1971)

FUMES. Gaseous emissions that are usually odorous
and sometimes poisonous. (Merrill-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. (Defina,
1972)

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

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

GOVERNMENT/MUNICIPAL REGULATIONS. In urban areas,
the physical arrangement of the dwelling types is
regulated by a number of different governmental
agencies including zoning,
building codes,
planning and public works.

GREENHOUSE. A structure for planting small flowers,
trees, and shrubs. It is generally heated in winter
by electricity, gas, or oil. (Merrill-Webster,
1971)

GRID. A system for supplying electrical energy to user groups;
by a
system/accseses
indicated
a
culvert or sewer. (DePina,
1953)

HEAT TRANSFER. The transmission of heat
from
one body to
another body.

HEAT. The height of water above any plane or point of reference.
Head in feet = \( \frac{h}{g} \) (in lb/ft. 
ft.)

HIGH-RISE. Dwelling units grouped in five or more stories,
with shared stairs and lift for vertical circulation.

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

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

ILEGAL. That which is contrary to or violating a
rule or regulation or something having the force of law.

INCOME GROUPS. A
group of people or families within
a
range of incomes.

INCOME GROUPS. A

stored
water network; storm drainage, electrical network)
GLOSSARY

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

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

KISOWATT (kw). 1000 watts. A convenient manner of expressing large wattages. Kilowatt hours (kwh) measure the energy consumed by a given appliance in a given time. 1kwh represents the use of an average of 1 kwh of electrical energy for a period of 1 hour. (NUTC ST 45-7, 1971)

LAPPOLE. A vertical pipe or shaft leading from the surface of the ground to a sewer, for admitting light for purposes of inspection. (Merriam-Webster, 1971)

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, access, etc. (U.S.D.P.)

LAND ECONOMY. The setting of a land for a term of years for an agreed purpose or for a term of years as long as 99 years. (U.S.D.P.)

LAND-ECONOMIC VALUE. Refers to: 1) the present monetary value of the land; 2) the present economic 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 on a parcel of land. (U.S.D.P.)

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

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

LAND UTILIZATION. A qualification of the land around a dwelling in relation to user, physical controls and responsibility. PUBLIC (streets, walkways, open spaces; user -anyone/unlimited; physical controls -minimal; responsibility -public sector and user. PRIVATE (dwellings, lots; user -owner or tenant or squatter; physical controls -complete; responsibility -owner. COLLECTIVE (cluster courts; user group of owners and/or tenants; physical controls -partial or more controlled). (Merriam-Webster, 1971)

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

LAND UTILIZATION: RESPONSIBILITY. The quality/estate of being morally/legally responsible for the use and maintenance of the public sector. (Merriam-Webster, 1971)

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

LATRINE. A receptacle (as in the pit 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 which public interest, safety, health or safety, comfort, etc. are not damaged. STANDARD, are levels set and established by authority, custom of general consent, as a model, example or pattern. (Merriam-Webster, 1971)

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

LOCALITY SEGMENT. A 400 x 400 area taken from and representing the residential character and layout of a locality. (Merriam-Webster, 1971)

LOCATION. The position in or 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 substantial common court (owned in common with a group of owners). (U.S.D.P.)

LOT CONTINUITY. 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.)

LUMINARIE. In highway lighting, a complete lighting device consisting of a light source, reflector, refractor, housing and such support as is integral with the housing. (Merriam-Webster, 1971)

MANSIBLE. 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, containing official suggestions 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. (Merriam-Webster, 1971)

MEDIAN BARRIER. A double-faced guard rail in the median or island dividing two adjacent roadways. (Merriam-Webster, 1971)

MEETING BOUNDARIES. Characterized by continuing, homogeneous land uses or topography, expressed as: LINER property lines, political or municipal divisions, main arteries; EDGE, 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)

MISPON. Manpower 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. (Merriam-Webster, 1971)

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

NATURAL FEATURES. Prominent features 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 the distinguishing characteristics. (Merriam-Webster, 1971)

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

NEUTRAL WIRE. Wire carrying no voltage between itself and a ground. (Merriam-Webster, 1971)

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

OCEM (electrical). The unit of resistance to the flow of electricity. The higher the number of ohms, the greater the resistance. When resistance is constant, amperage (and wattage) is directly proportion to voltage. Resistance varies inversely with the cross-sectional area of the wire. Ohms = volts/voltage. Ohm = 1 volt/ampere. (U.S.D.P.)

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

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

PARK. A small, often detached building having a bench, table, pipes, etc. (U.S.D.P.)

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

POPULATION DENSITY. It is the ratio between the population of a given area and the area. It is expressed in people per hectare. (Merriam-Webster, 1971)

PRESENTATION. The establishment of physical controls so that production and distribution of data are different than the standard in the U.S. (U.S.D.P.)

PUBLIC. A system which is owned and operated by the local governmental authority or by an entirely private utility company which is controlled and regulated by a governmental authority. (Merriam-Webster, 1971)

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 COLLECTOR. 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 function to control fluctuations in supply and pressure. (Merriam-Webster, 1971)

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

HOUSING (DIMENSION).-Portion of the highway included between the boundaries of the sides of pavement shares by an employer, by an employer, with increased rainfall density. Runoff-rainfall ratio rising increasing runoff flow. (U.S.D.P.)

UNOFF. That part of precipitation carried off from the area upon which it falls. (U.S.D.P.)

RUNOFF.-The portion of overland flow that is not returned by evaporation, depression storage, surface wetting, and percolation; with increased rainfall duration. Runoff-rainfall ratio increasing runoff flow. (U.S.D.P.)

SANIO. Loose, distinguishable grains of quartz/field spar, mica ranging from 0.02mm to 0.002mm in diameter. (U.S.D.P.)

SANITARY SEDIMENT. The system of artificial usually underground conduits to carry off sewage composed of: wastes; waste matter eliminated from the human body; domestic wastes; used water from a home/community complex; infectious solids; and some industrial wastes, but not water from ground, surface, or atom. (U.S.D.P.)

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

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

SERIES CIRCUIT. Circuits connected in a circuit by a single wire. When one circuit is out, the circuit is broken. Several different systems cannot be used efficiently in the same circuit. (NRTC ST 45-7, 1953)

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

SEDAM. The effluent in a sewer system. (U.S.D.P.)

SEWER. The conduit in a sewer system 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.)

SEWER 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. (Merriam-Webster, 1971)

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

SILF. Loos, unconsolidated sedimentary rock particles (grains from 0.002mm to 0.0002mm 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; NET 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 commercial purposes. Some of the site projects are aimed to improve the housing conditions for the low income group by providing: a) SITE: use access to a piece of land where people can build their own sewings; b) SERVICES: use access to communal, utility, service and community facilities, financing and commun. (U.S.D.P.)

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

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

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

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

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

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

SOIL SUITING (INITIAL). An on-site examination of surface soil conditions and reference to a GENERAL SOIL SUITING (INITIAL) soil classification to determine restrictions basins for early planning considerations. (U.S.D.P.)

STACK. The vertical pipe in a dwelling or vent-pipe system. (NRTC ST 45-7, 1953)

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

STAICIF. A pipe riser with tap used as a source of water for domestic purposes. (Merriam-Webster, 1971; National Standard Agency, 1944)

STORM DRAINAGE. Storm sewer: a system designed to carry water waste water, except (exclusively) water from falls (or sewage, 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 real land for residential or other purposes. (U.S.D.P.)

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

SUMMARY OR BUNCH SEWER. A collector pipe receiving sewage from several sources. (U.S.D.P.)

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

SUFFICE. A drainage or refusal except a house, farmstead, warehouse. (Merriam-Webster, 1971)

TAP (also FASCET). A fixture for filling 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 Turkey; a ten-year tax exemption on new buildings. (Abraham, 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 - TRANSITION. 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 which the unit occupies, (i.e. domestic income-in servant. (U.S.D.P.)

TITLE. The instrument (as a deed) that constitutes a legally just cause of exclusive possession of land, dwellings, etc. (U.S.D.P.)

TOILET. A fixture for defecation and urination, exp. water closet. (7th Collegiate Webstruct, 1663)

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

TRANSPORTATION. Means of conveyance or travel from one place (the site) to another (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. (NRTC ST 45-7, 1953)

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

UNIT. A determinate quantity adopted as a standard of measurement for the 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; the cause to take on urban characteristics. (U.S.D.P.)

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

USER INCOME GROUPS. Based upon the subsistence (minimum) way living for a family consisting of the natural and man-made features. (Merriam-Webster, 1971)

VIBRATION. 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.)

VALUE. A water supply distribution component which intercepts 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. (NRTC ST 45-7, 1953)

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

VIEW. 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) carries water from wash basins, sinks, and similar fixtures. (NRTC ST 45-7, 1953)

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

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

WATERWAYS. The whole system of reservoirs, channels, bays, estuaries, and pumphouse and pumping station by which a supply of water is derived 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 and amperes. Both watts and horsepower measure the rate of work being done. 746w = 1hp. (NRTC ST 45-7, 1953)

WATERING ORDINANCE. The regulation of a city or ordi- nary manner concerning the use of or distribution of water. See regulations of regulations to govern the use of land and the location, height, weight, extent, value, population density, and coverage of structures within each zone. (U.S.D.P.)

GROUP that can afford housing without subsidy, by cash purchase, through mortgage payments, or by rent. VERY HIGH (0.5 or 0.5 subsistence level): the income group that represents the most economically mobile sector of the population. (U.S.D.P.)

GROUP that can afford housing without subsidy, by cash purchase, through mortgage payments, or by rent. VERY HIGH (0.5 or 0.5 subsistence level): the income group that represents the most economically mobile sector of the population. (U.S.D.P.)
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Studio work. HEURISTICS OF URBAN DESIGN. Participants: Navroz Dabu, Faieda Atto, Humberto Rodriguez, Trevor Davis, Mayeedur Rahman. Instructor: Prof. Horacio Caminos; Reinhard Goethert. Spring 1982, MIT.

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 = 1550 square inches or 10.7639 square feet
1 hectare = 10,000 sq. meters = 2.4711 acres
1 square foot = 0.0929 square meters
1 acre = 0.4047 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)