ANALYSIS OF LAND SUITABILITY FOR URBAN DEVELOPMENT IN THE EASTERN FRINGE OF DHAKA CITY: AN APPLICATION OF MULTICRITERIA EVALUATION TECHNIQUE

By

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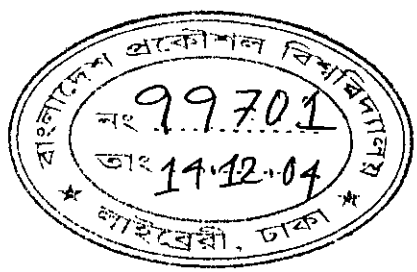
A thesis submitted to the Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology in partial fulfillment of the requirements for the Degree of Masters of Urban and Regional Planning (MURP).



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ABSTRACT

Urban development is a complex process, which is a multiple function of different socio-economic and physical factors. The fringe area for this study is taken from eastern fringe where it would be easier than other fringes to find the difference of development type. This large area is in between the built-up legal limits of the metropolitan and the largely rural or agricultural land surrounding it. Multi Criteria Evaluation (MCE) is a technique to select the best one from a set of alternatives on the basis of a number of criteria. It may serve as an approach for urban planners while decision-making is involved. The research has been designed to study the urban fringe area and it's trends of development from the urban planning point of view. At the same time it studies the applicability of MCE as a part of planning process. Grossly the area about 500 acres of the eastern fringe has been taken as a case study site.

The research was conducted on the basis of information collected through a primary survey, observations, interviews, and finally the author's judgments and experience. Setting criteria for MCE on study area was a difficult part of the job. There are a number of criteria to be dealt with. Due to the limited scope of the study many criteria has been simplified or even ignored. The study includes trends of urban fringe development and its characteristics, past and present strategies related to urban fringe development on the basis of a brief review of plans prepared for Dhaka city. The current trend of fringe area development does not follow any specific method. This research aims to high light several phases of development issues that should be considered while development takes place. Finally it has suggested a set of policy and standards for fringe area of Dhaka.

The present study has developed a concept of MCE to understand its use for land suitability analysis. Based on literature and interview with local experts possible factors underlying every kind of land use type were identified with help of MCE and it's application for landuse suitability analysis. The land use pattern of eastern fringe is generated for different alternatives. However, the results still need care to interpret becausc of limited data. MCE is proved a good tool to understand the spatial pattern of land use suitability especially in fringe area development.

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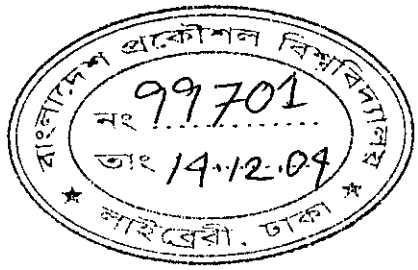
ABBREVIATIONS AND ACRONYMS

BWDB	Bangladesh Water Development Board.
CAT	Countryside around Town
DMDP	Dhaka Metropolitan Development Plan
DMAIUDP	Dhaka Metropolitan Area Integrated Urban Development Plan
DCC	Dhaka City Corporation
DIT	Dhaka Improvement Trust
DAP	Detailed Area Plan
DESA	Dhaka Electric Supply Authority
DMA	Dhaka Metropolitan Authority
DND	Dhaka – Narangang-Demra
DSMA	Dhaka Strategic Metropolitan Area.
DPHE	Department of Public Health Engineering
FAP	Flood Action Plan
GIS	Geographic Information System
GoB	Government of Bangladesh
HSD	Housing Settlement Directorate
MCE	Multicriteria Evaluation
NEC	National Economic Council
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Kartiphakkha
SPZ	Strategic Planning Zone
UDD	Urban Development Directorate



1 Introduction

1.1 Background and Statement of the Problem

Urban development is a way of land development process and it is particularly true for the Dhaka City. It is a complex process, which is a multiple function of different socio-economic and physical factors. The "land" is available in and around Dhaka city but development process is very slow. This is a fact that "urban land" is scarce in this city because of its topographical characteristics and due to limitation of available fund for land development process.

Even if new land is made available, it cannot be expected that new areas instantly be developed in full capacity, whatever those capacity might be. It may take many decades for these areas densities to reach the metropolitan average. Uttara developed by the RAJUK in 60's, is the example for slow pace of land-developed process. After 30 years of accomplishment of the project, still there are reasonable vacant plots. On the other hand, land conservation process in informal sector in Dhaka has different scenario. Without considering the qualitative values, this process is comparatively higher than formal sector.

According to DMDP study, the 1980s was the period of major land conversion from rural to urban. It was calculated that between 1983 and 1991 more or less 5500-hector land were converted to urban uses (DMDP 1995). Around two-thirds of this total land converted in the fringe areas, and the rest in the central urban areas of the city. At the same time, the population increased only 30% in the fringe area, and 70% in the central urban areas.

Eastern and western parts of suburbs are directly under the threat of annual flooding. It is surprising that, flood free land is available around Tongi, within 20km from the city center, which have remained underdeveloped. It is not the case that valuable flood free areas have preserved for special purposes for special people or the land price of those areas are not affordable. There are other causes for this underdeveloped

land. Therefore, it is said that flood is one of the important factor to guide the development of the city but not the only factor.

The metropolitan fringe is defined in this study as the zone mentioned in Dhaka Metropolitan Development Plan study. This large area is in between the built-up legal limits of the metropolitan and the largely rural or agricultural land surrounding it. Urban fringe area is highly potential area for further development; at the same time it is threatened to haphazard and unplanned growth because of its proximity to the urban areas and low cost of land. So these areas seek special consideration while planning for the city. The term metropolitan fringe is considered synonyms with "rural-urban fringe" (Wherwein 1942, Lal 1984 and Phadke and Sita 1987) or 'peri-urban area" conceptually (Shankland Cox Partnership 1981). Many terms synonymous to fringe such as urban fringe, rural urban fringe, sub-urban areas, suburbs, urban periphery and more recently extended metropolitan regions have been used in contemporary planning literature.

Techniques are essential elements in a planning process. Planning involves many working tasks such as needs, identification of deficiencies and problems, forecasting of future demand for some services (housing, transport, health, education, recreation, shopping etc), prioritization, and evaluation of alternatives, monitoring and so forth. Most of these working tasks comprise application of a particular type of technique. The concept of Multi Criteria Evaluation is a technique that is to find out the best alternative from a set of alternative basing on some criteria. Planning is always a tricky job. It needs to be better solution, planners are often confused about choice of best solution. MCE can help them to find a way out of this confusion.

Multi-Criteria Evaluation (MCE) is a technique to select the best one from a set of alternatives on the basis of a number of preset criterions. It may serve as an approach for urban planners while decision making is involved. It may help the decision-maker to describe, evaluate, sort or rank and select or reject a specific decision. Evaluation aims at rationalizing planning and Decision Making Process (DMP) by structuring relevant aspects of problem, understand its behavior and answer the questions like: Are the choice possibilities realistic (can they be realized)? Do the choice possibilities fulfill various minimum conditions? Do they correspond to the social desires?

Finally MCE is supposed to provide the decision makers with the following out comes:

- Identification of best alternative
- Rejection of "bad" ones or identification of good ones
- The complete ordering of the alternatives
- Understanding the pros & cones
- Creating, sharing knowledge
- Support learning by doing

1.2 RATIONALE OF THE STUDY

All human settlements sustain on land and it is the land, which constitutes the single most important component of the total environment. Any environmentally compatible urban planning must begin with a comprehensive look on the use of land. So, the planners need detailed information about the extent and spatial distribution of various urban land uses, housing characteristics, population growth patterns, urban sprawl, existing condition of infrastructure, utilities etc. For planning of these utilities in a better way, planner needs the total information in a map and information related to these aspects for perspective planning and management. The need of the hour is to create an information system of urban development to retrieve, integrate and create various planning scenarios for decision-making.

The rapid and random expansion of urban centers along their peripherics is typical phenomenon of urban landscape in developing countries in general and in Bangladesh in particular. The emergence of fringe zone with its complex problems of adjustments in between rural and urban ways of life has lead to serious land use problem- loss of agricultural land, unauthorized urban sprawl, high land values, speculation in land and related problems and has assumed great typical importance but sadly remained a neglected area in urban research. Infrastructure and its installation are the major focus of urban planning. The fringe area of a city plays an important role in guiding the direction of development. From previous experience it is clear that traditional approach of planning is not sufficient to keep pace with the growth of Dhaka, especially in peripheral areas. This study has critically analyzed the characteristics of

fringe area and discussed planning considerations for its development. Also evaluated the existing planning deficiencies in terms of effort & strategies in the specific location of fringe areas. The study has provided a detail analysis of the common characteristics of urban fringe areas as well as the requirement of proper planning for them. It intends to contain in depth knowledge of land suitability analysis by using a planning technique (MCE) to select the priority area, past and present trend of urban fringe and lastly to give some standard and policy development

1.3 OBJECTIVE OF THE STUDY

The entire process of urban development in the fringe area of Dhaka is very dynamic and complex. It is neither the scope nor the intent of the present study to venture into all the aspects. Thus it has narrowed down to a choice, and the objective could be outlined as follows:

- To study the trend of fringe area development.
- To study past and present strategies for development of fringe areas of Dhaka City.
- To prepare a land suitability analysis by using MCE technique in the study area.
- To formulate a policy framework for planned development in the study area.

1.4 OUTLINE OF THE METHODOLOGY

It is apparent from the outset that all empirical researches in such fields must be exploratory not only because of the problems of definition but also because of the lack of adequate statistical information. The research methodology followed in this study is therefore self-explanatory.

The methodology involves the selection of part of fringe area by using the application MCE for land suitability analysis through personal interviews. The questionnaire has been designed to seek information from the filed survey & from the expert opinion who are engaged to urban development

The following methodology has been adopted to fulfill the above objectives

1.4.1 Selection of Study Area

The area that has been selected as the study area is located in eastern fringe of Dhaka, which is surrounded by Progoti Saharani on the west, Begunbari khal on the south, Balu river on the east and the main road of RAJUK project on the north. The considerations for selecting the study area include a) it is a typical urban fringe of Dhaka city; b) close proximity to the city center. c) availability of required data for the research etc. Data on trend of development, topography, socio-economic characteristics etc. has been collected and studied in detailed to identify the requirements. Figure 2.2 shows the study area on the map of Dhaka city.

1.4.2 Primary Data Collection

Primary data has been collected by field survey conducted on the study area. It includes detailed description and characteristics of the area, demography, and development requirements. Two types of questionnaire have been prepared to fulfill the above objectives. One is for the key personnel of urban development for priority settings and the other is for the local people of the study area. In addition to justification of the selection of the study area it would help to proceed with the next part of the study.

1.4.3 Secondary Data Collection

This phase includes relevant literature collection and review and collection of maps (CS map and other relevant maps), images, photograph and secondary materials from the concerned authorities and different offices.

1.4.4 Review of the Collected Materials

The collected literature and other materials have been thoroughly reviewed in this stage of the study. It helped to develop a structured theoretical discussion on MCE as well as fringe areas and their characteristics to fulfill the requirements of objectives one and two. Discussion on previous planning reports and other secondary data has been helpful to fulfill the requirements of objective one i.e. to study the past and present development strategies of urban fringe.

1.4.5 Analysis

1.4.5.1 GIS Development and Map Preparation

All physical feature data has been incorporated into Geographic Information System (GIS) for analysis purpose. From the survey map to final work, all sorts of maps have been developed through an integrated database concept.

1.4.5.2 Development Planning Technique

Multi Criteria Evaluation (MCE) can help to solve problem by comprising suitable alternatives. The steps that have been followed for MCE are setting up the alternatives, setting the criterion, setting score to the criterion, preparation of decision table, identify the decision makers preferences, standardization of the criterion, putting weights to the criterion, sensitivity analysis and finally selection of the best alternative.

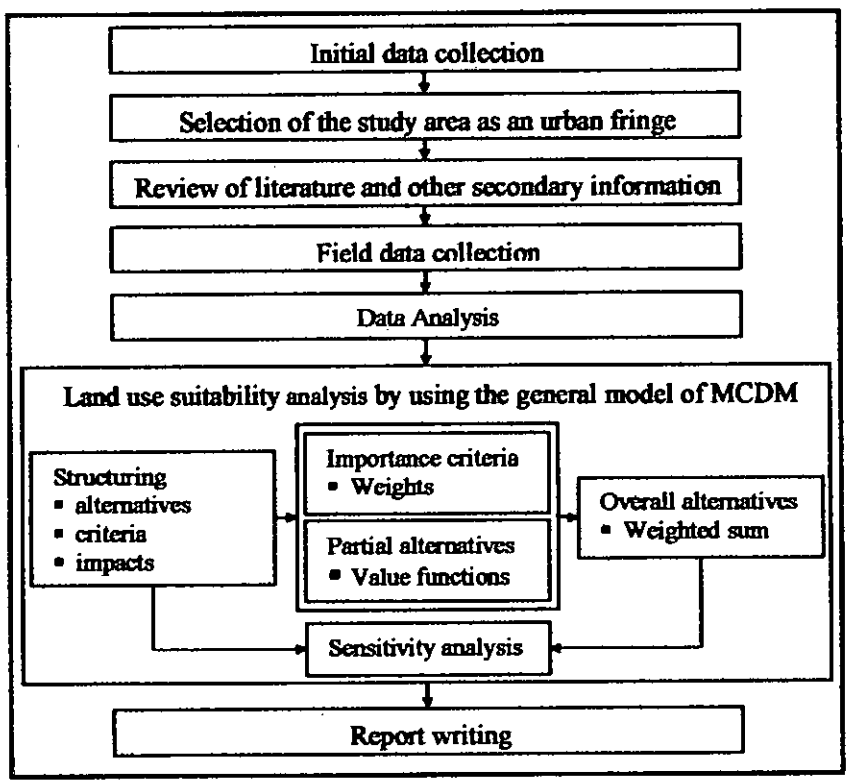


Figure 1.1: Flowchart of the Methodology

1.5 Scope and Limitation of the Study

A few research conducted on the urban fringe of Dhaka city as well as Asian countries and other countries of the world. Some of the studies have emphasized on sustainable development of countryside around town. A study was conducted on peripheral areas in 1989 when Rampura was a fringe area. There is no recent research conducted on planning point of view about urban fringe in Dhaka city.

A comprehensive and thorough study requires much time and resources. This study has been conducted on selected survey area of fringe area and concentrated on selected factors relates to land development. Therefore, the study has not covered all the peripheral areas of Dhaka city.

The discussion on the planning effort, that have been studied but it is limited on the fringe area part only. It is often very much difficult to get reliable information from different planning organizations about the present problems and issues on fringe areas. As a result the information relevant for this present research were mainly collected through a primary survey, observations, interviews, and finally the author's judgments and experience. Application of MCE technique to analyze the suitability of land in the study area requires inclusion of number of criteria. Due to the limited scope of the study many criteria has been simplified or even ignored.

In spite of all these constraints the study will provide at least an opportunity to examine the problem in its real perspective leading to some degree sequential progress towards the expected solution.

1.6 Organisation of the Study

The research has been organized in seven chapters. The first chapter provides the introduction including the introductory, objectives, and statement of problem. Chapter two describes the urban fringe area and Dhaka city, it includes the detail definition of urban fringe, its characteristics, trends and study area as an urban fringe and also describes an overview of Dhaka and presents trends of urban development. Chapter three deals with the planning efforts of Dhaka and it's history. It includes a brief review of plans for Dhaka City master plan, structure plan, urban area plan, and others under DUTP etc Chapter four narrated about the study area including location, area, population, characteristics & description of the study area. Chapter five represents the

concept of MCE & its application of Urban Land Use Planning. Chapter six is for application of MCE on the study area to select the suitable land for urban development. It is an example of MCE as an effective method of planning. And last but not the least chapter seven contains some concluding remarks to set some policy and standards of study research.

2 Fringe Area and Dhaka City

2.1 FRINGE AREA

While urban fringe areas act as a bridge to the wider countryside, the countryside around towns is also seen as providing land and resources for a combination of agricultural production, physical space and settings for residential use and recreation (Hodge. 2001). For the majority of the population, the urban fringe is the first experience of countryside, and for the countryside itself, it is the leading edge of urbanization. With rapid social and economic changes, the countryside around towns is now under increasing threat, and as a consequence, appears more precious than ever before.

In terms of urban development patterns and trends, the urban fringe is a pressure point, residual element, and container for urban structures. Urban fringes are by their nature zones of rapid transition and change, where new land uses need to be accommodated while previous ones become dysfunctional.

2.2 COUNTRYSIDE AROUND TOWN (CAT)

The countryside in and around the city has different name depending on these form, shape and position. They may be urban open space, urban edge, inner fringe, and outer fringe (Figure 2.1).

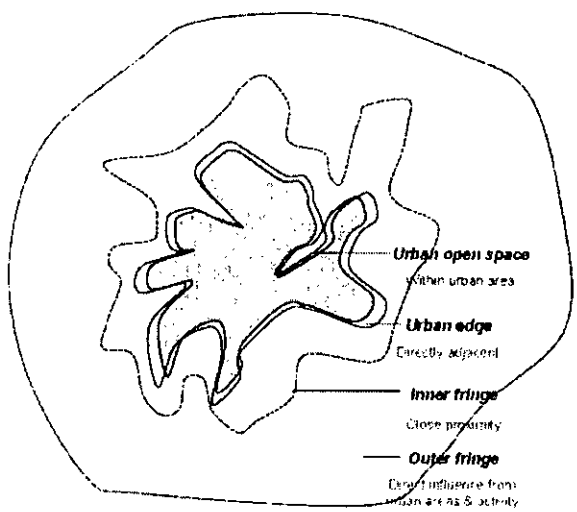


Figure 2.1: Diagrammatic Representation of CAT
Source: CAT Report, 2002

2.2.1 Urban Open Space

Urban open space is the larger or strategic areas of open space or open land within the city itself. They may be planned or unplanned. Urban open space helps to ensure better living

environment. Sometime large vacant land serves the purpose of open space.

2.2.2 Urban Edge

Urban edge is the boundary between any built-up areas and open land, together with land parcels immediately adjoined to the built up area. This area is mainly the starting point of urban fringe.

2.2.3 Inner Fringe

Inner fringe is the fringe area with urban flavor. They are open land or open space, predominantly in mixed or non-rural uses, in large metropolitan areas, or surrounded on more than one side by built-up areas or urban infrastructure.

2.2.4 Outer Fringe

Like the inner fringe outer fringe is the fringe area with rural flavour. They are open land or countryside around freestanding settlements, predominantly in rural uses, but significantly affected by urban pressures, depending on the size of settlement. The outer fringe category is clearly a flexible definition, depending on what is perceived as an 'urban pressure'.

2.3 URBAN FRINGE: SOME DEFINITIONS

The urban "fringe" is that part of metropolitan areas that is not settled densely enough to be called "urban". Low density development of new houses, roads and commercial buildings causes urban areas to grow further out in to the countryside, and increases the density of settlement in formerly rural areas (CAT Report: 2002).

The peripheral growth of the city explores the land use composition and the function of fringe developments. Traditionally city does not expand outward in an orderly manner rather it extends haphazardly. Thus an incoherent land use pattern represents the fringe area. A fringe of a city is the result of its spread outward. Some definition of the fringe area can be stated as follows:

a) The urban fringe has an important role-play in urban development. The urban fringe represents opportunities for growth and innovation, converting agricultural land to urban uses often involved investments in infrastructure such as roads,

sewerage, utilities and schools. as well as open space on the social scale and fencing, drainage landscaping etc on the individual private scale. (Mori, 2001 cited in Islam 2003).

b) "A particularly problematic area quite close to a given city boundary, which for all practical purpose is an integral part of the core city" (Prakasa, 1964).

c) "A kind of partially integrated, semi urban, slum squatter, stagnant settlements at the periphery of large urban metropolitan centers" (Kabra, 1980 cited by Rahman, 1989).

Elaborating on this formulation urban fringe can be defined as "a transitional or twilight zone situated in between well recognized land uses of the city and the agricultural tracts of the village, inhabited by relatively low-income, marginal groups with consequent emergence of slum like conditions in their midst. It is, generally speaking, smaller than the commuting or trade area of a city and can be distinguished in terms of peculiarity of land uses. In fact, most of the land uses in the fringe are in a flux where industries, residential quarters, commercial places, streets, drains, shacks and slum jostle in space."

d) "A circumferential belt surrounding the average central city separating it from agricultural lands in which the city and urban fringe area analogous to an island with a bordering beach". (Murphy 1974).

e) "Urban fringe is the zone of transition in land use and social and demographic characteristics, lying between (i) the continuously built-up urban and suburban areas of the central city and (ii) the rural hinterland, characterized by the almost complete absence of non-farm dwelling occupations and land use; and of urban and rural social orientation; and incomplete range and penetration of urban utility services; unconditioned zoning or planning regulation' Arial extension beyond although contiguous with the political boundary of the central city and an actual and potential increase in population density, with the current density above that of surrounding rural districts, but lower than the central city." (Pryor, 1968).

f) Clawson, 1960 (cited by Rahman, 1989) explains that the demand for urban peripheral land has been growing, primarily because of more people living in cities and their extending urbanized areas. Followed up by Pryor (1968) adds, that the demand for the peripheral land can also be resulted from the personal decision

and motivations of the individuals, along with the search for less congestion, more privacy and access to employment. But these decision and motivations vary from individuals to individuals and may be co-related with socio-economic status. In addition to these, work can give another important reason. He explains that the demand for the peripheral land can also be necessitated for the proper functioning of a city by placing its various secondary functions over there.

g) Hart (1976 cited by Rahman 1989) explains that the demand for the urban peripheral land has been growing increasingly because of the high-speed highway along with the high-speed automobile, which together makes an easy commuting distance from urban jobs.

h) Ramp's (1975 cited by Rahman 1989) study on urban peripheral land leads to another direction. He argues that the demand for the peripheral land is the consequences or Government policies that have directed and subsidized large-scale investments over long periods of time.

Reviewing the above definition for the present study the fringe area can be defined as the area where mixed urban and rural land uses are found and agriculture land use predominates. Most of the people are supported by work in the urban area. The provision of utility services is incomplete, majority of the peoples is living inheritably and highest percentage of the houses is not permanent in structure.

But as all these explanations came mainly from the studies of the cities in the western world, and so, it cannot be generalized for the cities in the developing countries. In most of the developing countries, the personal decisions and motivations of the individuals to search for land in the urban periphery for less congestion, more privacy or leisure are rare to happen, because the net work infrastructure and the commuting systems in these countries are often poor. Moreover, the majorities of the city dwellers are poor, and usually want to stay near to the city center where most of the job opportunities are concentrated. In addition to these, unlike western cities, the Governments in the Third World cannot subsidize large scale investment due to the institutional, financial and management problems. As a result, the demands for the urban peripheral land in the developing countries are largely dependent on its proximity from the city center, and its accessibility.

2.4 CHARACTERISTICS OF FRINGE AREA

Wissink (1962 cited by Rahman 1989) Characterizes urban periphery as an area of great differentiation where various land uses with underlying farming are intermingled in a random fashion rather than a homogeneous one.

2.4.1 General Characteristics

General characteristics of fringe area stated as follows:

- Changing pattern of land occupancy.
- Residential expansion is rapid.
- Lack of water supply system.
- No public sewerage system wastewater disposal and drainage system.
- Lack of curbs or side walks.
- Population is mobile and of low or moderate density.
- Unpaved and unaccepted streets.
- Lack of city carrier services.
- The majority of the families are middle class family.
- Speculative building is common.
- Low density of population is predominant as contrasted with the high density of central city.
- Most of the peoples are supported by work in the CBD.
- The citizens of fringe area demanding regular municipal services.
- A wide mix of land uses from untouched rural villages to modern residential estates, from variety of commercial and industrial development.

2.4.2 Physical and Social Characteristics

About dwellings in peripheral area, Pryor (1968) found, that most of dwellings in the peripheral are incomplete and temporary with less number of rooms, but the lot sizes are greater than those of the urban area itself. In addition to this, the average house rents in the peripheral area are lower than the urban place, but higher than that of the

surrounding rural areas. Socioeconomic characteristics of urban periphery show that the majority of the dwellers, especially, in the residential peripheries, have the socio-economic status in the high and upper middle-income brackets. Though the residents are usually economically tied to the central city, but they prefer to live in the periphery for spacious living. He also found that though the residents exhibit a low degree of socio-community participation and associational ties but they are generally well satisfied with their location with the exception of unsatisfactory utility services.

2.4.3 Administrative and Planning Characteristics

Besides these physical and socio-economic characteristics there are also studies which have identified its administrative and planning characteristics. Bukman (1964 cited by Rahman, 1989) identified that the peripheral areas are characterized by the excessive and premature sub-division and undergoing a transition or stagnation in land use due to the tax delinquency. Moreover, by the provision of landuse zoning and by providing desired services through Government intervention is very much needed in peripheral area for the planning and control.

Characteristics of urban fringe in the above discussion is mainly based on the studies on cities in the western world and so, there has been found many differences between those cities and the cities in the developing world.

2.5 Fringe Area Development Trends

In Bangladesh, it is mainly by the low-income people who prefer to live in fringe mainly because of its proximity to the city center and low cost of land and house rent. Fringe areas in Dhaka City are continuously going under changes. Areas considered as fringe 40years back are now part off inner city. Currently Dhaka City is surrounded by fringe area in all directions. The trend of sporadic development is much more evident in the eastern fringe of Dhaka city. The major development works in these areas are carried mostly by individual household sector, private developers and partially by public sector. But all such attempts lack appropriate policies, strategies and sustainable planning proposals for the potential expansion of the city in this direction. The situation was worse since the inception of growth in the area and further augmented with the passage of time. Presently the area is marked by haphazard and unregulated growth environmentally substandard settlements,

overcrowding, slum and squatter settlements, traffic congestion, unsanitary situation and chaotic uses of land.

The fringe land development during 50s to 70s have been mostly (a) the public sector agencies (b) the individual households while (c) the formal private sector agencies played a minor role. During this period fringe lands were developed and used for different purposes including residential, industrial, institutional and agricultural uses by the above agencies. Public sector was mainly responsible land development and land conversion from rural to different urban uses during this period. The public sector has also made large-scale conversion of agricultural land in the inner and outer fringe into residential area, for example, Tejgaon and Tongi in the 50s and Joydebpur in the 60s.

Some other examples of fringe area development during 1950s-1970s are as follows:

- Development of Mirpur into a large residential satellite in the 50s and 60s by the housing and settlement directorate (north-west periphery);
- Development of Gulshan as a high status residential area in the 60s by the RAJUK (in the north-east fringe);
- Development of Uttara as a large middle and upper middle income residential suburb beginning in the 60s by RAJUK;
- Development of Khilgaon, Bashaboo, Madartek, Goran, middle and lower middle income residential suburb in the 60s (north-east, fringe);
- Development of Rampura, Badda middle and lower middle income residential area in the 70s (north-east periphery);
- The Government decided to retain DND area as agricultural land in the late 50s and 60s. This large area has now been turned into a lower middle class residential area without official approval;
- Large tracts of fringe lands across the river Buriganga south of the city have been brought under mixed use of industries were houses and lower income residents, by a combination of public and private efforts, but more prominently by private initiative.
- Conversion of the outer fringe into academic, military or other institutional

uses were also initiated by the govt. in the 60s and early 70s, e.g. Jahangirnagar university campus at Savar in the 60s and the Cantonment at Savar in 70s.

It is evident from the above example that transformation of fringe areas took place by both govt. and private initiative and in a planned or unplanned way.

The role of the housing agencies, such as the housing companies and housing cooperatives in converting the inner and outer fringe lands (mostly agriculture or forest type) became noticeable even from the mid 50s. Thus out of 181 housing societies and housing cooperatives registered by 1980s, as, many as 46 were formed between 1953 and 1964. However their actual contribution to development of fringe lands for residential purposes during 50s and 60s was restricted mainly to purchase of land for future sale and distribution. Later some housing development also took place, a good example being the 'Bank town' near Savar. (Islam et al, 2003).

The conversion of the fringe lands into residential use area was done by the individual households to a large extent. The residential developments in the fringe lands have been made by the lower middle-income households. In general the role of individual household in the residential development process is very significant because more than 90 percent of the housing stock in the city has been provided through this process.

The development of metropolitan fringe land has taken place in the 80s under all the agencies, which were operative in earlier decades. However, their roles have been changing a little. Besides, land and residential development through squatting and slum growth is one of the current features in metropolitan fringe. Land is usually developed through government agencies in the inner as well as outer fringes. In Dhaka city, it is mainly RAJUK, which is responsible for land and housing development and to lease out land to private individuals, usually for a period of 99years. The plots are then transferred by the authority to private individuals for a lease of 99years and allocation of such plots are supposed to be made considering income, occupation, age, previous ownership of land in the city, income tax etc.

Land and residential development through private sector housing companies or housing societies cooperatives has become more active in the 80s in the fringe areas of Dhaka city. The commercial housing companies bye land in the fringe areas, then

make subdivision plan for that particular land parcel and get approval from the concerned authority. Then they subdivided the land, sometime develop it filling and then make allotment. Only a few among the many real estate companies have gone for housing development itself. However, increasing number of such companies seems to have become interested in actual housing activities in the recent years. It has been alleged that commercial housing companies are motivated primarily in making high profits and are occasionally involved through land transaction. The cooperated society supported land housing developments are concentrated mostly in the outer northwest fringe and the inner northwest fringe. Only recently some societies have also started to operate in the eastern fringe areas.

The private individual households have always played the most significant role in housing development Dhaka city. Their role has always been equally important in land and residential of the urban fringe of Dhaka. In the fringe area, the rural landowners are the land developers, land sub-dividers and land speculators. They sub divided their land themselves, without any approval from the government authorities and as a result the road patterns and building plots are often laid out in an unregulated manner.

Since most land in the fringes of metropolitan Dhaka are low and liable to annual flooding, the individual household which buys the land also develops it, generally by earth filling. Generally land in the fringe where slums and squatters emerge are marginal in quality, mostly low lands liable to flooding liable to flooding almost every year. Infrastructure facilities including access roads are either absent or highly inadequate. Houses are of semi-permanent or temporary nature. The occupants are obviously the poor.

2.6 Problem Associated with Fringe Area Development

The growth of activities in an urban area has influenced the nature of the fringe areas, which transformed from a dominantly agricultural use to an area with mixed uses. The conversion of the urban fringe lands from rural to urban uses does not usually proceed in an orderly and efficient way; rather it creates several problems. The general problems of the fringe area growth are haphazard and scattered, conflicting land use, sub-standard settlement and inadequate network infrastructure (Yasmin, 1988 cited by Taufique, 1995).

The rapid population growth of major cities is accommodated by their outward expansion, which takes place, by conversion of their urban fringe lands from rural to urban uses. As described by Archer (1989) this urban development has three main parts, these being the construction of the network infrastructure, the subdivision of the land holding in to streets, open space and building plots, and the building development of the plots. Although most urban fringe and is usually privately owned and privately developed, the Govt. sector is normally responsible for providing the network infrastructure trunk lines as well as the social infrastructure.

The urban fringe is usually fragmented into many small land parcels. These parcels are small, often irregularly shaped and usually without any public road frontage. So they can't be separately subdivided into building plots and streets connected to the metropolitan road network. Moreover, most of the fringe areas are low lands and subject to flooding. The land parcels need to be consolidated for urban development purposes, but the private land sub dividers find this difficult because there are many owners to be negotiated with.

2.7 FRINGE AREA: IN PRESENT STUDY

For this study, a small part of inner fringe area has been considered. The area is surrounded by Progoti Sharani on the west, Begunbari khal on the south, Balu river on the east and the main road project on the north. The area is characterized by typical characteristics of an urban fringe.

- It is located just on the eastern edge of the city.
- Urban characteristic area predominant than rural and conversion is taking place from rural to urban.
- Most of the lands are low and subject to flooding.
- Conflicting land uses and substandard settlements with inadequate infrastructural facility.
- Low cost of land and house rent compare to the urban areas but higher than rural areas.
- Excessive and premature sub-division of land and undergoing a transition land uses.

2.8 DHAKA CITY AND ITS URBAN DEVELOPMENT TREND

It is the fact that the finest achievements of civilization of the world, from the past to the present, are cities. In every country, cities are the social, cultural, communication, economic and commercial centers of national life. It is geographic areas dominated by continuous production of ecological goods and services. In ecological terms, the city is a node of pure consumption existing parasitically on an external resource base- which must be somewhere, it must be adequate, it must be available and it must be grow if the city grows. Economists see them as the locus for intense socio-economic interaction amongst individuals and firms and the engines of production and national income growth. This chapter describes the overview of Dhaka City with its topography and climatic conditions; it also includes unplanned urban development, which are under pressure.

2.8.1 Dhaka, the Mega City

During the 1970's the United Nations (UN) established the title, Mega City, for cities around the globe that housed a population above 8 million by 2000. However, there is no agreed term defining a mega city. The Asian Development Bank (ADB) also uses the same term; however it requires a city with a large population, a complex economy and a unifying transport system. According to

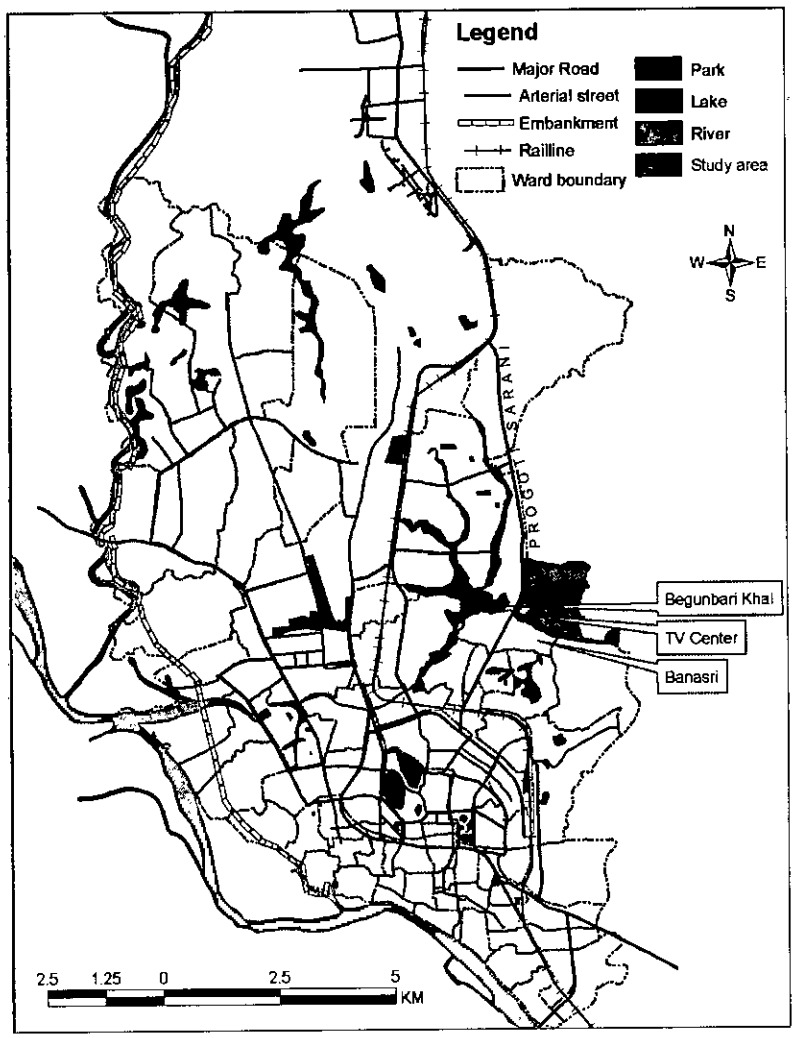


Figure 2.2: Map of Dhaka city showing the study area

the ADB, a developing nation's city must have over 10 million in population to be classified as a mega city. There are four mega cities in India and Dhaka has become the fifth populated Mega City on the globe. Figure 2.2 shows the study area on the map of Dhaka city.

Dhaka is now termed as 'Mega-City' where the population bomb has already been exploded. More than a crore people now live in the city with innumerable problems. Mega cities have both positive and negative features. They generate a higher-than-average proportion of the nation's output of goods and services; they are centers of innovation in science, the arts, and lifestyles; contain many of the cultural assets of the country; and offer some of the best opportunities for people to lead full and satisfying lives (Ali, 2000).

Yet, mega cities also suffer from a shortage of water, environmental pollution, traffic congestion, and proliferation of slums, crime, and social alienation. With the increasing globalization of business and industrialization of Asian economies, most of the region's mega cities will continue to grow and to play a significant role in economic production, social organization, and knowledge generation. At the same time, their quality of life and their productivity could be adversely affected unless steps are taken to improve their management (Ali et al.1996).

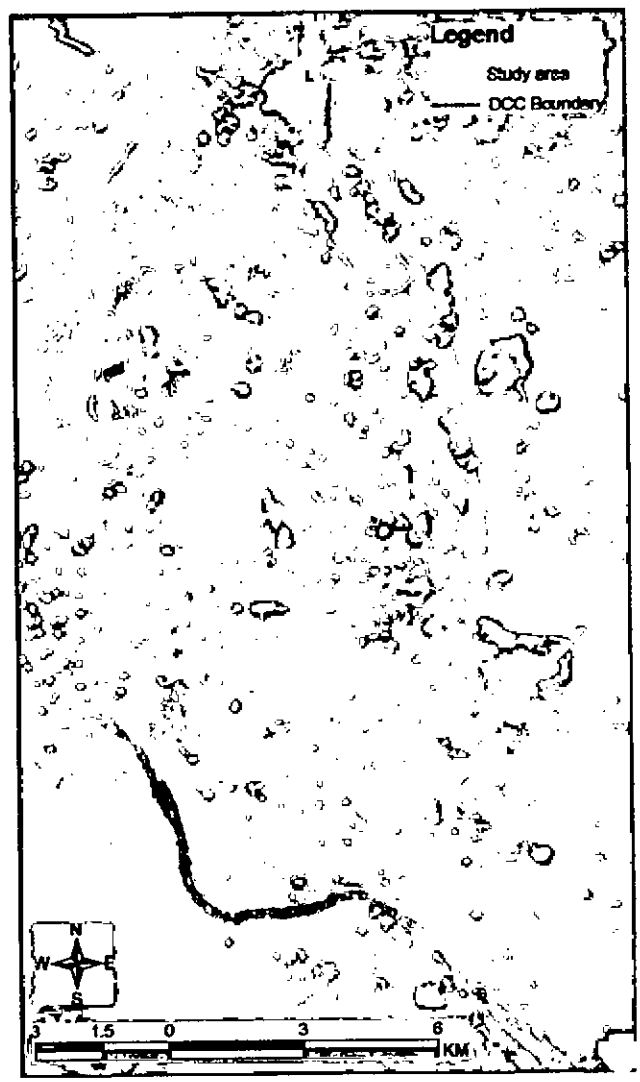


Figure 2.3: IRS Image of Dhaka city area

2.8.2 Land Use Pattern

It is the fact that all flood free area in Dhaka City has already been developed. Physically, it is dominant character in the small area, which is permanently flood free. Savar, further 15 km away towards north-west, still has undeveloped flood free land. The areas to the west, south-west and east of the city are low-lying and consequently underwater for many months. This imposes a significant constraint on development of this area. Its shape has been made by the relative susceptibility to flooding. Last 30 years of development, its population has been grown more than 6 fold but the urban land has not been developed proportionately. Therefore, this situation has significant impact on the land use pattern. Figure 2.3 shows a satellite view (IRS 1996) of Dhaka city area. The first "Master Plan 1959" which was proposed the following different land uses.

It is clear from the Table 2.1 that 42% land was designed for the open space in and around the Dhaka City in 1959. Within the area, 5.14% was proposed as urban recreation area (park) and rest 36.86% area marked as buffer land for annual flood. More or less the city was designed to a garden city. Due to socio-political and socio-economic changes, the 59's provincial town became the capital of Bangladesh. But, the 59's plan was not updated or revised for the capital of Dhaka. Therefore, unplanned and spontaneous urban growth is the common phenomenon in this city. Proposed 42% land was converted to different uses due to the demand of growing population. The existing urban area became over saturated. The existing land uses are described in the following table (Table 2.2).

Table 2.1: Land use in Dhaka City. 1959

Land use	Area acreage	Area in hectares	*% of total*
Housing	5848	2362.59	22.45
Industry	906	366.02	3.48
Central business	246	99.38	0.94
Commerce	330	133.32	1.27
Ware house	388	156.75	1.49
Govt. center	100	40.4	0.38
Govt. area	456	184.22	1.75
Education	942	380.56	3.62
Main road	790	319.16	3.03
Open space	1338	540.55	5.14
Cantonments	971	392.28	0.43
Reclamation area	3766	1521.46	14.46
River & flood plain	9389	3793.16	36.04
Railway land	439	117.35	1.69
Steamer & business	26	10.5	0.10

Source: Master Plan, 1959

From these two different land use data sets, it is clearly identified that the significant change was occurred in the housing sector. Within the thirty years, planned residential areas increased from 22.5% to 25%, but unplanned residential areas increased by 37%. Where as the urban green decreased by 1.5%. It is important to point out that the 59's plan was prepared for 1.5 million people but that plan was valid until the DMDP Structure Plan was approved.

Table 2.2: Land uses in Dhaka in 1995

Land uses	Area in hectors	% of total
Planned residential area	2976	25
Unplanned residential area.	4444.64	37
Govt. Administrative	440.8	4
Educational Institution area.	236	2
Industrial area	636	5
Other Institutional area	395.2	3
Urban green area	425.6	4
New airport area	616	5
Old air port area	240	2
Cantonment area	1135.2	10
Central commercial area	84	1
Commercial area along road	270	2
Total	11899.44	100

Source: Unpublished Research by Taufique, 1995

The Master Plan in 1959 did not provide a map of the land use of the Dhaka Statistical Metropolitan Area or the Dhaka Metropolitan Area (Islam, 1996). Surveys conducted in 1991 by the Japanese International Cooperation Agency (JICA) produced a land use map of the 265-sq. kms of the Dhaka Metropolitan Area. The studies showed that only 19 percent of Dhaka City's land was used for residential purposes, 8 percent on commercial and industrial usage, 11 percent for roads and other categories, 4 percent for village settlements, 45 percent for agricultural usage, and a further 14 percent of the capital is occupied by water (GOB, 1991); only 39 percent of the city's land was urbanized while the rest 61 percent was used for agricultural and non-urban rural usage.

2.8.3 Population Growth

Table 2.3: Urbanization in Bangladesh and Growth of Population in Dhaka between 1951-2001

BANGLADESH				*DHAKA CITY*	
Year	Total Urban Popn ('000)	Percent of Popn. Urban	Annual Rate of Growth	Population	*Annual Rate of Growth*
1951	1820	4.33	1.58	335928	*1.28*
1961	2641	5.19	3.72	550143	*5.18*
1974	6274	8.78	6.70	1607495	*9.32*
1981	13228	15.70	10.97	3440147	*9.994*
1991	22450	20.15	5.40	6105160	*5.90*
2001	2,88,08,477	23.39	-	12,300,000	*1.96*

Source: BBS, 1981, Population Census 1991 and Preliminary Census Report of 2001.

The level of urbanization and urban centers in Bangladesh grew at a sluggish rate up to the 60s. Ever since the Liberation War in 1971, the number of urban centers flourished at a faster rate. Bangladesh's 22,450,000 total urban populations in 1991.Dhaka was the home of 6,105,160 urbanites. The growth of Dhaka from 1850 to 1995 can be seen as the growth of the urban population due to several factors, i.e., rural to urban migration, natural native population increase, and the expansion of Dhaka City's borders. By 1991, the urban population rose to 6,105,160. The City housed a population of 12.3 million in 2001.

Table 2.4: Population changes in Dhaka Metropolitan Area, 1961-2016

Year	Population	Growth rate	Remarks
1961	709471	-	-
1974	1950252	8.0	1961-74 trend rate of growth
1981	3458602	8.5	1974-1981 trend rate of growth
1991	7334000	7.8	World Bank estimate
2001	11162000	8.2	Structure Plan estimate
2016	15569000	8.33	Structure Plan estimate

(Source: Census Report and Dhaka Structure Plan, 1995-2015)

In 1961, Dhaka's population was only 709471 and only grew to, 19,50,252 by 1974. However, Dhaka's growth rate in the same period was at a rate of 8.0 percent. By 1981, Dhaka's population was 34,58,602 people with annual growth rate of 8.5 percent between 1974-1981.

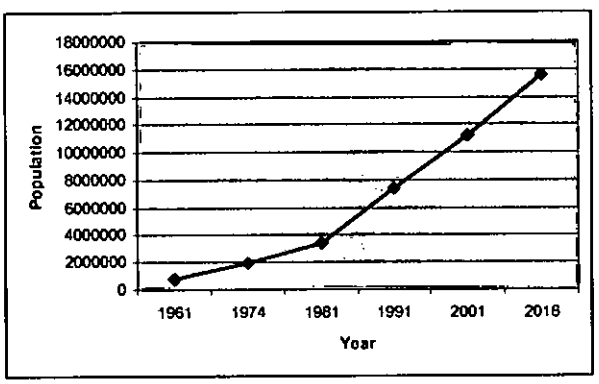


Figure 2.4: Population growth of Dhaka city

It is observed that the population is increasing rapidly, especially in defined fringe areas of Dhaka City; the land in urban use is also increasing in the fringe areas. Populations of these are shown bellow (Table 2.5):

Table 2.5: Population growth in fringe areas

Fringe	Zone	Population 1991	*Population 2006*
Northern fringe (Uttara-Tongi)	14	200000	*480000*
Northern west fringe (Dhaka-Savar)	17	363000	*760000*
Southern fringe (Dhaka- chittagong)	1&7	1068000	*1740000*

Source: Strategic Growth Option, Dhaka 2016.

It is apparent that heavy growth that is taking place is likely to be doubled by 2006. Such a huge increase in population will have severe impacts on utilities and socio-economic facilities that are already inadequate compared to the demand.

The DMDP Master Plan envisages the city planning up to 2015. The World Bank and Bangladesh Centre for Urban Studies authorities recently in a joint perspective study commented that a number of Asian countries, with lesser or equivalent GDP growth rate, have achieved remarkable progress transforming themselves from largely agrarian and underdeveloped economies into dynamic industrial and export powerhouses. The experience of these high-performing economies provides many useful lessons for Bangladesh in identifying the right policies and strategies to adopt, while reversing/ renewing or shunning what has proved to be wrong.

3 Urban Planning in Dhaka and Its Fringe Area: Past and Present

This chapter contains a brief discussion on major efforts of planning for Dhaka City in last 400 years. The history is classified according to different ruling periods. This chapter also includes a brief description of the plans that has been made for the well being of Dhaka city.

3.1 History of Development of Dhaka City

Dhaka continued to grow unhindered from 1610 to 1717 under the Mughal rule. For the whole of this period excepting 1639 to 1659, Dhaka remained the capital of East Bengal and Assam. In 1639 the capital was removed from Dhaka to Rajmahal where it remained till 1659. Dhaka was designed and developed to control the trade and commerce and for collection of revenue from the region of Eastern Bengal. Unfortunately in 1716 capital of Bengal was shifted from Dhaka to Murshidabad.

Figure 3.1: Historical development of Dhaka city

This gave a blow to Dhaka's further prosperity. But this could not destroy the economic potentiality of the city. In 1757, after the British conquest, the decline of Dhaka began in real sensc. Historical growth of Dhaka City is showing in Figure 3.1.

Between 1801 and 1840 many densely populated locations were largely abandoned. In 1837 the Government of Bengal expressed its cautious willingness to ameliorate urban living conditions and passed a modified chaukidari. The Bengal Act III of 1864 which lead to the establishment of the Dhaka Municipality was a landmark in the city urban development. This Act not only created an institution for urban development but also empowered it for the first time, to impose taxes for financing improvement works. The Municipality undertook a number of improvement works immediately after its inception. A special Act for improving the sanitaria condition of the town of Dhaka Act III of 1870, was accordingly passed, which, together with Act III of 1864, gave the Municipality a very wide range of fiscal financial and civic powers. Following the enactment of conservancy Act of 1870, Municipality made elaborate arrangements for town cleaning and sewerage removal. (Nasrin, 1989).

One of the successful improvements on Dhaka's urban life was marked by installation of modern water works near Lalbagh area, a product of public Charity and municipal funding. In 1878 the water works opened with a capacity of 35,000 gallons a day.

After partition of India in 1947, Dhaka became the capital of the then East Pakistan. At that time the city had to accommodate new administrative establishment and increasing population including incoming refugees from India. The Communication and Building (C&B) Department was the central body to initiate major infrastructural and development and building activities in the public sector. This department prepared the layout plan of Tejgaon Industrial Area in 1950, which ultimately was not implemented.

In 1948, the East Bengal Government created the Planning Division to cover areas of architecture, communication building and irrigation. A sub-committee prepared a physical plan of Dhaka city for its future growth. The plan was prepared in a period of twenty-five days only. The plan covered areas, like major and secondary roads, railways, cottage and small scale industries, development of airport, rail station, office, open space, residential areas, administrative zones, offices, missions and residence of government officers. Total area planned was thirty square miles. This

plan was implemented partially. The areas developed according to this plan are Azimpur, Motijheel and Tejgaon. With the growing importance of Dhaka, the tempo of development in the city was getting faster at the beginning of fifties. The DIT came into being in 1956 with a view to create a new planning and development Organization for the city to gear up its planned development. It was the outcome of:

(1) The East Bengal Building Construction Ordinance, 1951;

(2) The East Bengal Building Construction Act, 1952; and

(3) The Town Improvement Act 1953.

The first ordinance and Act were designed as instruments to halt haphazard construction, which was "Likely to interference with the planning of certain areas". These were not, however, planning laws. It merely gave power to the provincial government to approve building applications a power previously vested exclusively in the municipal bodies. The 1953 Act was copied verbatim from the 1911 Calcutta Improvement Act. It described the DIT as a development agency authorized to take over municipal and private property re-build of otherwise improve an area, as soon as possible, return property to the original owners. The trust was given the power to prepare zone plans. The DIT was also authorized to review and veto building applications approved by a municipality a power related to its development role.

In its initial form the Town Improvement Act continued a tradition of government well entrenched in the subcontinent, the separation of development and maintenance functions. Once an improvement was completed the area was to be returned to the relevant municipality for permanent management. Conceptually, the DIT was even setup as a temporary body. It was to complete all of its improvement schemes and then be dissolved its assets and liabilities being taken over box appropriate municipal bodies.

Consequently the Town Improvement Act was amended by the Town Improvement (Amendment) Ordinance, 1958. The amendment sought to turn the DIT into a management agency, having a master planning responsibility and control over building applications, in addition to its development rule. The 1958 amendment marked significant transfer of municipal functions to a statutory and improves for authority. At the same time it recognized the presence of the DIT as an institution. (Nasrin, 1989).

In 1959 DIT prepared a Master Plan for its 320 sq. miles area including the city. The plan was approved by the government in 1960. According to Town Improvement Act, 1953, DIT undertook many city development projects that can be classified into nine categories, as follows:

(1) Construction of Roads

(2) Development of Industrial Estate

(3) Development of Commercial Area

(4) Construction of Shopping Area

(5) Development of Housing

(6) Construction and Sale of Flats

(7) Construction of Staff Quarters

(8) Development of Rehabilitation Zone

(9) Creation of Recreation and Service Facilities

During 24 years after the partition of India, significant political changes took place in the country, which also induced changes in socio-economic structure of the city. Population of the city almost tripled during this period. Commercial, administrative, social and political activities of the city increased, which called for development of commercial establishments, offices, educational institutions, hospitals and above all residence. Till 1971 the Dhaka city was stretched from Buriganga river in the south to Mirpur, Gulshan, Banani in the north; Mohammadpur, Rayer Bazar, Hazaribagh and Nawabganj in the west to Khilgaon, Ramalapur, Gopibagh, Jatrabari and Dholarpar in the east. However, Comparative to old part of Dhaka, density in new Dhaka was thin. (Nasrin, 1989)

After independence in 1971, Dhaka became capital of the country. This historical change in status of the city brought about dramatic changes in the socio-economic and physical character of the city as well. Unprecedented population growth took place during the first decade after liberation. Rise in population was also marked by physical expansion of the city. The expansion trend of the city continues with the growth of population.

In the east, Bashabo, Manda, Mughdapara, Dhania Jurain, etc areas were developed. In the west, however, growth was closed by existence of deep low-lying lands beyond Mohammadpur and Rayer Bazar. In the south overspill took place indiscriminately in Keraniganj area, beyond the Buriganga River. In the north, expansion was blocked by deep low lying lands beyond Mirpur, Malibagh, Rampura, Badda, and these areas started getting populated since mid seventies. But posh residential area at Baridhara and diplomatic enclaves established in the city with serious drainage problem

For all practical purposes, the DIT is the planning and land development authority for greater Dhaka. Since its inception, DIT's role as a planning-cum-development authority of the city has been under controversy. In 1987 the name of DIT changed to Rajdhani Unnayan Katripakha (RAJUK), following the prototype of the Calcutta, Madras and Jakarta Metropolitan Development Authorities, through the amendment in the Town Improvement Bill in the Parliament. The Board of Trusties, which had administered the DIT, has been abolished and the new authority has been given more 'direct' and executive power than it had previously. As an initial step, the metropolitan planning limit was extended in 1987 by extension of jurisdiction of the then DIT from 320 sq miles to 590 sq miles. This latest extension added 270 sq miles to RAJUK covers most of Savar, Joydevpur, Keraniganj and Narayanganj in its fold for purpose of regulatory control.

All the other agencies are primarily service organization, responsible for delivery of specific services to the city. The Dhaka municipal was turned into a municipal corporation through Government order in 1978. Subsequently, in 1982 two adjacent municipalities of Gulshan and Mirpur were merged with the Dhaka municipal corporation. As a result, the Dhaka municipal corporation area coverage was extended. A separate ordinance for the establishment of the Dhaka municipal corporation was formulated in 1983 repealing the application of Paurashava ordinance, 1977. DMC used to share responsibility with some of the other organizations for example with RAJUK in some areas of physical development, with DPHE and WASA in extension of sanitation facilities, and with the Ministry of Health in extending occasional health services of various organizations responsible for the delivery and maintenance of the urban services.

Subsequently Dhaka Municipal Corporation was renamed as the Dhaka City Corporation (DCC). In DCC, there are more than sixteen government/autonomous

organizations directly involved and nearly thirty other organizations indirectly involved in urban development activities. The administrative boundary of different organization is shown in Figure 3.2.

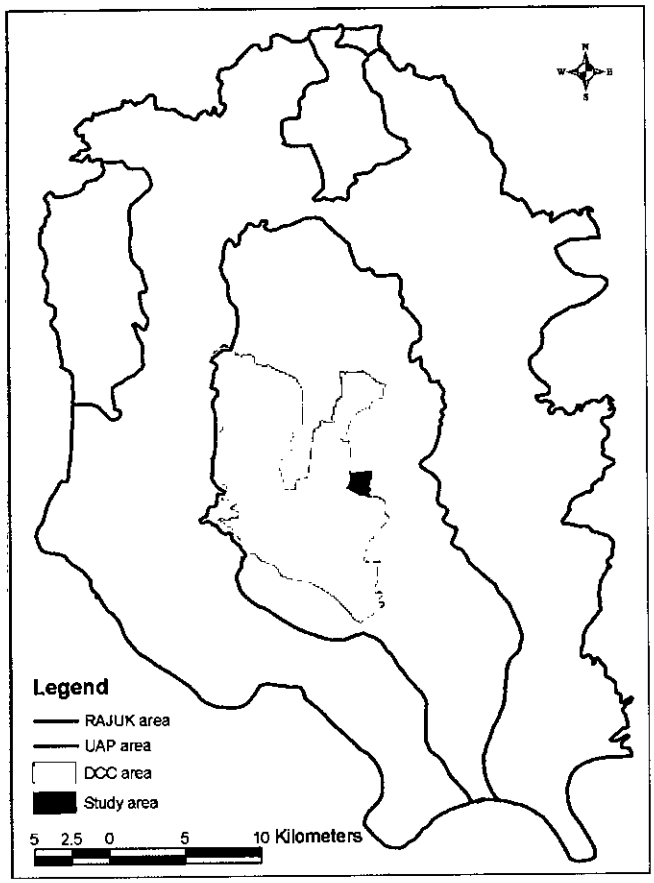


Figure 3.2: Boundaries

3.2 DEVELOPMENT PLANS FOR DHAKA

The current metropolitan planning project (DMDP) is the third study to look at the growth and development of Dhaka comprehensive fashion. Other planning studies have been undertaken for specific parts of Dhaka, either in connection with RAJUK's own proposals or with various improvements and developments aided by multi-lateral agencies. A number of sectoral level studies of Dhaka have been completed. Other national and regional studies contain recommendations, which apply to the capital, currently, a number of relevant studies have already started or will soon do so.

The physical boundary of Dhaka city has grown from 72 sq. km. In 1951 to the present size of 265 sq. km, Dhaka City Corporation (DCC) area. Compared to present DCC area of 265 sq. km, the RAJUK administrative area is 1528 sq. km with population of nearly 6.84 million in 1991 and 7.0 million in 1994 (Rahman, G and Toufiq, M. S. 1993) of Dhaka have been dominated largely by the physical configuration.

3.2.1 The Dhaka Master Plan 1959

The Dhaka Master Plan was prepared by foreign consultants working with officials of the Dhaka Improvement Trust (the precursor of RAJUK) and was submitted in 1958. The plan covered the then DIT area of roughly 320 square miles, with a population

slightly exceeding 1 million, of which 575,000 were in Dhaka City. A short report was supplemented by a map of the DIT area at 1:20000 and the Dhaka City area at around 1:40000.

The consultants emphasized that the plan was meant to establish broad planning principles, not lay down a detailed inflexible basis for future development. The need for follow–up detailed plans and continuous review was also noted.

Average annual population increase was assumed at 1.75% and the Dhaka-Mirpur-Tongi (1978) population estimated at 900,000. The plan provided for major expansion areas at Mirpur, Tongi and Gulshan/Banani/Badda and proposed large-scale reclamation at Keranigong, Postgola and part of the DND triangle, to accommodate a population increase of 250,000 between 1958 and 1978.

The plan is very much a product of its time in its emphasis on spatial planning. But it would be unrealistic to expect any plan to predict some of the events of the next two decades. Nevertheless, many of the plan's recommendations have been followed and certain of its provision still apply. The metropolitan study project document (Source: Nagario Prokoton, 1994) notes that the major assumptions still holding good are:

- The continuing importance of the Buriganga River for transport.
- The continuation of Old Dhaka as a business cores.
- The new railway alignment.
- The impossibility of substantial alleviation of annual flooding (though this is debatable since the Government initiated flood protection measures in 1988).

Some of the major assumptions that have been proven invalid are:

- In 1.75% pa. Growth rate.
- The 1,000 acre new university development at Faydabad.
- Non-extension of the cantonment.
- Although over thirty years old, the plan remains the basis for development control within the area it covers.

The 1959 Dhaka Master Plan was a land use type 'master plan'. The major deficiencies of the 1959 Master Plan were:

- Its development control framework was not fully formulated nor effectively implemented.
- It did not effectively relate the issue of urban density with its impact on infrastructure (e.g. sizing of water supply lines).
- It was never linked to the ADP and government budget.
- Its various development components were not prioritized and funding sources were not identified.
- The 1959 plan has been interpreted too rigidly and is not adaptable to the rapidly changing urban circumstances of Dhaka.
- It does not provide a suitable framework for inter-sectoral coordination of spatial planning with the capital budgeting of government development agencies.
- It only identifies "where" general types of development are allowed but does not indicate satisfactorily "what", "how" or "when" that development takes place on the ground and who should take responsibility for its implementation.

These same deficiencies of land use type 'master plan' have long been recognized by planners in many major cities throughout the world. They have therefore largely been abandoned as urban planning tools by many countries due to their well-documented ineffectiveness. They have now been replaced with a dynamic 'development planning process' which is intended to enable timely and flexible responses by planning and development agencies to the changing needs of rapidly growing urban areas.

3.2.2 Dhaka Metropolitan Area Integrated Urban Development Plan (DMAIUDP) 1981

DMAIUDP evolved from a series of reports and missions concerned with storm water drainage and flood protection. It was funded by ADB/UNDP. ADB strongly recommended that despite all previous studies and partial implementation of a flood control embankment, further flood protection investment should await the outcome of a broad multi sectoral strategic study to evaluate metropolitan planning alternatives. Work in the study was undertaken in 1979-80 and the final report submitted in March 1981.

The primary objectives of DMAIUDP were:

- To prepare a long-term development strategy to guide and regulate future growth in the Dhaka metropolitan area.
- To set out policies to implement the strategy and facilitate implementation of priority projects.
- To identify priority projects and prepare prototype proposals for the low-income housing.
- To develop local staff skills and establish effective institutions for implementation.

The options considered identified and evaluated, subjected to more rigorous evaluation prior to selecting the preferred strategy.

Evaluation of Alternatives

- Continuation of current trends- sustained peripheral growth, limited expansion towards Tongi-Joydebpure.
- Peri-urban development- low-density resettlement with intensive agricultural production surrounding city.
- Comprehensive flood control protection of the city and development areas by embankments.
- Sub-regional dispersal-decentralization of urban development to maximum number of existing towns in the region.
- Limiting urban growth by reducing investment in favor of rural areas.

There has been more development than predicted in the DND Triangle, Kamrangir Char and eastward toward Balu River north of DND and south of Begunbari Khal. DMAIUDP is the only comprehensive approach to planning and development in the Dhaka region since the 1958 Master Plan. Many of the constraints, opportunities and issues it considered are equally relevant now. It provides a comprehensive and widely used database and argues a coherent case for a particular land use strategy. Many, if not most, of its arguments are still valid. Accordingly, this study proposes to draw heavily on many of its findings, arguments, and recommendations. It is a valuable recourse for use during the DAMPP study.

3.2.3 Dhaka Metropolitan Development Plan (DMDP)

The New Dhaka Metropolitan Development Plan was approved in 1995. It is comprised of an integrated 'package' of plan components. Each component has a specialized function designed to address particular planning requirements. The contents of all components require to be combined to form the integrated Metropolitan Development Plan. The Dhaka Metropolitan Development Plan 'package' contains the following components:

- Structure Plan
- Urban Area Plan
- Detailed Area Plan
- Instrument for Implementation

The Dhaka Structure Plan was prepared for 590 sq. miles (1528 sq. km) and divided into 26 Strategic Planning Zones (SPZ). The Dhaka Structure Plan has recommended the preparation of Detailed Area Plans for each SPZ gradually to cover whole area of the Structure Plan. The map of Strategic Planning Zones (SPZ) is shown in Figure 3.3.

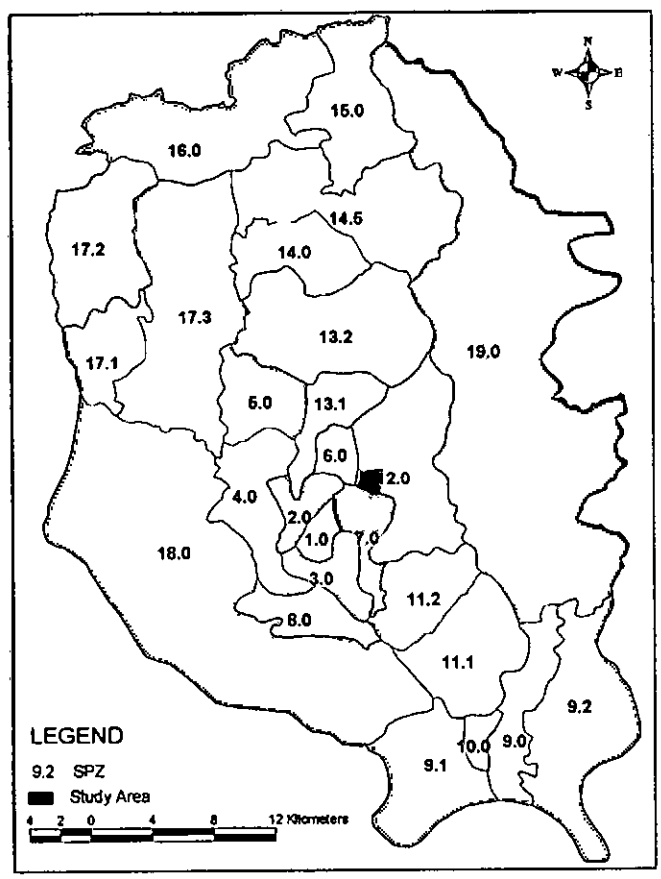


Figure 3.3: Spatial Planning Zones and Study area

Each component of the Dhaka Metropolitan Development Plan 'package' is complementary but they will be adopted and tailored to address particular problems and planning needs of Dhaka. It should be emphasized; however, the Detailed Area Plan requires specifying detailed lot-by-lot land use zoning.

3.2.3.1 Structure Plan

Structure plan is a policy plan and was prepared on sector basis in outline form. It serves as the substructure and guide for the lower level plans. With a short appraisal of issues it sets forth policies for planning to be followed in the subsequent levels of plans. The Structure Plan will provide the broad planning framework showing the arterial roads, physical characteristics, and possible urban area in the next 20 years. The plan will accompany a descriptive report. The time duration of the plan is 20 years and the map scale is 1:10,000.

Dhaka's total land area has been divided into 4 major categories for selection of development strategies. They are established urban area, urban fringe area, new urban area and peripheral area.

Figure 3.4 shows the population projection of the areas according to the strategic plan. The plan contains specific development strategies for all these four types of area. In short the recommend strategies are like this.

- Peripheral area will be partially enabled or discouraged for development.
- New urban area will be promoted for development.
- Development in urban fringe area will be accelerated.
- Development will be consolidated in existing urban areas.

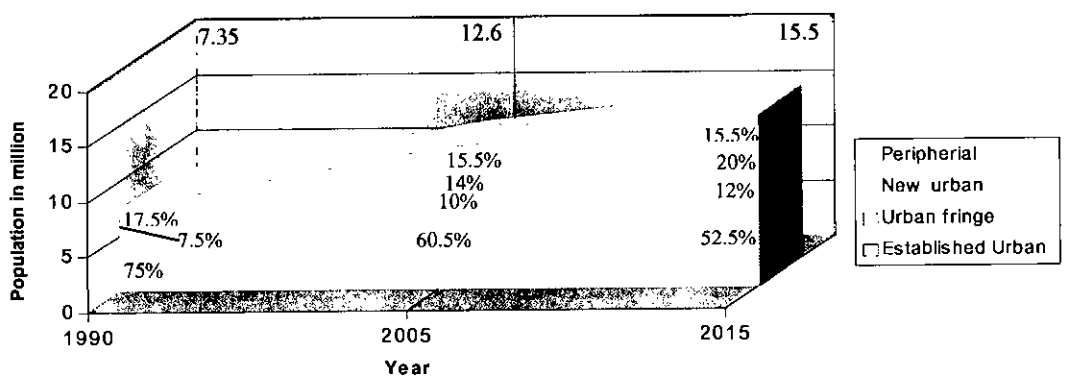
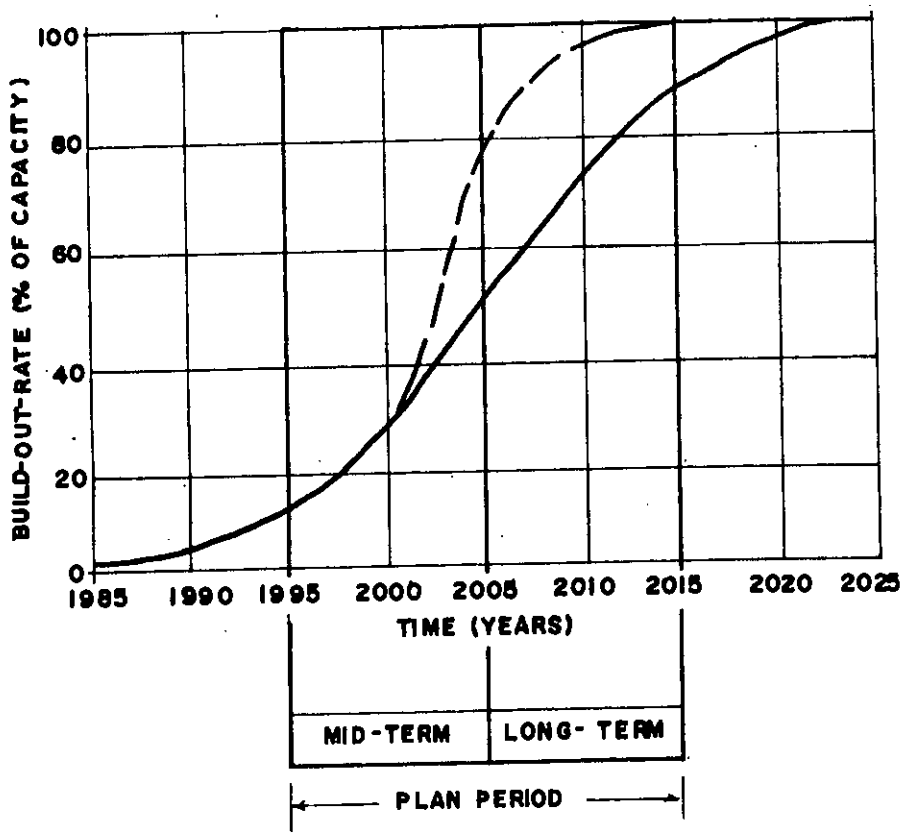


Figure 3.4: Projected population in various urban areas

The concept behind the Accelerate Development Strategy is illustrated in the Figure 3.5. The solid curved line shows the likely rate of build-out, in accordance with past trends. Hence for a development cycle started in the early 1980's, completion would

take 40 years or more. The broken curved line shows the target rate of build-out as per the Accelerated Development strategy, whereby completion would be reduced to 25 years. The impact in terms of faster development and population absorption can be illustrated by the following example:



Source: DMDP, Vol-2, Urban Area Plan

Figure 3.5: Accelerated development of the fringe areas converted to urban use

For 100 acres of land converted to urban use in the urban fringe in 1985. Assuming a national capacity density of 200 ppa, the acres would have a population in 1995 of 3000 (100 acres x (15% of 200 ppa)).

The benefit of achieving such an acceleration of development would have its greatest impact in the middle years of the DMDP Structure Plan period, with build-out completed by 2010.

The private sector development proposal covers a large area of the eastern fringe east of Badda. The proposal is in the right area and is based upon landfill. The available land is developed to the brim and takes no care for the adjacent areas nor for off site requirements. Being within the protection zone of the eastern embankment that still is

to be constructed the area should also contribute to the need for retention ponds to manage storm water of the Dhaka.

The recommendation therefore is to basically agree with the development, but to put a number of conditions as to the storm water management, the fitting in the area road structure and the development of the fringe areas in line with the surrounding areas.

All other proposed developments would require such an assessment of their value against structure plan and the UAP policies and objectives (DMDP, vol-1).

3.2.3.2 Urban Area Plan

Urban area plan UAP is prepared for the 10 years of time frame and specifies in considerable details permissible land use and development standards based on structure plan proposals. It incorporates the legal and administrative framework giving emphasis on control, promotion as well as conservation areas. The UAP also design the area in a manner so that provision for small-scale projects is incorporated; the cost and benefit analysis can easily be made for the targeted beneficiaries. It serves medium term development goals and provides a framework for realistic investment choices within known financial, institutional, environmental and human resource constraints.

The whole area of Dhaka metropolitan development plan has been divided into 26 Spatial Planning Zone (SPZ) and specific proposals are made for the SPZs. SPZ 12 covers the eastern fringe of Dhaka city, in the study area.

SPZ 12 Eastern Fringe

The area is mostly undeveloped with some rural villages and fisheries settlements along side Balu River. The area east to Progoti Sharani is experiencing very rapid development by poor and comparatively low-income people. Total area is 4070 acres and in 1991 population was 144 thousand that is expected to be 423 thousand within 2006. The zone is partly owned by private developers and several developers are implementing large-scale land development projects ignoring the FAP-8A project requirement. In the established areas around Pragati Sharani considerable development of one to four storied walk up houses has taken place. The area is poised to develop quicker than presently expectation if as the proposed Eastern Bypass road is be realized earlier than schedule. In spite of all the apprehended constraints the

zone will experience densification, especially in the lake part in the next 10 years. Study area in context of priority area is shown in Figure 3.6.

Major Issues/ Problem of SPZ 12

- The area is low lying, part of the flood plain of Balu River and spawning ground of various species of fishes.
- It will require landfill even when protected from flooding by FAP-8A projects and Eastern Bypass.
- A system of canals fairly covers the area providing water transport as other access facilities are very limited. The water transport and drainage network is under threat by indiscriminate land filling by private developers.

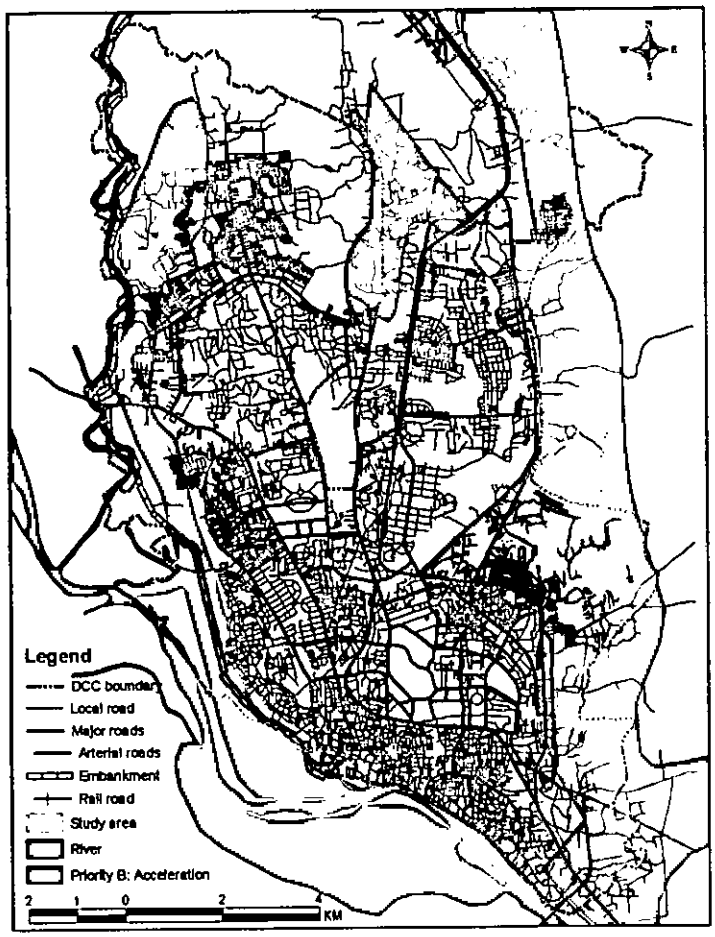


Figure 3.6: Study area in context of DCC and priority area

- As estimated by FAP-8A study 12.0% areas should be reserved as retention pond.
- A large portion in the western periphery known as Badda has already been developed in a most haphazard manner.
- Geo-physical conditions are not favorable for vertical expansion. Rumpura Fault on Begunbari Jirani Khal makes the area vulnerable to settlements in case of quake.

- Private developers are not taking into account the FAP-8A requirements nor the geo-physical constraints.
- One of the private developer's proposed projects will destroy the effectiveness of Begunbari Khal, which drains one third of Dhaka's storm and wastewater.
- The established areas are in short supply of all types of utility services and wider road network is required to cater the future anticipated densification.

Opportunity

- FAP-8A, if realized, will free the area from annual flooding and thereby augment the supply of flood free land for urban development.
- The Structure Plan and Urban Area Plan/ DITS proposed east-west roads and north-south roads will provide access facilities in the area.
- Proximity of Gulshan-Baridhara makes some areas of the zone-preferred areas of development.
- low and middle income people will find it suitable for their living because the area is located within close proximity to several commercial centers
- A very large part of the zone is not yet development. Thus development of this area can be steered in a planned manner.
- Private developers are developing a substantial portion of the zone, which if regulated, coordinated and managed will initiate planned development in the zone.

Action Committed/ Required

- In order to realize FAP-8A proposals, areas for retention pond and east-west polders should be reserved.
- Detailed Area Plans should be prepared for the whole zone and make assessment of utility requirements and thereby provide adequate infrastructure for delivery of those services.
- Further analysis of the fault line and geological condition should be made to ensure proper development.

- The development plans of the Eastern Housing Developer need to be reviewed with urgency to have it adhere to the water management requirements.

In Urban Area Plan (UAP) second priority is given to the developing areas of the urban fringe, developed post 1983 next to (pre 83 developed). They will take some further decades to reach the population densification as the core. Low initial densities in these areas do not justify supply of a full range of service, as they will initially be underused. However, it is essential that planning and reservation of rights of way, at least for primary networks, be undertaken soon to enable provision when justified by increased density levels and allowed by resources. The Figure 3.7 is showing the priority area of DMDP.

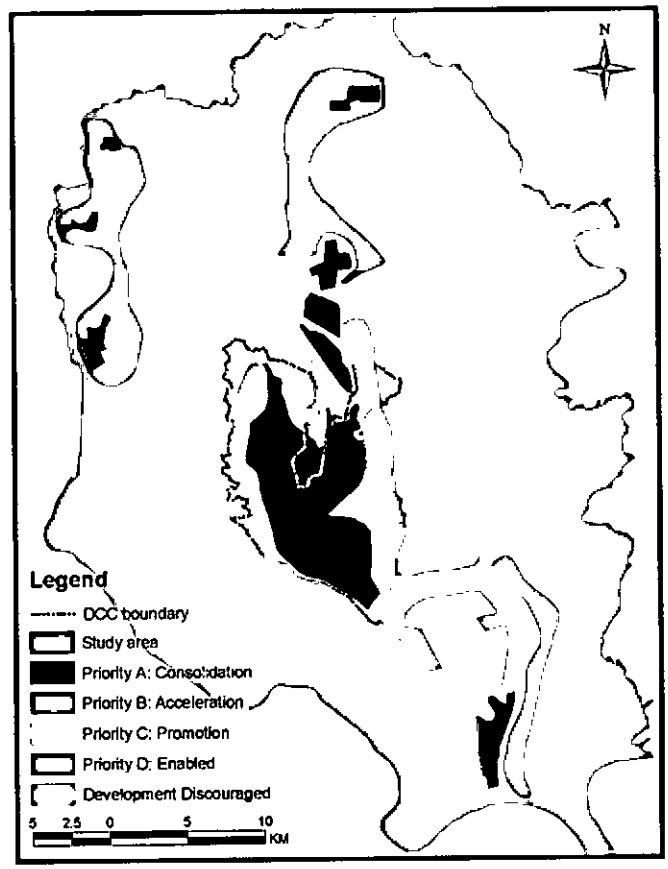


Figure 3.7: Priority areas in DMDP

3.2.3.3 Detailed Area Planning (DAP)

Detailed Area Development Plan (DAP) is supposed to be prepared in the prescribed manner for an area within the jurisdiction or any part thereof on the basis of the *urban area plan* and all such development schemes shall contain plans for the proposed developments, including those for housing if any, written reports, specifications of works, estimates of cost and proposed methods of financing. Prescribed time frame to the detailed area development plan is 5 years.

Overall development strategies and development guidelines are formulated by the Structure Plan and Urban Area Plan as the first and second level of planning. On the third level these have to be elaborated and turned into an effective implementation

tool through DAP. The whole area of Metropolitan Dhaka (with priority for the area covered by the Urban Area Plan) can be covered by DAP.

Purpose of DAP

- Providing a detailed analysis of the area and basic urban design of good quality.
- Providing a reference document for land management actions ('freezing' of development, land clearance and acquisition, land pooling, and readjustment, site and services, etc).
- Providing a program for public sector investment aiming at the implementation of the plan (including agency responsibilities, priorities and phasing)
- Providing controls and guidance for private sector land use and development in the area of the plan.
- Providing clarity and security with regard to future development for inhabitants and investors.

Detailed area plan cover two consecutive five year periods (at present 1995-2005, when necessary extended to a longer period)

The plans have to be reviewed at least once in every five years, extending the plan 'horizon' five years further into the future.

Format of DAP

Like the other plans DAP will consist of report along with maps. It will be prepared on the large scale Cadastral Survey (CS). Various maps will show mainly the cadastral base, administrative boundaries, geographic features and infrastructure. Beside these comparatively small scale maps will show the background, development plan proposals, critical planning issues and instruments for plan implementation. On the other hand the report will contain the development management and zoning documents, public sector action program and legalization procedure. Detail of the format of the DAP is shown in Figure A-1 in Appendix - III.

Process of DAP

Preparation of DAP starts with the survey of the areas. Engineering survey and socio-economic survey area the major components of this stage. Engineering survey includes existing physical feature, land use and topography. Socio-economic survey will be done in sample basis to identify the socio-economic condition and planning requirement of the area. Higher–level framework will be developed on the basis of separate consultation meeting with the local stakeholders. Finally plan will be prepared along with the implementation instruments and legal aspects. The process model of DAP is shown in Figure A-2 in Appendix - III.

Despite many drawbacks finally Dhaka could come at the edge of having a complete set of plan package. But that could not be materialized due to the circumstances. The completion of the preparation process of the plan package and their implementation could change the situation abruptly.

4 Profile of the Study Area

The study area is the selected part of eastern fringe of Dhaka city. The greater Dhaka East is the least developed compared to the other part of the city. Majority of the central and southern areas of eastern side remains flooded for most of the year. The northern area is comparatively higher but quite distant from the city center.

4.1 LOCATION

The area is located on the southern part of Badda. It is surrounded by Progoti sarani on the west, Begunbari Khal on the south, Balu river on the east and main road of RAJUK project on the north. The Rampura bridge is located on the southwest corner of the study area, followed by Bangladesh Television Center. Banasri Residential area is located next to the Begunbari khal on the south of the study area.

Plate 4.1: Progoti Sarani, the entrance of the study area

4.2 AREA AND POPULATION

The study area covers parts of the eastern fringe land comprised with only the eastern part of various local communities. These areas are the part of east Rampura (Aftabnagar), Anandanagar, Merul, little part of Badda and their surrounding areas. It is a long stretch of land along the eastern side of Progoti Sarani. Grossly the study area covers an area of about 500 acres.

Plate 4.2: Begunbari Khal, southern part of study area

Since the study area covers parts of the eastern fringe and comprises with only the eastern part of various local communities along the Progoti Sarani, it is difficult to make a fair estimate of population size and by local leaders, knowledge person and from field survey and secondary sources. From the secondary sources the population of the study area is 3,7490. (DMDP, vol.-II). Being in a zone of transition, the study area is characterized by population, which are both native residents.

4.3 PHYSICAL CHARACTERISTICS

The whole area is compact with unplanned and haphazard development and characterized by high density in part of Badda and Anandanagar. The main cause of such high density may be the proximity to city center. Infrastructure provision may influence and precede the pattern of growth. Thus, unplanned growth of various portion of study area followed existing roads and others infrastructure services. Most of the existing built up areas lies adjacent to the Progoti Sarani.

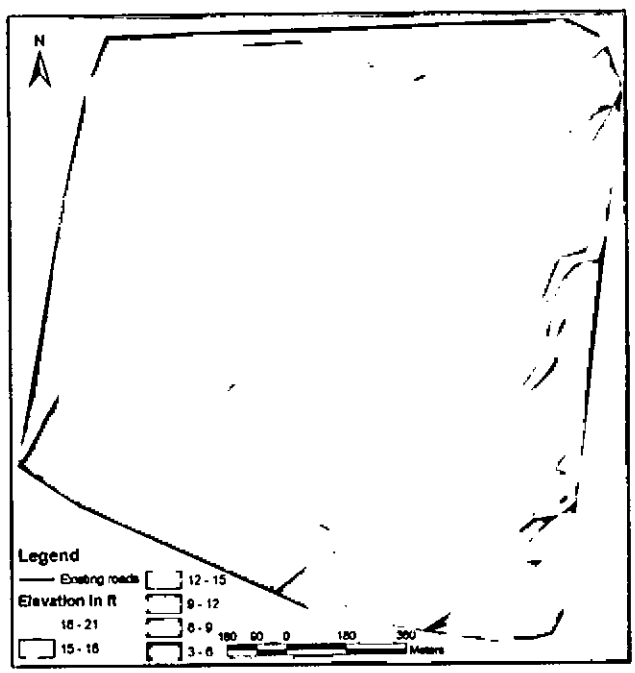


Figure 4.1: Digital Elevation Model (DEM) of the study area

4.4 TOPOGRAPHY OF THE AREA

The whole area is mainly low-lying. Progoti Sarani passes through the western part of the area it this part is having the highest elevation. Figure 4.1 shows the digital elevation model (DEM) of the area. It is generated interpolating the point data obtained from the topographic map of Dhaka 1996. Triangular Irregular Network

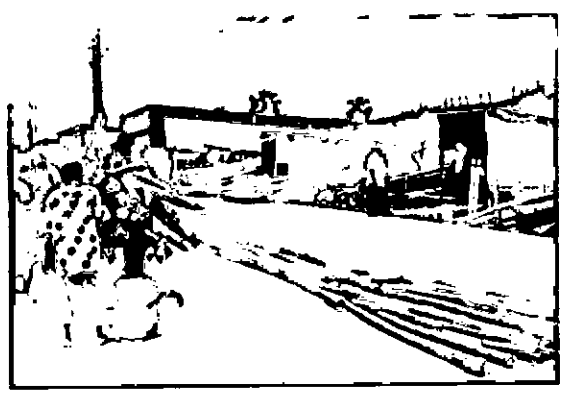


Plate 4.3: Whole sell of bamboo market

(TIN) has been generated for interpolation. As the number of points was not enough to obtain a regular shaped DEM, some points were taken from the satellite images.

Eastern part of the area is having comparatively higher elevation than the western part. In fact, the area was developed in a haphazard way and land filling was done before development work had been taken place. That is why the developed part of the area is higher. On the other hand western part is still less developed and of lower elevation as well. The canals on western and southern parts are of lowest elevation.

4.5 SETTLEMENT DISTRIBUTION

A little part of the area studied is still agricultural or non-urban in character. Some part of the area is densely populated, having spontaneous settlements. The density is higher along the highways. Mainly low-income residential area exists there, having better access to the city center. Commercial developments along the highways are important feature of the area. Some of the existing settlements are still original rural type settlements and rests are recently developed urban settlements. Much of the settlements are residential except along the main road where retail shops, wood mill, motor parts stoppage and similar commercial settlements are found. A large part of the study area is now being commercially developed as private residential area for middle income group. Aftabnagar has been prepared through massive land filling along the Begunbari Khal.

Plate 4.4: Unplanned gathering of wood occupies the footpath study area

Plate 4.5: Motor parts stand is available in the study area

4.6 LAND DEVELOPMENT

The area is developed mainly by local inhabitants latter by the developers for commercial developments. Aftabnagar, by Eastern Housing Ltd. holds the major part

of the area. Rest of the area is occupied by RAJUK project and some other small projects. Residential projects in the study area are briefly discussed bellow:

4.6.1 Aftabnagar

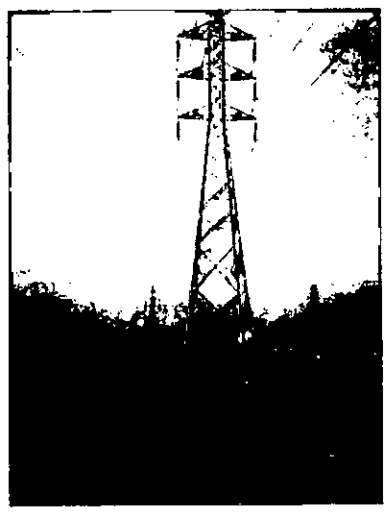


Plate 4.7: Aftabnagar main road

Like other fringe areas of Dhaka City the Aftabnagar area was low lying and still now most of the areas are barren and under water with some agricultural land. Originally the name of the area was Anandanagar. Much of the low agricultural land was primarily owned by Hindu families. After the partition of 1947, the Hindu families gradually stated sold off their agricultural land and migrated to India. The middle class Muslims families who used to live in the nearby areas like Anandanagar, Badda, Rampura, Malibag came to know about the land availability in this area and as the price of these lands were low, they bought these lands with the expectation of having their own house in this city. As time passed, by more and more families gradually came to buy this area. Mr. Jaharul Islam is one of the famous businessmen who bought at about 600 bighas of khash land with a nominal price after the liberation war. Late Mr. Islam started his real estate business, he named the area 'Aftabnagar' a project of Eastern Housing Ltd. Banasri Housing is the southern part of Aftabnagar, it is also the project area of Eastern Housing Ltd. In 1987, the developing company got permission from RAJUK for about 500 bighas of land to develop sell plot commercially. Then they started to sell in diving it to block (A-M) wise. They have sold the A and B block of 3, 3.5 and 5 katha. Now 2500 bighas of land is under the project to get permission of RAJUK has given permission up to F block. The price lists of the block are:

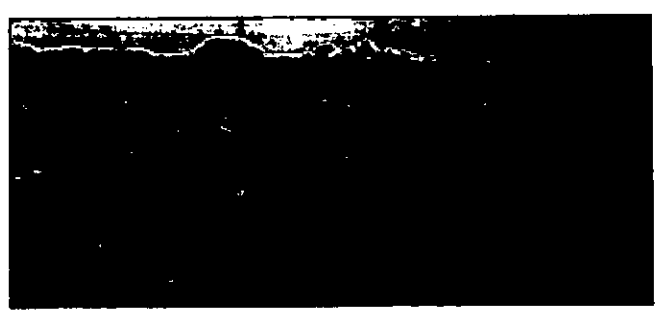


Plate 4.6: A view from F block of Aftabnagar

North to West Face	Tk.5.50 Lacks
South to East Face	Tk.5.75 Lacks
North- West Corner	Tk.5.90 Lacks
North- East Corner	Tk.5.95 Lacks
South- West Corner	Tk.6.05 Lacks

There is a tendency of the private developer to acquire land of their own wish without knowing the actual landholders of the area. So the landholders have lost land. This is the general and available scenario. The existing Aftabnagar is not exception. For this reason the actual landholders start to live there without having proper utility services.

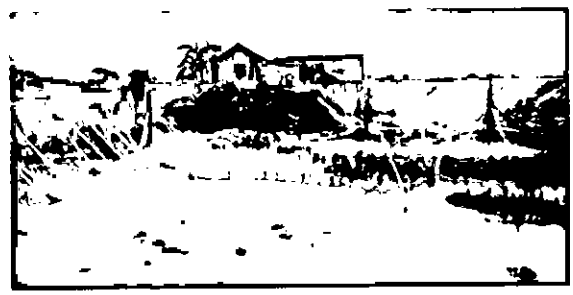


Plate 4.8: Poor living condition

No construction has yet been completed in the site in Aftabnagar. Only one company Heritage Design & Development Ltd. started their apartment building to sell commercially.

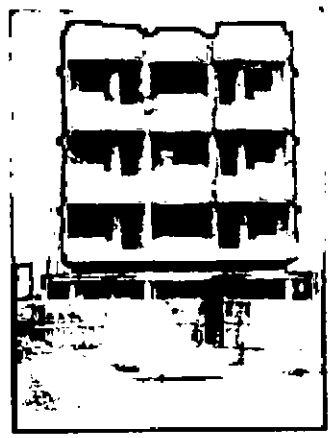
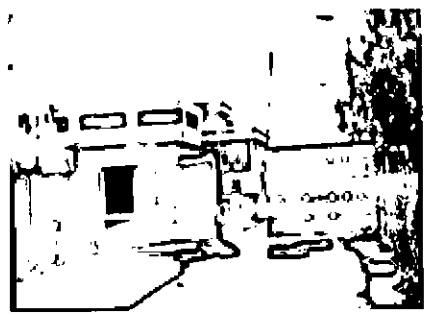


Plate 4.9: An under construction building

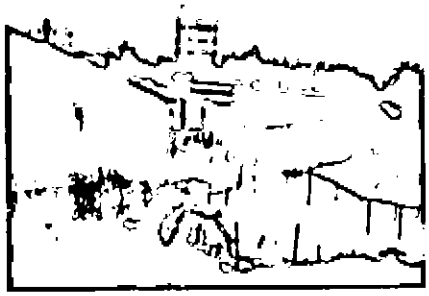
4.6.2 Anandanagar

Originally the name of the area is Baidertek. As the Gypsy (boat people) stay here for 3-4 months during the monsoon. The residential settlements near this area were Merul and Saidantoli, which were mostly inhabited by Hindu families. They still have a shrine (Nag mondir) at Merul.

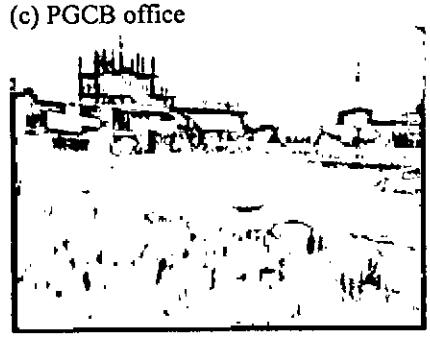
(a) Unhcalthy living condition



(c) PGCB office



(b) Wetland is common



(d) Little agricultural land found

Plate 4.10: Some views from Anandnagar

In 1958, when the then DIT acquired land for Gulshan. One family was compelled to come to the area and buy 16 bighas of mainly low agricultural land with some high land. Mr. Hazi Akramuddin's family was the first Muslim family to start living in this area permanently. There was no road and during dry season they used the field dividers for their movement. But even then they have to cross a canal. For their convenience of movement they built a bamboo bridge (shanco) over it. But the area used to submerge under water for more than half of the year. In 1987, the residents with their own initiative and donations raised the road level and the road was extended up to Saidantoli (south Anandanagar). Almost all-male adult inhabitants of the locality directly or indirectly participated in this development activity. In 1989 the residents of Anadanagar applied to WASA for a deep tubewell in the area to overcome the water crisis. They were giving their voluntary labor for widening of the road, which will enable them to bring the vehicles for installing deep tubewells.

4.6.3 Arshinagar

The price of land in this area was very low as compared to surrounding areas such as Badda, Rampura, Khilgaon, Malibag etc. Adjacent areas Badda was acquired by Rajeuk and this area was declared flooded zone by RAJUK, as the area was submerged under water for almost ½ of the year. The Banasri housing is the southern part of Arshinagar. It is now established housing state with proper facilities. The nearby Aftabnagar is going to start their constriction work within 2 years. The most of the land of the area is under water.

Plate 4.11: A distance view of Arshinagar

4.6.4 Porshinagar

After 1980, a group of businessman from Nayabazar started living nearby Anandanagar. They gave financial help to carry out road construction. In 1984, the elderly people of Anandanagar formed a club named Anandanagar Arasha Samaz Kalayan Samity. The primary objectives of their works are to physical development of the area, ensure better living condition of the area, prevention of any unsociable activities and other social works. On December 1989, they formed a primary school Anandanagar Adrsha Primary school on a khash land of about one bighas. They built semi pucca structure comprises 6 classrooms. And at that time they bought about 25 bighas of Khash land and built another Samity named Proshinagar Unnoyon Bohumukhi Shmabai Samity. They wanted to develop a planned residential project. The development of the area is ongoing by proper land filling.

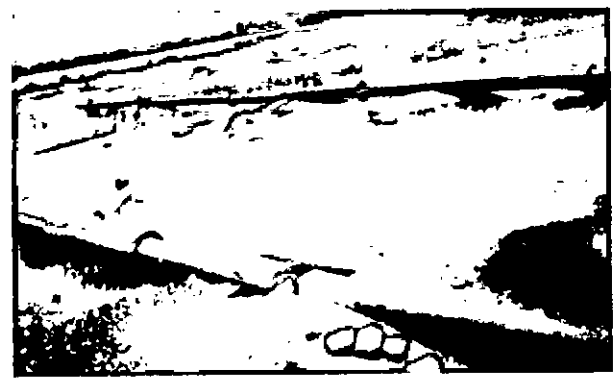


Plate 4.12: Preparation of land by sand filling from Balu River

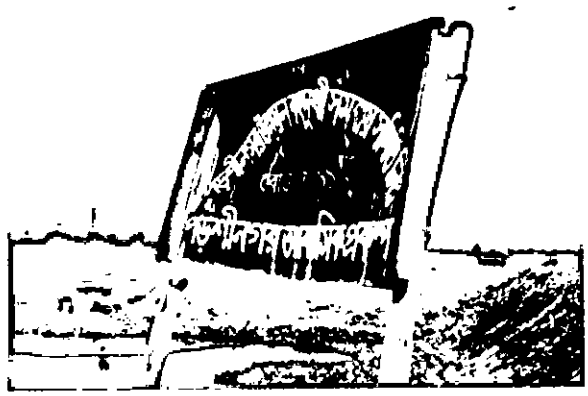


Plate 4.13: A sign board showing the Project

Plate 4.14: A view of Porshinagar

4.6.5 DIT project

There are other areas where RAJUK intend to implement their own development and where development intends to proceed in accordance with a RAJUK zonal plan. The project area is acquired mainly for the third or fourth-class workers of RAJUK. The area is little fulfilled by gas facility but improper in water and electricity. There are also commitments for large scale planned private development. Elsewhere-unapproved developments are proceeding. Many structured have been contracted and

12-ft access road construction work is ongoing now. But major portions of the project area have conflict between the general people and RAJUK. For this reason unhealthy environment is found here.

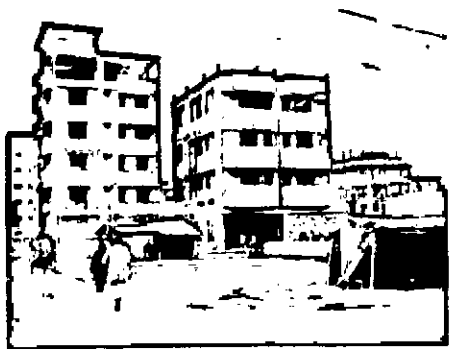


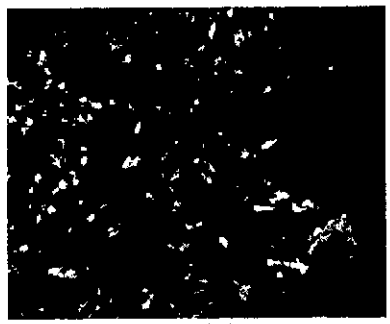
Plate 4.15: Buildings of DIT project

Plate 4.16: 12' access road in DIT project area

After 1980, a group of businessman from Nayabazar started living nearby Anandanagar. They gave financial help to carry out road construction. In 1984, the elderly people of Anandanagar formed a club named Anandanagar Arasha Samaz Kalayan Samity. The primary objectives of their works are to physical development of the area, ensure better living condition of the area, prevention of any unsociable activities and other social works. On December 1989, they formed a primary school Anandanagar Adrsha Primary school on a khash land of about one bighas. They built semi pucca structure comprises 6 classrooms. And at that time they bought about 25 bighas of Khash land and built another Samity named Proshinagar Unnoyon Bohumukhi Shmabai Samity. They wanted to develop a planned residential project. The development of the area is ongoing by proper land filling.

Construction of multistoried buildings after partial landfill is common throughout the DIT project area. Untimely construction of structures on inappropriately compacted land requires heavy pilling. 60-ft width road is the main access road of the project. But due to lacking of lengthy procedure of planning various illegal structures are found the above area.

Plate 4.17: 60' access road to DIT project area



(a) Dumping of solid waste

(c) Sporadic of slum available in the area

(b) This is the only retail shop found in the project area

(d) Illegal structure of the projected area

Plate 4.18: Some views from DIT Project area

For detailed questionnaire survey, all residents of the study area were selected randomly. The main features are summarized below while detailed information is given in the tables in the appendix.

The purpose of the survey was to understand the existing housing demand, basic utility services, and future initiatives to improve their situation. And also look at the problems of the present pattern of development at this fringe area.

4.6.6 Information Related to the Household

4.6.6.1 Occupational Pattern

The surveyed households in the study area regarding occupation were seemed to do rather well. The occupation pattern is presented in Figure 4.2.

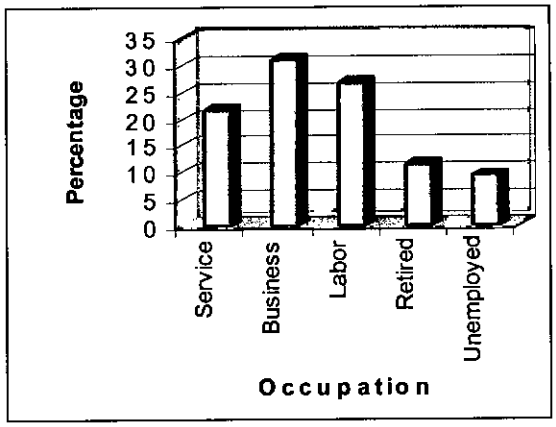


Figure 4.2: Occupational pattern

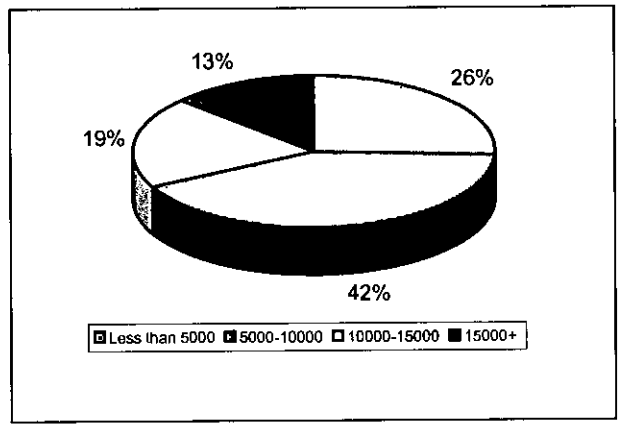


Figure 4.3: Income pattern

4.6.6.2 Income Pattern

The information collected from the respondents about their monthly average income can be treated as fairly responsible indicators of the economic standing of the households. The income classification is presented in the Figure 4.3. The collecting necessary information from the respondent, it is found that the study area predominantly middle class area, with a few households that are fairly wealthy and a considerable percentage of households who are in the low-income category.

4.6.6.3 Tenure Status

To find the land and house ownership pattern of the respondents' questions were asked. Figure 4.4 shows the tenure status of the study area. About 58 percent of the respondents were owner-occupier and live in their own houses. Again 41 percent respondents were tenants and only one percent live in sublet.

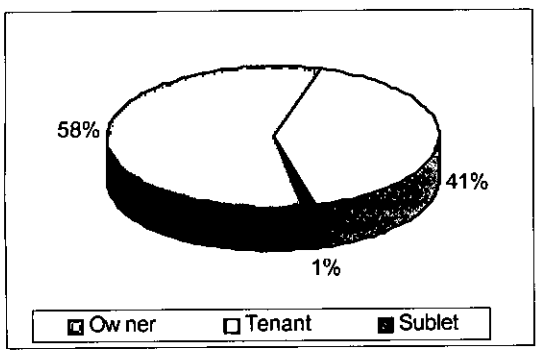


Figure 4.4: Tenure status

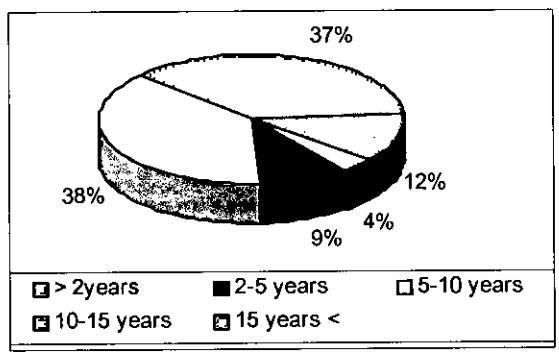


Figure 4.5: Duration of living

4.6.6.4 Duration of Living

It is founded from the surveyed data that majority of the respondents have been living in this study area since last few decades. The pattern of duration of living in the study area is presented in the above figure (Figure 4.5).

4.6.6.5 Reasons for Living in the Area

The survey data (Figure 4.6) shows that majority of the people is migrated from the outside. Cheap land price is the major consideration of selecting the area.

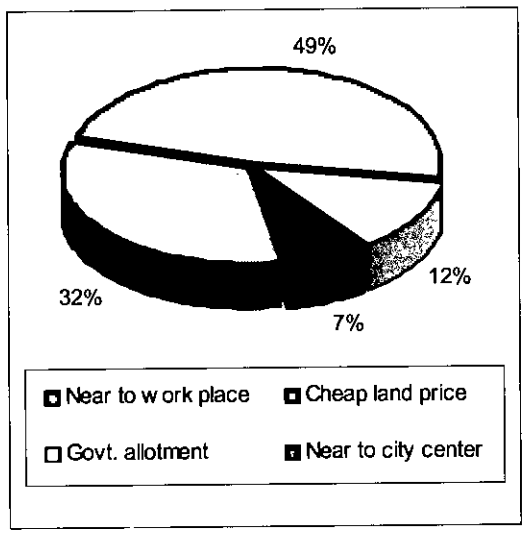


Figure 4.6: Reason for living in this area

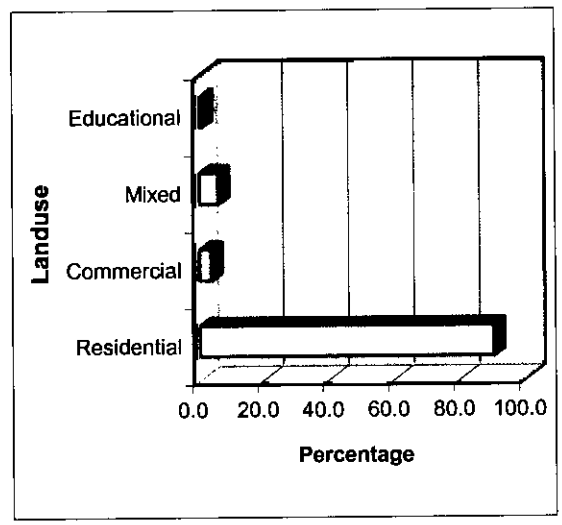


Figure 4.7: Existing land use

4.6.6.6 Existing Land Use

In the study area residential use constitute majority of total land. Majority of the plots on which the households were surveyed has predominantly fully residential use. Mixed residential use is also found. The land uses of the plot are presented in Figure 4.7. The existing land use map is shown in Figure 4.8.

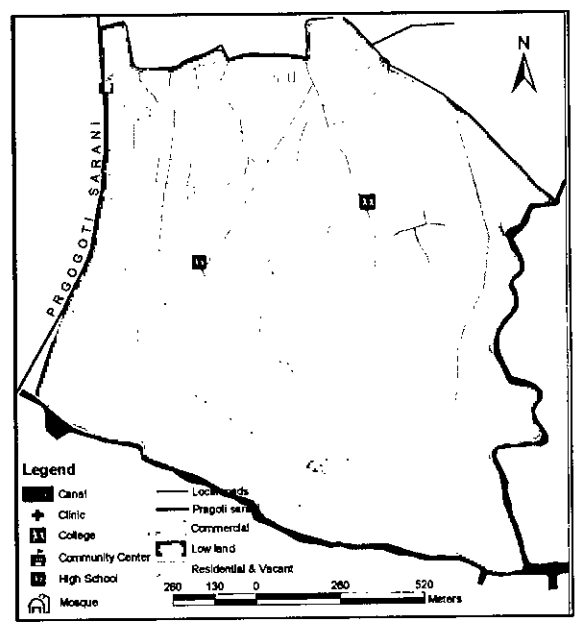


Figure 4.8: Existing land use of the area

From the field survey it is found that the regarding expected future land use 91% population wanted residential with recreational facilities, 3% in commercial and others area mixed. From the field survey

it is founded that most of the residents of the study area are mainly wanted to develop their land through private developer. Because the land price is so high for them to buy and it is really too tough to construct buildings individually.

4.6.6.7 Basic Utility Services

The questionnaire survey of the resident households also collected information on existing facilities, services and utilities covering a variety of components such as water supply, electricity, gas, drainage, garbage disposal etc. A good number of households were dissatisfied with the available community services. Most of the households are deprived of direct access to memorable road. Many of the households do not have private home connections for piped water supplied by WASA. The study area is beyond the DCC boundary and situated only under jurisdiction of RAJUK. For this reason the area lacked under various municipal services. Most of the residents are deprived from the provision of gas supply system.

The process of urbanization in the study area has given rise to typical land use associations where the contemporary and dynamic land use pattern is developing side by side. The various land-uses, new residential extensions, real estate housing, commerce, city service and farming are not nearly sorted out into homogeneous areas but are intermingled in a random fashion which gives a distinctive quality to the land use pattern of the area. The dynamic change from rural to urban landuse is so fast that the resultant need and complex use coupled with shortage of land have led to speculation and increase in land values. Most of the houses have been built so far without official approval from RAJUK. Infact, only about a few percentages of households have built their houses with RAJUK permission. In other words, the rest of the houses were built informally. These houses all are officially liable to be demolished, unless RAJUK relaxed building regulations.

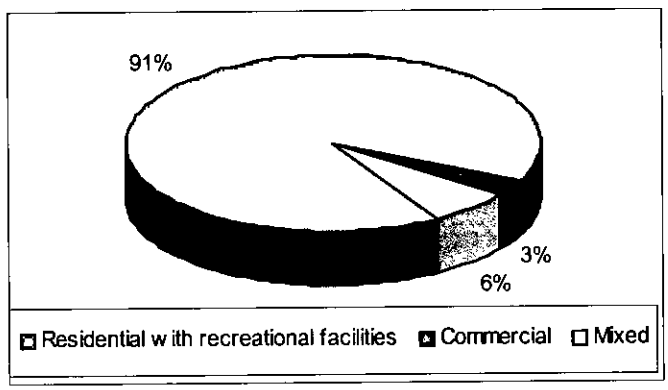


Figure 4.9: Respondents view regarding expected future land use

4.7 General Problems of the Study Area

In most of the cases the fringe area becomes a 'problem area' for the city because of its location right at the periphery of the city. The general problem of the study area is given in the bellow:

- The area is inhabited by relatively lower middle income, marginal groups with consequent emergence of slum- like conditions in there midst. So, these areas area usually marked by haphazard and unregulated growth, overcrowding, inadequate infrastructural facilities.
- For further development of the area, to bring water connection, gas, and to improve the road quality, huge amount of money is required. But most of the inhabitants belonged to middle income group and due to limited financial resources the process of development was very slow.
- Other necessary urban facilities such as school, playfield, market, hospital were seriously lacked in this area, due to absence of appropriate planning.

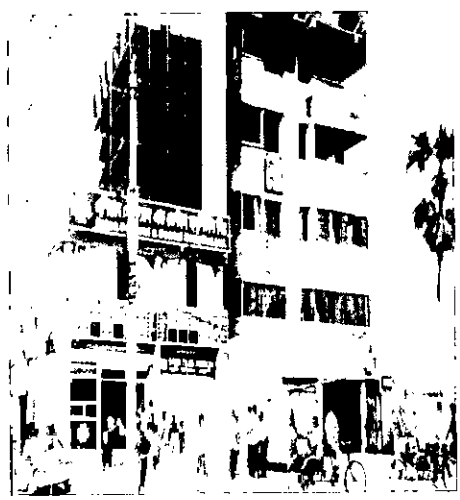


Plate 4.19: Some views from DIT Project area (up)

Plate 4.20: Only clinic and community center of the area (right)

- As there is no play field in the study area, the residents of the area come to play in the vacant land of Aftabnagar.
- Majorities of the houses have been built without official approval from RAJUK. Even among the authorized construction in majority of the cases set back rules were not properly followed. As a result the area becomes congested and creates unhealthy environment.

- In the study area several acres of low land have already been filled up. But the land filling process was not in a planned way.
- In the study area real estate developers have filled up a considerable portion of low-lying land. Among the developers, Eastern-Housing Limited is dominant. The company filled low land indiscriminately, flouting a recent government directive and laws. So, the developer engaged in illegal and unlawful moves. This is a severe threat to the environment.

5 MCE and Its Application in Urban Land Use Planning

5.1 CONCEPT OF MCE

Traditionally, prescriptive decision analysis has taken the form of either an objective or subjective evaluation criteria. In objective analysis, attempts are made to provide a functional appraisal of decision event by identifying all the potential effects and the magnitude of such impacts based on the market value of events and criteria involved. The net values of the benefits of possible alternative choices are then compared with the costs associated with the decision to help make a choice (cost benefit analysis). Subjective analysis of decision events on the other hand, comprises various approaches, which share the common purposes of helping decision-makers to express consistent judgment and choose rationally.

The techniques adopted in the various approaches of subjective analysis are called Multi-Criteria Decision Methods (MCDMs). These methods incorporate explicit statements of preferences of decision-makers. Such preferences are represented by various quantities, weighting scheme, constraints, goals, utilities and other parameters. They analyze and support decision through formal analysis of alternative options, their attribute vis-à-vis evaluation criteria, goals or objective and constraints.

Originally, MCDMs were developed to select the best alternative from a set of competing options. Over the years, these methods have evolved into a diverse range of decision aid techniques. Now MCDMs include methods that can be used to:

- Structure the decision problem and improve the understanding of the main issues involved in the decision;
- Identification of pro's and con's of various management process in order to improve negotiations;
- Accommodate various types of information (quantitative and qualitative);
- Present the effects of policy alternatives in various forms;

- Support the evaluation of multiple policy alternatives;
- Reduce the amount of information in order to provide comprehensibility;
- Compare multiple policy alternatives;
- Present the choices and priorities made in the transparent and effective way;
- Support reasoning in the negotiations; and
- Analyze the sensitivity and robustness of the results.

5.2 APPLICATION OF MCE

Originally MCE was developed to select the best alternative from a set of competing options. Over the years, MCE has evolved into a diverse range of decision aid techniques. Now it cannot only be used to select the 'best' alternative, but also as a tool for:

- Ranking alternatives;
- Product evaluation;
- Understanding the process (formative evaluation);
- Identification of pros and cons of various management process in order to improve negotiations;
- Negotiations;
- Combined product and process evaluation sustainability assessment or natural resources;
- Structuring the decision problem and improving the understanding of the main issues involved in the decision;
- Assessment the overall impacts.

5.3 ELEMENTS OF MCE

5.3.1 Decision problem

A decision problem is defined according to Janssen (1992 cited by Sharifi, 2003), as "a situation where an individual or group perceives a meaningful difference between a present state and a desired state, and where:

- The individual or group has alternative courses of action available;
- The choice of action can have a significant effect on this perceived difference, and
- The individual or group is uncertain a priori as to which alternative should be selected."

A multi-criteria decision problem can be described by the set of alternative courses of action and one or more objectives that a solution of the problem should achieve. To what extent an alternative courses of action attains the objectives can be measured by a set of criteria. If the performances of the alternatives are non-spatial, the impact of one alternative for a certain criterion can be measured by one value. Then the total impact, i.e. the impact of all alternatives for all criteria, can be presented in an effects table or evaluation table. A decision problem is considered as defined if the objectives; the criteria and the alternative are defined.

5.3.2 Alternatives

The alternatives present the possible solutions to the problem; therefore they are considered as possible choice. To obtain a clear and proper evaluation process of any problem (e.g. environmental problem) examined, it is important that all relevant alternatives are taken into account: all alternatives, because adding new alternatives in a final stage of the policy making process will cause serious delays; only relevant alternatives, because including relevant alternatives can cause rank reversal. Another difficulty in defining alternatives is that, in practice they can consist of a combination of different elements, for example, extensive house building plans composed of different house building locations or proposals for different routes to connect an island with mainland, which can involve different types of connections like a bridge or a tunnel. In these cases it is tempting to divide the problem into two smaller sub-problems and evaluate these sub-problem separately. Unfortunately, if the effects of the elements in the sub-problems are dependent on each other, evaluation of the whole problem does not necessarily have same result as evaluation of the sub-problems separately.

5.3.3 Criteria

Criteria can be defined as a measurable aspect of judgment by which a dimension of various choice possibilities under consideration can be characterized. They are used to

evaluate the objectives of a decision problem. A criterion gives an indication about how well the alternatives achieve a certain objective. It is important that the set of criteria is a good reproduction of the objectives of the problem, because, if this is not the case, the evaluation of the alternatives will also not be in accordance with these objectives. If the set of criteria is very large, it is reasonable to divide the criteria into groups and/or subgroups of about 7 ± 2 criteria. This benefits the comprehensibility of the effects table and hence the problem. However, making a hierarchy of criteria is not that easy.

There are two major types of criteria. Benefit criteria and cost criteria. Benefit criteria are those more of, which is better. On the other hand, cost criteria are those criteria, less of which is better. Apart from these two there is a different type of criteria that is called veto criteria. It is a binary function. Failure in satisfying veto criteria refers to disqualification of the alternative.

5.3.4 Criteria Scores

The performance of an alternative for a criterion can be measured in different measurement scales: the interval and ratio quantitative scales and the ordinal and binary qualitative scales. Another often-used scale is a scale with pluses and minuses. This scale can either be quantitative, if pluses and minuses actually mean certain value, or qualitative if the pluses and minuses only signify 'good' or 'bad' in different, not well-defined grades. The qualitative measurement scales are often used, especially in environmental decision problems, where it is difficult to measure criteria accurately. The type of scale used to measure a criterion does not give any indication of the importance of that criterion. The effect scores in an effects table are almost abut also it emphasizes how the criteria are measured; what problems are experienced with measuring them; what accuracy of the scored measured is; etc. the Dutch Commission for the EIA gave a set of recommendations to make the effects table as comprehensible as possible (Voogd , 1983), viz.:

- Take care in making a good presentation and use a clear title and legend;
- Include all relevant alternatives in the table;
- Make sure it is possible to recover from the report the information used to make the table;

- Only manipulate information if it improves the comprehensibility substantially;
- Report the unit of measurement with the criteria and if necessary the time-and-space characteristics; when using percentages, explain to what they are related, or use the absolute scores;
- When using a pluses/minuses scale explain carefully how this scale is defined.

5.3.5 Standardization

Before a multi-criteria method can be applied, for most methods, the criteria table needs to be standardized. Scores from the various criteria can only be compared if the measurement units are the same. Through the standardization procedure the measurement units are made uniform, and the scores lose their dimension along with their measurement unit.

Even if the criterion scores have been determined on a ratio scale for all criteria, these are mutually incompatible since most of the measurement units will differ from each other. One criterion might be expressed, for instance, in number of houses whereas other criterion is measured in acres. To make the various criteria scores compatible it is necessary to transform them into one common measurement unit, for example by taking care that each criteria will have a range of 0 to 1. This kind of transformation is called Standardization.

Standardization can be made in different way, depending on the nature of criteria. They are:

5.3.5.1 Maximum standardization

The scores are standardized with a linear function between 0 and the highest absolute score. For a benefit criterion the absolute highest score is indicated with 1, for a cost criterion this is 0.

$$\text{Benefit criteria: } \frac{Score}{Highestscore}$$

$$\text{Cost criteria: } -\frac{Score}{Highestscore}+1$$

Equation 5.1: Equation used for Maximum standardization

The result of this standardization is values between 0 and 1. The benefit criteria always have a 1, and the cost criteria always have a 0. If both negative and positive scores have been filled in for a criterion, then the values may also be out of the 0-1 ranges.

5.3.5.2 Interval standardization

It is also called expected value method. The scores are normalized with a linear function between absolute lowest score and the highest score. In a benefit criterion the absolute highest score is indicated with a 1, and the absolute lowest with a 0. For a cost criterion it is the other way round. The result of this standardization is positive scores for both the benefits and the cost criteria. The standardized scores are exactly between 0 and 1.

$$\text{Benefit criteria: } \frac{(score - lowestscore)}{(highestscore - lowestscore)}$$

$$\text{Cost criteria: } -\frac{(score - lowestscore)}{(highestscore - lowestscore)} + 1$$

Equation 5.2: Equation used for interval standardization

5.3.5.3 Goal standardization

It is needed to specify for every criterion an ideal or goal value and a minimum value. A meaningful minimum value can be the score in the no action alternative, or the score of the worst possible alternative. The scores are normalized with a linear function between the end points of the range. For a benefit criterion the maximum of the range is indicated with a 1, and the minimum with a 0. For cost criterion it is the other way round. This method can be used for criteria with a ---/+++ scale. The minimum- and maximum values can be chosen from a list of possible values. The result of this standardization is positive scores for both the benefits and the cost criteria.

$$\text{Benefit criteria: } \frac{(score - lowestscore)}{(goalvalue - lowestscore)}$$

$$\text{Cost criteria: } -\frac{(score - lowestscore)}{(goalvalue - lowestscore)} + 1$$

Equation 5.3: Equation used for goal standardization

5.3.6 Priority assessment

In this case of decision makers analyst relationship, which assumes that somehow it is possible to drive the priorities of the DM, different methods have been developed and applied. Priorities or weights of criteria express the relative importance of the criteria. From application of multi-criteria techniques it appears that such priorities can have a major effect on the final evaluation result. The most straightforward method of assess weights is the direct estimation of their relative importance by assigning a value to each criterion. This method, however, appears to be a very difficult task for a decision

maker, especially if the number of criteria is large and the criteria are very different in character. Therefore, different methods to estimate the relative importance of the criteria have been developed.

5.3.6.1 Direct assessment

This procedure assigns quantitative weights to effects. A value for each effect must be assigned. Weights entered using direct assessment is divided by the sum of all weights to make these weights add up to one.

5.3.6.2 Pair-wise comparison

This method is also known as the Analytical Hierarchy Process (AHP). The user is asked to select the most important of each pair of effects. Subsequently the user is asked in qualitative terms to what extent the first effect is more important than the other is. The method converts these comparisons of all pairs of effects to quantitative weights for all effects (for the used calculations: see Kok and Lootsma (1985)).

5.3.6.3 Expected value method

After selecting a rank order of effects, numerical weights are calculated using the expected value method. In the Expected Value method the user is asked to arrange the effects from most important to least important. The procedure uses the expected value within this ordering to calculate quantitative weights.

5.3.6.4 Random weights

After selecting a rank order of effects, numerical weights are calculated using the random extraction method. In the Random Weight method the user is asked to arrange the effects from most important to least important. This goes identical to the expected weight method.

The numerical weights are found by random drawings of weights that fulfill two conditions:

1. The value of the weights must correspond to the ranking entered by the user.
2. The sum of weights of all effects is one.

The ranking of the alternatives is determined for a large number of sets of weights generated within these conditions by a random generator. These rankings will be

converted into a frequency table and further converted into one ranking of the alternatives.

The random weight method always leads to complete ranking. The ranking order is not always in agreement with all the entered quantitative weights, and is therefore not entirely certain.

5.3.6.5 Extreme weights

After selecting a rank order of effects, numerical weights are calculated using the extreme weight method. In the Extreme Weight method the user is asked to arrange the effects from most important to least important. This goes identical to the expected weight method.

This method is based on the extreme quantitative weights, which just fulfill the assigned qualitative ranking of the weights. Because there are always different extreme combinations of weights, this method can result in different rankings of alternatives. In this case it is impossible to determine a complete ranking of the alternatives.

In the Extreme weight method a ranking order is determined for all extreme points that meet the assigned qualitative weights. This leads to a table of the weights assigned to these extreme points. The ranking of the alternatives will be determined for each extreme point. A ranking can be determined with (as an intermediate result) an order-matrix. The matrix shows whether an alternative is better than another. A 1 means that the alternative to the left of the 1 is better than the one above the 1. The weights determined with the Expected Value method are not the same as those determined using Pair wise Comparison. The Random and the Extreme weight method do not lead to concrete weights. Both methods in combination with a multi-criteria method, lead to a ranking of alternatives.

6 Application of MCE on Study Area

Actually MCE is conducted to select the best one from a set of given alternatives. For this study it is assumed that the city requires all the functions that have been set as alternatives. The question is, among these alternatives which function would be assigned to the particular piece of land that has been selected as the study area. As all of the uses are required for the city, generally speaking the best option is to accommodate all. Considering the limitation of land, any one of them should be selected, and MCE can help to priorities the alternatives.

6.1 ALTERNATIVES

This research is designed to formulate a land use proposal for the study area and MCE will be used to determine the best possible land use for the area. Before having the best solutions all the probable solutions should be discussed thoroughly along with their merits and demerits. There may be many types of use of a single land. All the uses have some positive and some negative impact on the city and its environment. Often the effects are not quantifiable and so as not comparable to find the best alternative. To get the accurate result, all the options must be critically dealt with. There is countless possible combination of different land uses for a specific area. It may be either different combination of two or three land use classes such as residential, commercial institutional or different levels of same land use such as middle income and low income housing or both. It is a complicated process to deal with enormous number of alternative. As this study is just a demonstration of MCE its uses only three basic alternatives as example. The alternatives are briefly discussed here:

6.1.1 Residential

Residential use may be the major use of the study area. Residential development is one of the urgent necessities of Dhaka city. 68% of Dhaka's population does not have their own house to live (RAJUK 2003). Generally speaking, it may be considered as the most eligible use for the selected study area. To develop the study area as a

residential one, it will require the provision of essential neighborhood elements like internal roads, elementary school, parks and playground etc. The location is suitable for residential area also. As it is on the Progoti Sarani, it has good connection with Motijheel commercial area. It is very close to some existing residential areas like Banasri. Regarding the size of the area DMDP does not recommend any fixed size for standard neighborhood, According to the standard set in Dhaka master plan 1959 a neighborhood should be of 100 acre accommodating 7500 population. This use can be kept under active consideration for the area.

6.1.2 Commercial

Commercial use here refers to development of offices and other commercial activates. To discuss the feasibility of the area as a commercial one the first thing comes under discussion is its locational suitability. First of all a commercial area must have good access to rest of the cities. Dhaka's existing CBD Matijheel commercial area is not too far from this area. Now a day's Kawranbazar area is being actively considered as the second CBD of Dhaka city. Even then the option of developing the area as commercial one can be kept under active consideration. Commercial area has potential employment opportunity.

6.1.3 Industrial

While talking about industrial use, the first thing comes in mind is either it is heavy industry or light industry. If it is heavy industry then, the location is not suitable for that. Heavy industries should be a bit away from the city, may be in some commutable distance. Moreover the industrial area of Dhaka city that is located on Tejgaon is not fully utilized. So, the location of the study area is not good to be developed as an industrial area. It is recommended in the structure plan that no more industrial area will be allowed within Dhaka city until Tejgaon and Tongi industrial estates are fully occupied. On the other hand if it is light industries to be dealt with, its not wise from the urban planning point of view to utilize the valuable land for light industries also.

6.1.4 Open Space and Recreational

There are one more alternatives for the area that is to develop the area as an open space for recreation. There may be some parks and playgrounds along with water

bodies. These places may be used for recreation; it will help not only as a place of recreation for the urbanites but also to balance the adverse affect on the cities environment.

6.2 CRITERIA OF EVALUATION

To decide the best suitable use of the study area various criteria are set. Before going for cost and benefit criteria something regarding veto criteria should be discussed. As it was mentioned earlier that, veto criteria are those failure to satisfy which refers to disqualification of a particular alternative. So number of alternatives can be short-listed before the calculation of MCA. For this case locational suitability can be considered as a veto criteria. An option cannot be selected regardless to its merit if it is not suitable for this location. As mentioned earlier industrial use is not suitable for this location. So the alternatives can be short listed from four to three. The rest of the analysis will be done to compare residential and recreational uses. Before that, a short discussion on other criteria should take place.

6.2.1 Development costs

Development cost is a group of criteria that include various development costs. Various costs for the development works are considered under this category. It includes mainly those cost that make difference between the alternatives. Obviously there are many other costs involvement but only three of them are discussed to keep the analysis simple and avoid the complexity.

6.2.1.1 Land filling

The selected area is mainly low land. A significant part of the area will require filling before further development. Land filling is a huge cost hence it is considered as one of the cost criteria. For measurement it is considered how many acres of land needs filing. So scale of measurement is ratio and unit is acre.

While comparing the alternatives, it is checked from the existing image of the area that almost half of the area is low lying and so requires filing for further development. For commercial development it requires 250 acre of land filed, where as for residential use some of the low lying area can be kept as it is. They can be used as water bodies to increase the quality of landscape of the area. Hence, the score of residential area in this criterion is 200. The case of beautification is more important

for the other alternative. For open space and recreational uses even more space can be kept low lying. So, this alternative is given 100 for this criterion.

6.2.1.2 Road construction

Internal roads are important factor of any sort of urban development specially if it is residential, commercial or industrial. It carries a significant part of the total development cost. It is a cost criterion. Usually for residential areas it is some sort of norm that 20 percent of the total area should be used for roads. In Purbachal the figure is 23 percent. So the area covered by road can be calculated in terms of acres. So it a ratio scale and unit of measurement is acre. For this analysis road requirement for residential area is calculated 20 percent of 500 acres (total area) 100 acres. The roads of the commercial area should be wider as a result area coverage by roads in commercial area is more. Here it is calculated 25 percent of 500 i.e. 125 acres. For open space and recreation requirement for roads is very low. Here it is calculated 10% of the total area that is 50 acres.

6.2.1.3 Utility and Services Cost

The utility services required preserving public safety and health. These services embrace mainly power supply, water supply, sewerage and waste disposal. They have a considerable influence on urban planning because of their large capital cost and their requirements for land and access. Both the location and layout of urban growth areas must take the needs of these services into account if the most economic policies and development program to be achieved.

It is an important cost of any development project is to provide utility and services. That is why it is considered under cost criteria. For this particular analysis, residential use will require utility and services in its full fledge whereas commercial use will require less amount of utilities and open space and recreation will require least. So, this criterion is considered in ordinal scale in a sequence of residential, commercial and open space. As a cost criterion higher order of value will impact the result of MCA negatively.

6.2.2 Planning aspects

Planning aspects is another group of criteria. It includes the criteria that should be considered to fulfillment of the planning requirement of an alternative. It includes

landscape and recreation, schools, housing, shops, childcare facility, and playground. Some of them are cost and some are benefit criteria. Details of these criteria are discussed bellow:

6.2.2.1 Landscape and Recreation

Landscape and recreation is one of the most important parts of an urban area. It is a criterion that is difficult to quantify. Of course it is better and so as benefit criteria but how much better is difficult to measure. For this analysis, this criterion is kept as benefit criterion and measured in an ordinal scale. Higher order is better. For the analysis the alternatives area arranged as open space, residential and commercial. It is assumed that in commercial areas has least amount of open space and recreational spots.

6.2.2.2 Schools

Schools are one of the essential facilities and so it is considered as benefit criteria. The more schooling facility is provided the better it is. It is even quantifiable as the number of schools, their capacity in terms of students etc. can be measured with quantity. But in this analysis they are not required to be quantified. It is assumed that commercial and open space will not contain any schools. So this benefit criterion can be considered in binary scale, where 'yes' refers to better position.

6.2.2.3 Housing

Housing is one of the most important criteria especially in the present situation of Dhaka city. More than 60 percent of Dhaka's population does not own their own houses. So, the more people can be provided housing facilities the better it would be. Like the schooling, housing facilities can also be quantifying but not done in this analysis, as two of them do not have this criterion. This criterion is considered as binary benefit criterion.

6.2.2.4 Shops

Shops and markets are essential facilities for urban life. They must be within an easy distance. So this one is also considered as a benefit criterion. This criterion is measured in ordinal scale where commercial is having highest rank followed by residential and open space in decreasing order.

6.2.2.5 Child Care Facility

Childcare facility is another important component of urban life; hence it is considered as a benefit criterion. This one is also measured in binary scale as commercial and open space are not supposed to have this facility.

6.2.2.6 Playgrounds

This criterion is separated from 'landscape and recreation' only because it has a different scale to measure as well as different utilities. Landscape and recreation can be measured in binary scale as in residential it is nominal, where as playground can be present in both the cases. Difference may be made in terms of measurement. Open space and recreation may have more facilities than the residential one. But it is difficult to quantify that is why this criterion is measured in ordinal scale and it is a benefit criterion. It can be assumed that commercial area will have least amount of playground may be even zero, as a result commercial area is placed in the lowest order.

6.2.3 Environment

Environment is a group of criteria that deals with the environmental and ecological aspects of the alternatives. To avoid the complexity of Environmental Impact Assessment (EIA) the whole set of criteria is summed up to one, named environmental quality.

6.2.3.1 Environmental Quality

The criterion environmental quality is represented as a gross representation of the environmental parameters of the criteria, whether the alternative is environment friendly or not. The parameter area ground water condition, distance to green area, natural drainage system, vulnerable to flood, possibility to earthquake etc. It is difficult to say directly that a certain alternative is environment friendly or not but it is easy to compare two or more alternatives. That is why, this criterion is measured in ordinal scale and the open space obviously gets highest grade where as commercial one gets lowest.

6.2.4 Employment

Employment is a criterion of prime importance in urban life. This is the reason why people migrate from rural to urban area. Here employment is considered as a group of

criteria consisting of supply of work force and employment opportunity. In the year 1993, there 2.2 million jobs available in Greater Dhaka. The location of these jobs indicated the distribution of economic activity within the city. According to DMDP study 42% or 920,000 were located in CBD in Dhaka City, which covered the city core and old part of Dhaka.

6.2.4.1 Supply of Work Force

Supply of workforce is a complex issue. It can be viewed from different perspectives. From direct point of view only residential areas can supply workforce, as it is the origin of them. On the other hand secondary order workforce can be generated in commercial areas also. It is particularly true for expert level workforce. Experts in a particular field for short-term works or even part time jobs can be available in commercial areas who have their main job within that area. This criterion is easily quantifiable with the number of workable population within the proposed neighborhood. But for this analysis it is considered as an ordinal one and residential area is kept on the highest order as the supply of primary work force is of major importance and they are originated from residential area. Obviously open space and recreation gets its position at the bottom, as it does not supply any workforce. It is a benefit criterion.

6.2.4.2 Employment Opportunity

Things are a bit different in case of employment opportunity. All of the alternatives have some opportunity to generate employment. But commercial area will be highest by far in this regard. It is the major purpose of commercial area. In residential area some employment can be generated for the local shops and some other family requirements on the other hand in case of open space and recreation very few employments may be generated for maintenance purpose. This criterion could be measured in ordinal scale but that would be injustice for commercial one. Because the difference between residential and open space is not equal to the difference between commercial area residential. On the other hand if it is measured in binary scale, the few employment opportunity in residential and open space will be ignored. That is why direct ranking has been adopted. It is interval scale and the alternatives are graded by the decision-maker according to their importance. The grades are given in a

0-10 scale where 10 is the highest grade. Here commercial area has been given 10 and 2 and 1 for residential and open space respectively.

6.2.5 Safety

Safety is a group of criteria that includes cost criteria like risk of traffic accidents and fire accidents. Both of the risks are very important for any planning project.

6.2.5.1 Risk of Traffic Accidents

Risk of traffic accidents can be estimated for a certain use. But to keep this analysis simple, the detail calculation is avoided. It is assumed that the risk of traffic accident is highest in commercial areas and lowest in open space. That is why the scale of measurement of this criterion is decided to be ordinal. It's a cost criterion.

6.2.5.2 Risk of Fire Accidents

Like traffic accident risk of fire accident is also measured in ordinal scale with an assumption that residential area is more risky for fire accidents in comparison to commercial and open space and recreation. As a risk it is also a cost criterion.

6.2.6 Mobility

Mobility is a group of criteria that refers to the transportation condition of the area. Apart from any other factors only the traffic congestion is considered here.

6.2.6.1 Increase Congestion

Increasing traffic congestion is a cost criterion. It is analyzed in ordinal scale where commercial land-use is assumed to have highest congestion followed by open space and recreation and residential area.

Table 6.1: Criteria Table

	C/B	Unit	Standardization	Residential	Commercial	Open space
Costs						
Land filling	C	Acre	Goal	200	250	100
Road construction	C	Acre	Maximum	100	125	50
Utility & services cost	C	Ordinal	Interval	3	2	1
Planning aspects						
Landscape & recreation	B	Ordinal	Interval	2	1	3
Schools	B	Binary	1-0	Yes	No	No
Housing	B	Binary	1-0	Yes	No	No
Shops	B	Ordinal	Interval	2	3	1

	C/B	Unit	Standardization	Residential	Commercial	Open space
Child care facility	B	Binary	1-0	Yes	No	No
Playgrounds	B	Ordinal	Interval	2	1	3
Environment						
Environmental quality	B	Ordinal	Interval	2	1	3
Employment						
Supply of work force	B	Ordinal	Interval	3	2	1
Employment opportunity	B	Direct	Maximum	10	2	1
Safety						
Risk of traffic accidents	C	Ordinal	Interval	2	3	1
Risk of fire accidents	C	Ordinal	Interval	3	2	1
Mobility						
Increase congestion	C	Ordinal	Interval	1	3	2

6.3 STANDARDIZATION

To perform the analysis all the criteria have been standardized using different method. The methods of standardization usually depend on the data and scale of measurement. Following section describes various standardizations as well as their justification.

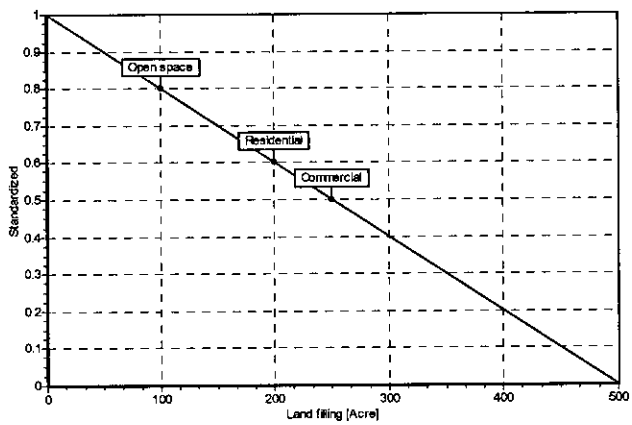


Figure 6.1: Standardized score for land filling costs

6.3.1 Development costs

Development cost is a group of criteria that include various development costs. It includes some ratio data and one ordinal. Different methods applied for different standardization.

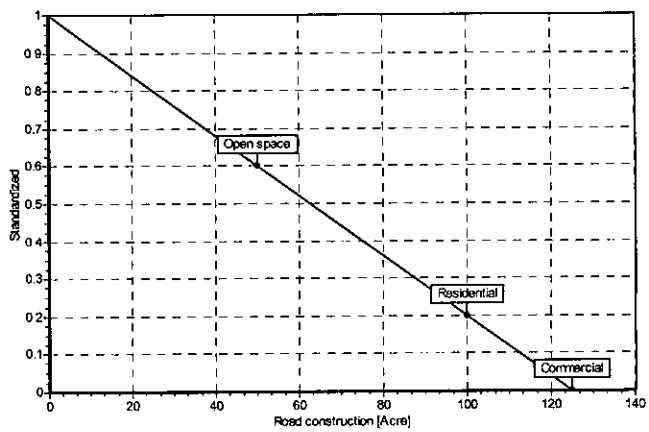


Figure 6.2: Standardized cost for road construction cost

6.3.1.1 Land filling

Land filling cost is ratio data with 'acre' as unit of measurement. As it has fixed upper limit goal standardization method has been applied for this criterion.

6.3.1.2 Road construction

Road construction is also a ratio scale, so it has the option of standardization in different method. But maximum standardization method has been used for this one.

6.3.1.3 Utility & services cost

Utility and services costs are ordinal data. So they must be standardized in expected value method.

6.3.1.4 Others

Standardization for the rest of criteria is comparatively easy to make. There is no room for further discussion. For the binary data it does not require to standardize, rather it is converted to numeric value from 'yes-no'. Usually 'yes' is converted to one (1) and 'no' means zero (0). The ordinal data are standardized using expected value method.

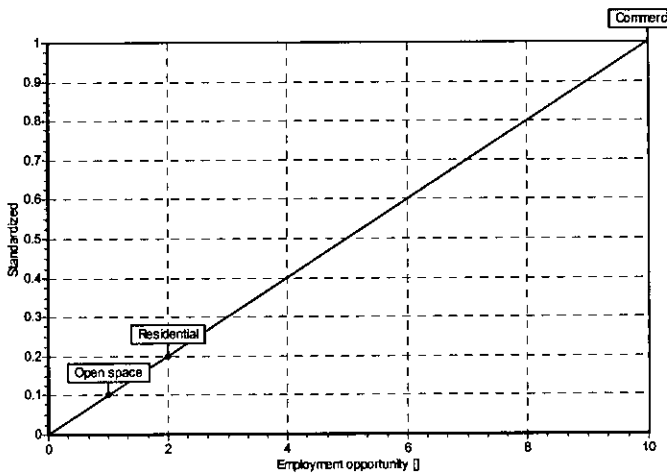


Figure 6.3: Standardized score for employment opportunity

Table 6.2: Standardized scores

	Standardization	Score			Standardized score		
		Res	Com	Opn	Res	Com	Opn
Costs							
Land filling	Goal	200	250	100	0.750	0.625	1
Road construction	Maximum	100	125	50	0.200	0	0.600
Utility & services cost	Interval	3	2	1	0	0.5	1
Planning aspects							
Landscape & recreation	Interval	2	1	3	0.5	0	1
Schools	1-0	Yes	No	No	1	0	0
Housing	1-0	Yes	No	No	1	0	0
Shops	Interval	2	3	1	0.5	1	0
Child care facility	1-0	Yes	No	No	1	0	0
Playgrounds	Interval	2	1	3	0.5	0	1
Environment							
Environmental quality	Interval	2	1	3	0.5	0	1
Employment							
Supply of work force	Interval	3	2	1	1	0.5	0
Employment	Maximum	2	10	1	0.2	1	0.1

	Standardization	Score			Standardized score		
		Res	Com	Opn	Res	Com	Opn
opportunity							
Safety							
Risk of traffic accidents	Interval	2	3	1	0.5	0	1
Risk of fire accidents	Interval	3	2	1	0	0.5	1
Mobility							
Increase congestion	Interval	1	3	2	1	0	0.5

6.4 PRIORITY ASSESSMENT

Direct assessment method has been used to prioritization of the criteria. Direct points have been assigned to various criteria depending on their importance. It is very important for the total analysis as it caries relative importance of the criteria and it reflects the preference of decision-maker. For this analysis, the technique that has been followed for prioritization is very simple. All the criteria have been given a point according to their importance in a scale of 0-10. The most important one got full 10 points. Some of them have been given low score as 1 as they are considered less important. These points are called given weights. In next step, the points are converted to a scale so that they sums up at 1. It is called their actual weight. One more thing to be clarified that is weight level. There are three types of weights.

6.4.1 Weight level one

Weight level one is assigned to the criteria groups only. It is the comparison between different criteria groups. As the most important criteria group, 'planning aspects' has been assigned highest point of 10, whereas mobility got the lowest 1. Environment and employment issues have been assigned 3 points and safety 2. It implies that the decision-maker's target is to assure planning aspects first with top priority.

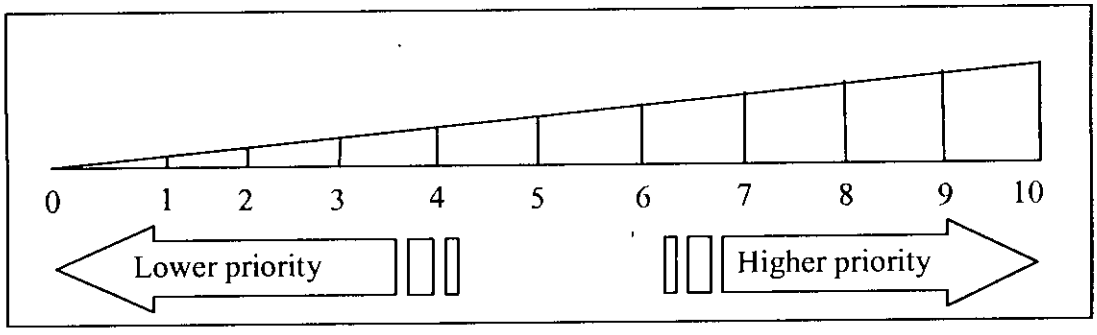


Figure 6.4: Scale for determining direct assessment

In weight level one, there are given and actual weights. Given weights are the points decision maker degree of preference in a scale of 0-10. These given weights have been divided by the sum of weight to convert them to actual weights. From the actual weights it is clear that about half of the total weights go for planning aspects.

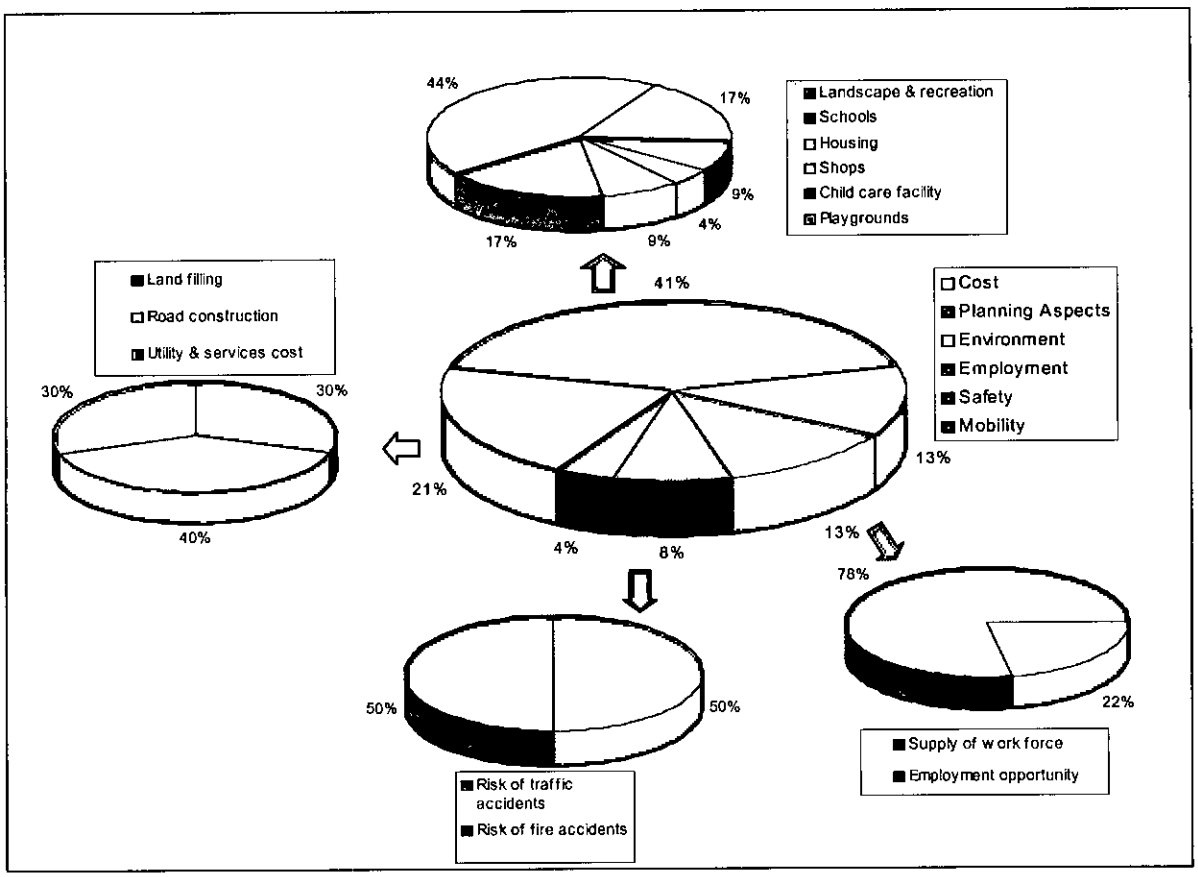


Figure 6.5: Weighing and their contribution

6.4.2 Weight level two

Weight level two is the weighing within the groups. These weights are specific for the criteria. Like weight level one, it also has two types of weighing; given and actual. But this time they are summed up to one for each group only. So it refers to the relative preferences of various criteria within a group.

6.4.3 Weight

Multiplying the weight level one with weight level two, the final weight for each criterion can be obtained. This is the final weights for each criteria. In this case the sum of weights of all criteria is 1.

Table 6.3: Priority assessment

		Weight level 1		Weight level 2		*Weight*
	C/B	Given weight	Actual weight	Given weight	Actual weight	
Costs		5	0.208			
Land filling	C			3	0.300	*0.063*
Road construction	C			4	0.400	*0.083*
Utility & services cost	C			3	0.300	*0.063*
Planning aspects		10	0.416			
Landscape & recreation	B			2	0.087	*0.036*
Schools	B			4	0.174	*0.072*
Housing	B			10	0.435	*0.181*
Shops	B			4	0.174	*0.072*
Child care facility	B			2	0.087	*0.036*
Playgrounds	B			1	0.043	*0.018*
Environment		3	0.125			
Environmental quality	B			1	1	*0.125*
Employment		3	0.125			
Supply of work force	B			2	0.222	*0.028*
Employment opportunity	B			7	0.778	*0.097*
Safety		2	0.083			
Risk of traffic accidents	C			3	0.500	*0.042*
Risk of fire accidents	C			3	0.500	*0.042*
Mobility		1	0.042			
Increase congestion	*C*			*1*	*1*	*0.042*

6.5 RESULT

Now, it is the turn of final scoring. All the standardized scores of each alternative are multiplied by the weights of relative criteria. The resultant figurer refers to the final score for each alternative. Summation of the final score for each alternative is their total preference. For this case residential use gets highest point (0.58875) followed by open space and recreation scoring (0.4695) and lowest score goes to commercial (0.27488).

Table 6.4: Final score

	Standardized score			Weight	Final Score		
	Res	Com	Opn		Res	Com	Opn
Costs							
Land filling	0.750	0.625	1	0.063	0.04725	0.03938	0.063
Road construction	0.200	0	0.600	0.083	0.0166	0	0.0498
Utility & services cost	0	0.5	1	0.063	0	0.0315	0.063
Planning aspects							
Landscape & recreation	0.5	0	1	0.036	0.018	0	0.036
Schools	1	0	0	0.072	0.072	0	0
Housing	1	0	0	0.181	0.181	0	0
Shops	0.5	1	0	0.072	0.036	0.072	0
Child care facility	1	0	0	0.036	0.036	0	0
Playgrounds	0.5	0	1	0.018	0.009	0	0.018
Environment							
Environmental quality	0.5	0	1	0.125	0.0625	0	0.125
Employment							
Supply of work force	1	0.5	0	0.028	0.028	0.014	0
Employment opportunity	0.2	1	0.1	0.097	0.0194	0.097	0.0097
Safety							
Risk of traffic accidents	0.5	0	1	0.042	0.021	0	0.042
Risk of fire accidents	0	0.5	1	0.042	0	0.021	0.042
Mobility							
Increase congestion	1	0	0.5	0.042	0.042	0	0.021
Total Score					0.58875	0.27488	0.4695

If the share of each criterion is considered, planning aspects has the highest share of 41%. This is mainly the decision maker's choice. He or she can put emphasis on different aspects that may alter the result. Decision-maker must be logical to decide these weights. On the other hand, while looking at the contribution of each criterion to the result it is clear that planning aspects helped the 'residential' to gain its achieved points. Where as environmental parameters were instrumental to bring up the other alternative.

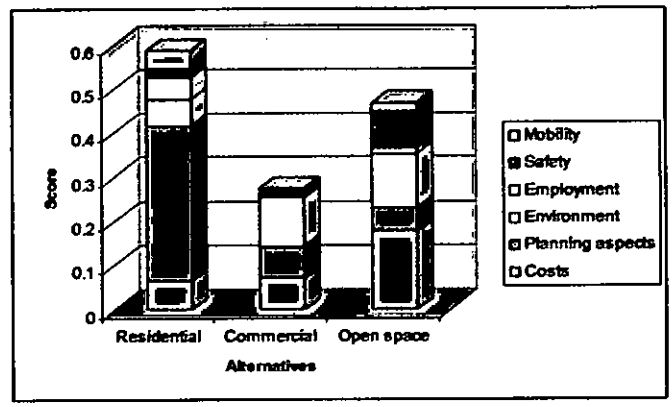


Figure 6.6: The final result and share of various criteria group

The result could also be different if the weighing is made in different way. Based on these criteria and given weighing the area has highest potential to be developed as a residential area. The weighing is supposed to be made on the basis of development policies and it depends on the development policies.

DMDP (the Urban Area Plan) considers these are under acceleration zone and acknowledge the necessity of preparation of detailed area plan with in a short time. During preparation of detailed area plan, it the above discussion might be considered and residential landuse should be given the highest priority.

7 Plan Preparation and Conclusion

7.1 Land Classification Planning in the Study Area

Land classification planning is spatially explicit statement of development policy. Land classification concentrates future development in to a few well-defined areas and delineates other areas where development should not occur. Areas where development should not occur for environmental reasons are called conservation areas, open space or areas of critical environmental concern, among other names, still other areas, which are less environmentally critical but not suitable for immediate development.

According to Ian Mc Harg's approach to land planning (MC Harg 1969 & earlier) is primately subdivided the area in to three categories- natural use, production and urban. Natural use areas have the highest priority and exclude even agriculture, production areas in the hierarchy; include agricultural forestry and fishing uses. Urban areas are lands left over after allocating the two higher priority areas. Urban areas are thus allocated to lands ill suited for either natural process or producing food and fiber.

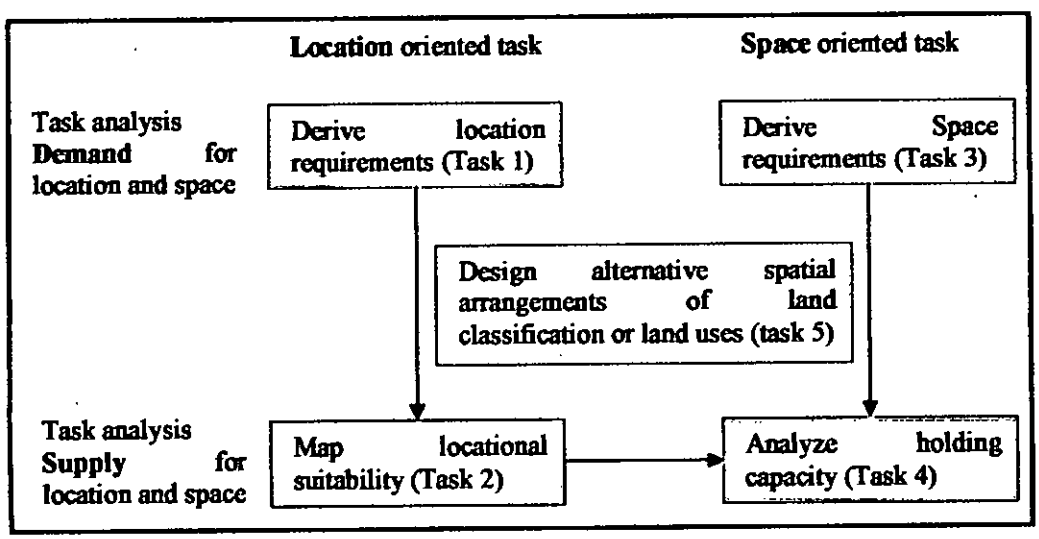


Figure 7.1: Tasks for land classification by Chapin, 1994

7.2 PLANNING APPROACH

Planning of an area requires systematic procedures to be followed. The approach for planning the study area is developed after (Chapine 1995). The approach consists following steps:

7.2.1 Formulating location requirement

Location principles apply to in-fill development in built-up areas, to the reuse of land in renewal areas, to partially developed areas and to entirely new development on the rural urban fringe. By applying MCE technique it is found that residential use has got the highest priority in the study area. To develop the study area as a residential one, it will require the provision of essential neighborhood and also the location is to be suitable for residential area.

7.2.2 Plotting suitability of residential development

This step is to derive the space requirement. The important considerations are:

i) Analyze quality, types, density, cost, and location of existing housing and trends with respect to new housing.

ii) Estimate the total no of new dwellings required housing the future population which is derived from density prescribed for this area by Purbachal standard.

iii) Estimate the proportions to the total that will be required for each of several future dwellings types; densities convert the proportions to qualitating of dwellings.

iv) Convert the quality of dwellings, by housing type to acres of land required by housing type.

v) Analyze the holding capacity of the suitable land supply-

In largely undeveloped areas, density should be used to account for land to be used for streets and supporting facilities. The holding capacity analysis should also discount lands unavailable for development.

7.2.3 Adding local support facilities

Finally local support facilities are added according to standard norms and provisions. These facilities may include the service, utilities and commercial facilities. Standard for housing is also developed in this stage. It also includes detailed design, land regulations, location and use.

7.3 PLAN PREPARATION

After having decision to develop the area with residential major, a detailed plan of the area is to be prepared as a residential one. The plan is proposed to be prepared in step by step.

7.3.1 Phase one: Formulating location requirement

As derived from the MCE, residential use should be the major land use of the area. The next prime question after having the major land use residential is the population. For how much population the residential area should be developed.

DMDP does not propose any fixed density for residential area. Dhaka master plan 1959 has a standard of a neighborhood size of 100-acre accommodating 7500 people. But the situation of Dhaka has been changed over last half a century. Here RAJUK's newly planned green city 'Purbachal' has been taken as the standard. Purbachal new town is planned to be build on 6150 acre among which 2500 acre will be residential. This 2500-acre of land will be accommodating a population of one million resulting to a net density of 400 persons per acre. Having this one as standard, our study area is designed for a net density of 400. So, design population of the study area is 2,00,000. So, rest of the plan should be prepared keeping in mind the design population of 2,00,000. This population size will be helpful to determine other requirements like service facilities.

7.3.2 Phase two: Plotting suitability of residential development

In step two, area is allocated to various uses. This is a rough guideline of the area distribution. Apart from residential plots some other uses will occupy spaces as well. Among them roads will be of major share. For area distribution, the standard set by the DMDP is followed. Sometime when no guideline is found in DMDP, other standards are consulted. In case of roads, the provision of Purbachal area is followed. 35 percent of the total land has been used for non-residential purpose among which 31

percent are open space. And remaining six percent will consist of urban services like school and other facilities that are supposed to contain a significant portion of open space.

Table 7.1: Elements of the Neighborhood

	Standards		Requirements for study area	
	DMDP	Other	No.	Area
Open Space	**4 acre / 25,000 Population**			**32 acre**
Education				**18**
Nursery school	1 school / 15, 000 population			
Primary School	1 School / 15,000 Population		14	10
Secondary School	1 School / 23,000 Population		9	7
High school		1/50 acre		
College				1
Urban Services				**5.60**
Kutcha Bazar	One in Each Ward, 0.30 acre each.		1	0.30
Community center		0.10 acre per 1000 population		
Hospital / clinic		1 for 10000 population		
Mosque		0.10 acre for 1000 population		
Market / bazaar		0.10 acre for 50 acres of land		
Shpos		1 for 100- 150 population		
Graveyard				5
Neighbourhood Centre	One in Each Ward, 0.30 acre each		1	0.30
Others	Police station, post office, gas, water supply, telephone, bus stand etc.	In terms of location and space requirements.		
Roads		**23% of total area (Purbachal)**		**92**
Primary road- minimum 60 ft				
Secondary road- minimum 30 ft				
Access road- minimum 20 ft				

Table 7.1 shows a tentative distribution of the area for various uses. They have been done in several steps.

7.3.2.1 Step one: Open Space

For open space, existing vacant lands are preferable. Especially lands that are less suitable for development works should be reserved for open space. It is shown in contour map that eastern part of the study area is mainly low-lying. It requires more land filling for further development works. Moreover it is far away from the major access to the city center Pragoti Sarani. That is why a strip on the eastern part of the area is proposed to be left vacant for development as open space (Figure 7.2). This proposed park covers 72 acres that is 14% of the total area. As Begunbari khal is beyond the area, the land should be kept open according to conservation category. The suggested open space should be conserved for environmentally sound and its have an advantage.

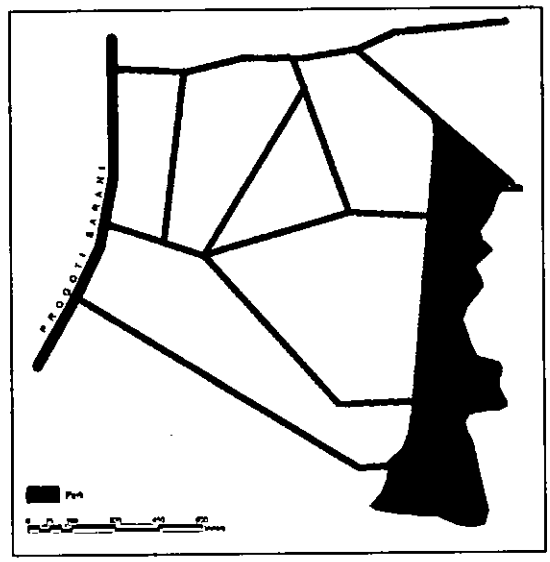


Figure 7.2: Step one: open space

7.3.2.2 Step Two: Roads

For reserving the area, the first thing comes are the roads. Its better to follow the existing trends of the roads even it can limit the construction cost. Figure 7.3 shows the existing roads and the design of new roads. Only major roads are proposed following the trends of old ones. It may be mentioned here that some other minor roads will be required to serve the area properly. One more important point is that, proposed roads are straightened. These roads occupied

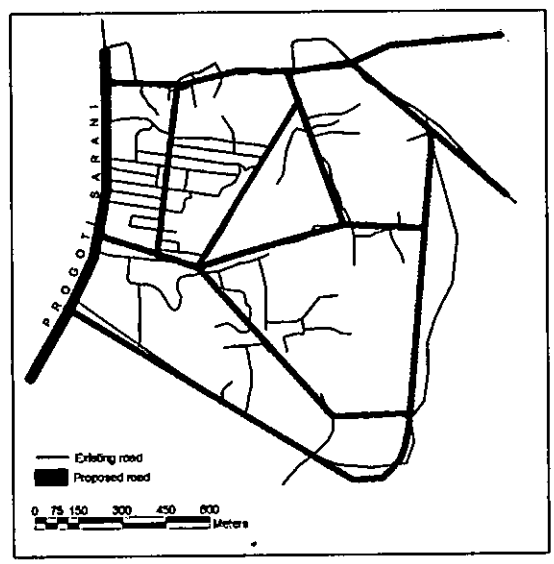


Figure 7.3: Step two: roads

51 acres about 10 percent of the total land. After adding rest of the roads it will cover 23 percent of the total area.

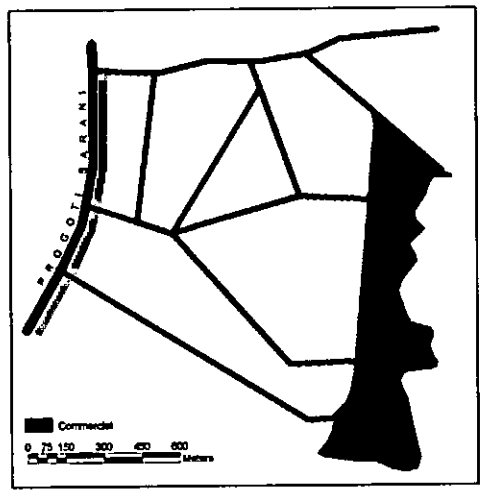


Figure 7.4: Step three: commercial area

7.3.2.3 Step Three: Commercial Area

Potential areas must be used for commercial purpose, as it is the most important income earning as well as employment generating use of urban land. Retail shops, small industry, market etc to be constructed, in study area the strip next to Progoti Sarani can be allotted for commercial purpose (Figure 7.4).

7.3.2.4 Step Four: Neighbourhood Center

Neighbourhood center should be located at the central position to provide optimum access to all urbanites. At the same time junction of maximum number of roads also can be the basis of good access to all. Considering all the parameters central part of the study area has been selected for neighbourhood centre (Figure 7.5). There is no regulation that neighbourhood centre is in the central point. It may be at any place but the main parameter is to good access to the neighbourhood centre.

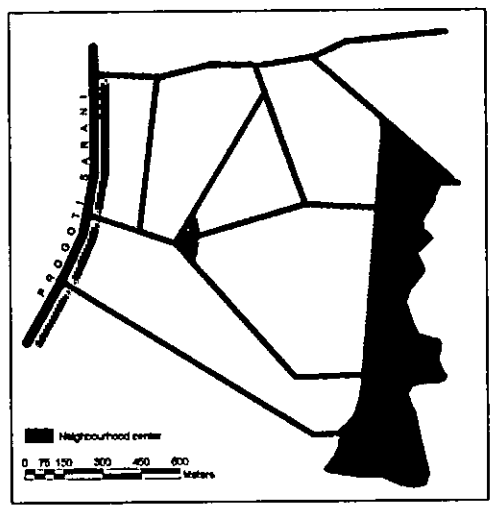


Figure 7.5: Step four: neighborhood center

7.3.2.5 Step Five: Residential area and other services

Rest of the area has been allocated for residential and other uses. Residential area has been divided in two parts. One is for comparatively higher income group of population. Area is 338 and 41 acres respectively. From these areas some has to be allocated for internal roads. Deducting

Table 7.2: Area Distribution in Various Land use

Land Use	Area in acre	%
Commercial	11	2.14
Neighborhood center	2	0.39
Park	72	14.01
Residential A	278	54.09
Residential B	34	6.61
Road	117	22.76
Total	514	100

required area for roads proportionately area remains for residential purpose is 278 and 74 acres respectively. Final distribution of land for various uses is given in Table 7.2. Following the standards given in Table 7.1 provisions should be kept for schools, market, clinic, mosques etc. Existing values of the area should be preserved to reduce construction cost. Existing school, colleges and other urban facilities can be remained with in the same location. Some extra services are proposed to be added. Figure 7.6 shows the final proposed land use of the area. It also shows the location of proposed institutions.

7.3.3 Phase Three: Sub-Division Plan

Subdivision regulations are the major factor to implement a plan. Standards are necessary in planning to assist the adequacy in services and facilities. Detail subdivision is not prepared in this study.

7.4 Policy Options

Urbanization operating in the fringe has brought a number of problems of housing infrastructure, service and loss of agricultural land. These problems require immediate attention of the planning and administrations. Broadly, the prominent factors to be contemplated for the better land use planning and development of the eastern fringe may be concentrated on the following issues.

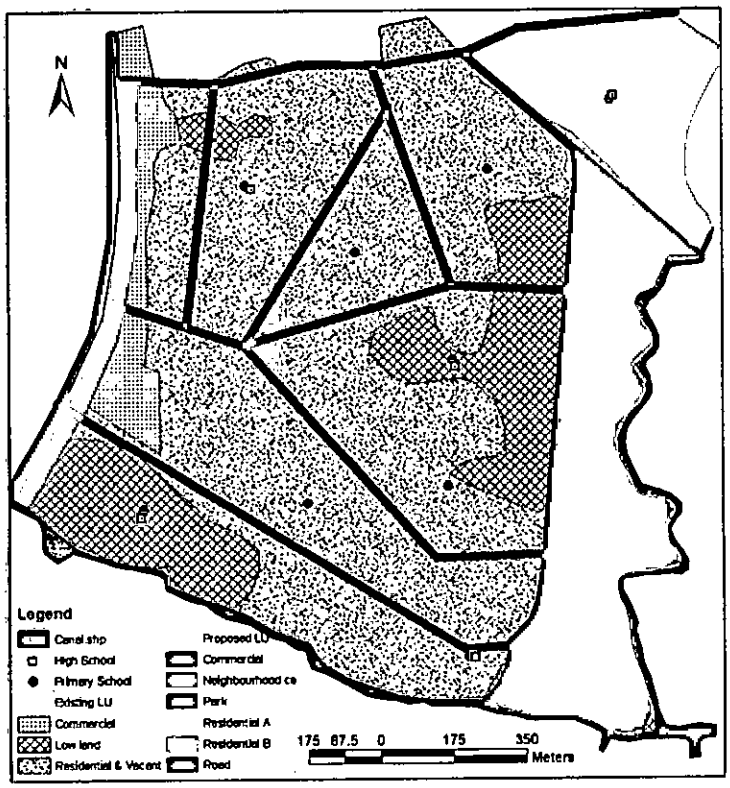
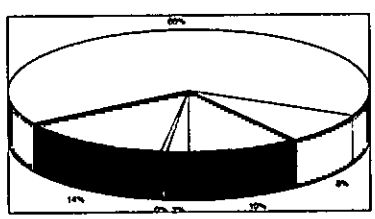


Figure 7.6: Proposed land use map



Land speculation especially on vacant land on the eastern fringe has given rises to premature conversion of the agricultural tracts and accelerated unplanned and ultimately sprawls development in

the area. To stop such land speculation suggestions deserve attention (a) restricting on premature conversion on agricultural land. (b) Taxes on land transfer to check speculation. (c) Generation of high resolution and digital topographical data for modern planning and infrastructure communication. Such satellite based information system has flexibility to accommodate any new data and provides integration as well as updating.

7.4.1 Environmental quality

Environmental problems are linked to economic loss and degradation of non-renewable natural resources, and if remain unattended will lead to a state which is not sustainable. This fact is clearly apparently with the Begunbari khal flowing through the study area. It is the main outlet to discharge almost one-third of the storm and wastewater generated from the whole Dhaka city causing serious health hazard to the residents of the study area with filthy surroundings and bad odors. Attempts should also be taken to convince some real estate companies operating in the area to maintain open space that would increase residential property value and thus the earnings of the study area.

7.4.2 Provision of adequate service

The major utility services such as water supply, electricity, sewerage and drainage etc which are inadequate and extended on the need of the people, have to be arranged in a regular network and grid. Public utility services, traffic and transportation, environmental pollution etc have seriously deteriorated and in many parts of the area have reached a crisis level. All access roads, as they have emerged in an unplanned manner, should be justified according to their usability to decide on which one should be promoted and which should not.

7.4.3 Jurisdictional authorization and regularity measures

The area can be managed by governing authority by providing government fair price shops, essential social infrastructure like schools and hospitals at low taxation and thereby spatial inequalities can be reduced in the way of life. Also, the pressures on the central city infrastructure, transportation and facilities can be lessened. Again considering the enormously huge poor population and presence of slums in the study

area, a slum improvement and schemes to rehabilitate them should immediately be on the way.

In the event of unplanned development in the eastern fringe, it has been of utmost importance to bring the area under the sole jurisdiction of public authority, which should act to ensure the betterment of the community and sustainability of the future development as a whole.

In the fringe areas most of the residents are middle and low-income group. The standards of developments may be kept as affordable and realistic for the particular income group as possible. RAJUK should try to formulate subdivision regulation. RAJUK should try to prepare plans for eastern fringe areas where very real urban emergency appears to be shaping up. Decisions on private development applications are not made in accordance with any overall framework. No consideration is being given to medium and long-term probabilities. Neither the future rational development of the area is possible without such a framework, nor can flood protection requirements be safeguard in its absence. It is, therefore, very strongly recommended that some overall plan be prepared for the study area as well as for the whole greater Dhaka east. The responsibility for land acquisition, control and management of land should be the responsibility of one agency, preferably RAJUK.

Strong regularity policies should be applied to prevent serious environmental degradation, unhealthy congested settlement and to ensure better access to basic utilities and amenities, affordable standards and effective monitoring and enforcement system. In doing so three key principles should be maintained. (a) Most individual and collective rights can be accommodated (b) a more efficient use of land is possible (c) a more active role of higher level of government to contribute towards more efficient land use pattern.

In the event of sporadic settlements, haphazard development of illegal occupation of land, a comprehensive land use regulations through zoning, detail area planning are needed to guide future development. However, economic instruments and planning tools like land information system, land pooling/land readjustment, land sharing etc. can be immediately implemented in the congested slum and squatter settlements of the study area.

7.5 CONCLUSION

The overall density of Dhaka City is 343 persons per hectares. In the city core area, the density varies from 410person per hectare to 450 persons per hectare. (Working paper PT/13, Oct 1993). It is also observed that the urban rich, 5 person of total urban population, are enjoying the 15 percent total urban residential land. The majority of low income people, (76 percent of total urban population), have access to 20 percent of the residential land in Dhaka. (Affordable shelter for urban inhabitants of Dhaka, July 1995). Beside this reality, the access to new urban land in Dhaka has been restricted by flood. This problem was highlighted in first master plan.

It is the fact that for the majority of Dhaka's population access to land is severely limited. The planned areas of past thirty years, which are implemented by the public sector, have been preserved for upper and middle-income groups. The options remaining to the urban poor are limited to existing built-up areas or largely unplanned peripheral locations of high flood risk.

Most of the urban land is usually privately owned, privately developed and privately used. Government has two key roles in development and use of urban land. Government normally responsible for the provision of physical infrastructure particularly networks infrastructure such as roads, drainage, electricity supply, water supply and sewerage and for regularly control of private development and land uses, usually through zoning, sub-division and building regulation. The growth of urban areas has constantly been faster the growth of infrastructure to service the dwellers. However, the government is short of funds to finance the desirable provision of infrastructure services in the newly developing urban fringe areas. As a result, a large section of population in the Dhaka City limited access to necessary urban services.

Without drastic changes in policy and the adoption of innovative changes in land management, the existing built-up areas will absorb more and more population and at the same time services of existing infrastructure will decline proportionately.

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APPENDIX - I

Format of the Questionnaire Survey

Department of Urban and Regional Planning

Bangladesh University of Engineering and Technology, Dhaka

Thesis Title: Land Suitability Analysis in Eastern Fringe of Dhaka: An Application of Multicrtiteria Evaluation Technique.

(Survey data will be used for Study Purpose only)

(A) Questionnaire

Date of interview: Respondent no:

1. Occupation of the Household Head.

i) Service. ii) Labor. iii) Business iv) Retired v) Unemployed.

2. Income Per Month

i) Less than 5000 ii) 5000-10000 iii) 10000-15000 iv) more than 15000

3. Tenure type

i) Owner ii) Tenant iii) Sublet

4) How long have you been in this area?

i) Less than 2 yrs. ii) 2-5 yrs. iii) 5-10 yrs. iv) 10-15 yrs.

v) More than 15 yrs.

5. Why have you been selected this area rather than any other area in the city?

i) Near to city center ii) Near to work place. iii) Cheap land price. iv) Govt. allotment.

6. What type of ownership of your plot?

i) Single ii) Joint. iii) Not applicable.

7. How did you acquire this plot?

i) By inheritance ii) By exchange iii) By purchase iv) By other means

8. Are you willing to improve your house or land?

i) Yes ii) No iii) Undecided.

9. How will you improve? Give your opinion

i) Own initiative ii) Govt. iii) Developer iv) Other

Give a precise description of main problems and give your own suggestion to solve this problem.

a) Main problems of the area?

b) How to solve problems of the area?

c) Who should take initiative?

d) What is the vision about his area?

10. Which of the following land-use would be most suitable for this area. Should be allotted in this area?

i) Residential ii) Commercial. iii) Industrial iv) Mixed

v) Others (specify)

11. What type of facilities do you want?

i) Infrastructural facilities ii) Health facility

iii)Community iv) Educational facility

(B) Questionnaire for the Direct Assessment Method of Land Suitability Analysis

Sir/Madam,

I, from the Department of Urban and Regional Planning (URP), BUET am doing a research on "Land Suitability Analysis in the Eastern Fringe of Dhaka City: by using Multicriteria Evaluation Technique". **In this regard, I am seeking for opinions about a few vital Land Use suitable factors. Your kind co-operation will be very useful for my research.**

Nature of Specialty:

Have you any experience of working (or any study) in urban development?

If yes, How long.....Yrs. (Please Tic in your choice)

Factor					
	Equally Important	Slightly Important	Moderately Important	Strongly Important	Extremely Important
Physical & Geographical	1	2	3	4	5
Physical/Geological	1	2	3	4	5
Socio-economic & Demographic	1	2	3	4	5
Utility/Urban Services	1	2	3	4	5
Environmental/Ecological	1	2	3	4	5
Social facilities & Transportation	1	2	3	4	5
Safety & Employment	1	2	3	4	5

Directions:

In the following land-suitability factor groups are shown in the above table. You have to choose the factor that is most important to the selection of a particular land-use. Reference the scale above to select a weight for the selected factor and tic to mark the degree/level of preferences.

Comments (if any)

Name of the surveyor: Date of survey

APPENDIX – II

Tables Showing Detail Information of Household Survey

Table A-1: Occupation Pattern

Occupation	Respondent	Percentage
Service	30	22
Business	43	31
Labor	37	26
Retired	16	12
Unemployment	13	9

Table A-2: Income per month

Income per month (tk)	Respondent	Percentage
Less than 5000	36	26
5000-10000	58	42
10000-15000	27	19
15000+	18	13

Table A-3: Tenure status

Ownership pattern	Respondent	Percentage
Owner	80	58
Tenant	57	41
Sublet	2	1

Table A-4: Duration of living

Length of stay	Respondents	Percentage
> 2years	5	4
2-5 years	13	9
5-10 years	53	38
10-15 years	51	37
15 years <	17	12

Table A-5: Reasons for selecting the area.

Reasons	Respondent	Percentage
Near to work place	45	32
Cheap land price	67	49
Govt. allotment	17	12
Near to city center	10	7

Table A-6: Land uses in the plot

Land use	Respondent	Percentage
Residential	125	90
Commercial	5	4
Mixed	8	6
Educational	1	.7

Table A-7: Respondents' view regarding expected future land use

Land use	Respondents	Percentage
Residential with recreational facilities	126	91
Commercial	4	3
Mixed	9	6

APPENDIX – III

PROCESS OF DETAILED AREA PLAN

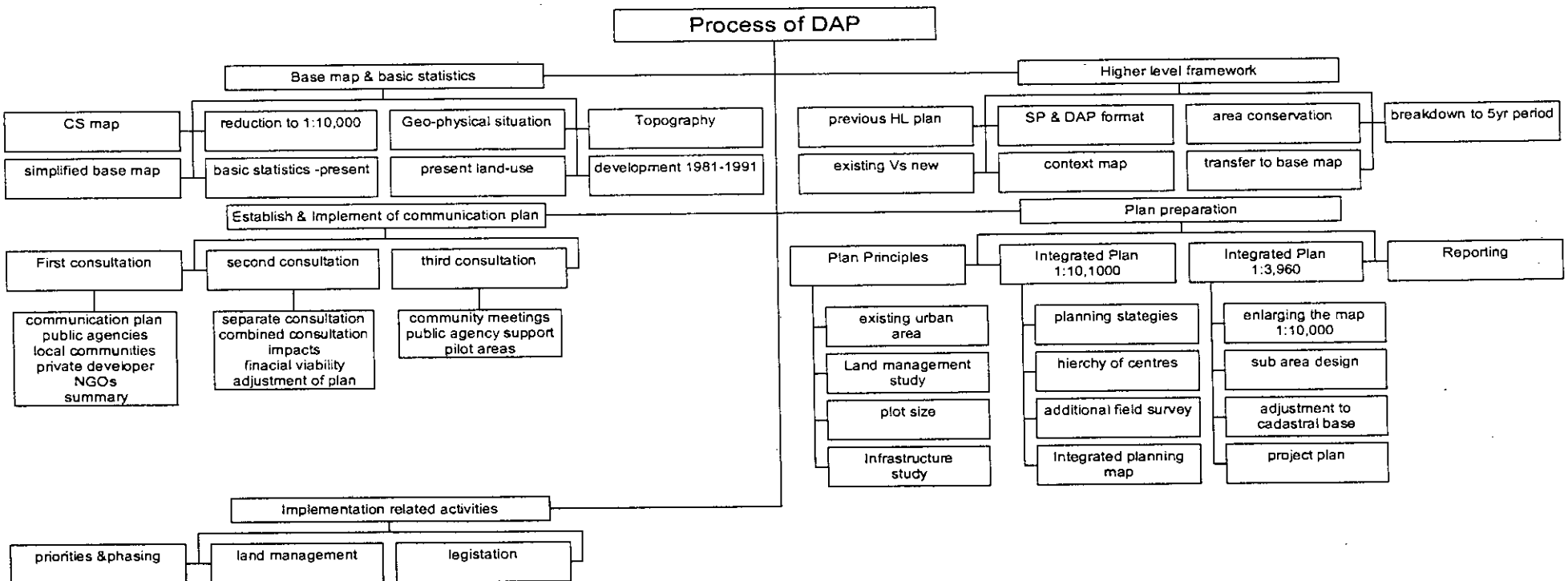

Figure A-1: Process model of preparation of DAP (Source: Manual for the Preparation of DAP, Oct 1995)

FORMAT OF DETAILED AREA PLAN

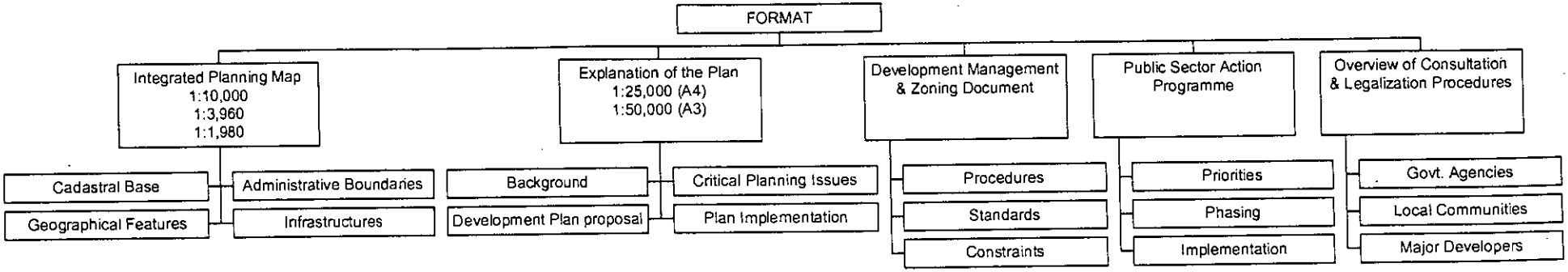

Figure A-2: Format of DAP (Source: Manual for the Preparation of DAP, Oct 1995)