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STATE OF DISASTER RISK MANAGEMENT IN DHAKA CITY



A Dissertation for the Degree of Master in Disaster Management

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ABSTRACT

This study is aimed at giving an idea about where we are standing regarding disaster risks in Dhaka. It started with the disaster management context at the national level and detailed out the development and urban management process of Dhaka City. Vulnerability issues for Dhaka considered flood and earthquake, though in the latter parts earthquake got more attention reasonably. An integrated approach for disaster risk management in Dhaka is yet to develop. The policy measures that have been taken so far in this regard lack proper enforcement. Laudable amount of quality research works have been conducted at the academic level considering the disaster risks that Dhaka holds. There have been some very good initiatives for capacity building in this field including academic programs, training and workshops. Different government and non-government organizations are dedicatedly working for awareness raising among communities. But lack of coordination and reluctance of the policy makers towards incorporating newer measures in the policy and lack of law enforcement as well, leave Dhaka in a very critical position considering specially the earthquake threat.

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LIST OF ACRONYMS

ADPC	Asian Disaster Preparedness Center
AFD	Armed Forces Division
BDRCS	Bangladesh Red Crescent Society
BES	Bangladesh Earthquake Society
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BoI	Board of Investment
BPATC	Bangladesh Public Administration Training Center
BPDB	Bangladesh Power Development Board
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CB	Cantonment Board
CCDMC	City Corporation Disaster Management Committee
CDMP	Comprehensive Disaster Management Program
CEGIS	Centre for Environmental and Geographic Information Services
CEO	Chief executive Officer
CIDA	Canadian International Development Agency
CPP	Cyclone Preparedness Programme
CPPIB	Cyclone Preparedness Program Implementation Board
CSDDWS	Committee for Speedy Dissemination of Disaster Related Warning/ Signals
DANIDA	Danish Development Agency
DCC	Dhaka City Corporation
DDMC	District Disaster Management Committee
DER	Disaster Emergency Response Group
DESA	Dhaka Electric Supply Authority
DHI	Danish Hydraulic Institute
DIT	Dhaka Improvement Trust
DMA	Dhaka Metropolitan Area
DMB	Disaster Management Bureau
DMC	Disaster Management Committee
DMDP	Dhaka Metropolitan Development Plan
DMIC	Disaster Management Information Center
DMP	Dhaka Metropolitan Police

DMTATF	Disaster Management Training and Public Awareness Building Task Force
DPHE	Department of Public Health Engineering
DRR	Directorate of Relief and Rehabilitation
DRTMC	Disaster Research Training and Management Centre
DWASA	Dhaka Water and Sewerage Authority
EBBCA	East Bengal Building Construction Act
EDRI	Earthquake Disaster Risk Index
FFWC	Flood Forecasting and Warning Center
FPOCG	Focal Point Operation Coordination Group of Disaster Management
GM	General Model
GSB	Geological Survey of Bangladesh
IAEE	International Association for Earthquake Engineering
ICZM	Integrated Coastal Zone Management
IMDMCC	Inter-Ministerial Disaster Management Co-ordination Committee
ISDR	International Strategy for Disaster Reduction
IWM	Institute of Water Modeling
KDA	Khulna Development Authority
MDGs	Millennium Development Goals
MoFDM	Ministry of Food and Disaster Management
MoHPW	Ministry of Housing and Public Works
MoLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MTMF	Medium-Term Macro-Economic Framework
NAPA	National Adaptation Plan of Action
NDMAC	National Disaster Management Advisory Committee
NDMC	National Disaster Management Council
NEC	National Economic Council
NEMAP	National Environment Management Action Plan
NGO	Non-Governmental Organization
NGOCC	NGO Coordination Committee on Disaster Management
NHA	National Housing Authority
NIRAPAD	Network for Information Response and Preparedness Activities on Disaster
NSET	National Society for Earthquake Technology, Nepal
PC	Planning Commission
PDMC	Pourashava Disaster Management Committee
PEER	Program for Enhancement of Emergency Response

PRSP	Poverty Reduction Strategy Paper
PWD	Public Works Department
RAB	Rapid Action Battalion
RAJUK	Rajdhani Unnayan Karttripakhya (Capital Development Authority)
RDA	Rajshahi Development Authority
RHD	Roads and Highways Department
RSS	Representative Spectral Signature
SARS	Severe Acute Respiratory Syndrome
SOD	Standing Order on Disasters
SP	Structure Plan
SPARRSO	Space Research and Remote Sensing Organization
UDD	Urban Planning Directorate
UDMC	Union Disaster Management Committee
UNDP	United Nations Development Program
UP	Upazila Parishad (subdistrict level council)
USAID	United States Agency for International Development
UZDMC	Upazila Disaster Management Committee
VDP	Village Defense Police
WARPO	Water Resources Planning Organization
WCDR	World Conference on Disaster Reduction
WMO	World Meteorological Organization

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Bangladesh is known as a disaster prone country. The economic development of the country has been repeatedly retarded by disasters and there has been little progress considering the disaster management till now. Disaster Management has long been misconceived as only relief and response oriented program. The good thing is that recently the concentration of disaster management has been shifted to risk reduction and a Comprehensive Disaster Management Program (CDMP) has been adopted.

Dhaka, the capital city of Bangladesh, holds the most important place considering administrative, business and commerce activities of the country. Rapid urbanization and unplanned physical development has put Dhaka in a very distinctive place compared to other parts of the country. Flooding due to drainage congestion is almost a regular phenomenon here and Dhaka is believed to be awaiting a devastating earthquake any time now. But as a matter of disgrace, Dhaka failed to get any special attention from the policy makers despite its special vulnerable characteristics.

Dhaka deserves special treatment because of its distinct urban characteristics and the associated various dimensions of vulnerabilities. The agencies that are responsible for the development of the city seem to have little or no knowledge about the potential disaster that the city is very often referred to.

Much has been talked by the researchers and technical experts about the measures that should be taken to reduce the potential loss of lives and properties, and the concerned agencies seemed to have taken them quite seriously while encountered by media. But what is the reality? Are we really ready for an unprecedented earthquake strike or a stand-still flood situation in Dhaka? What happens if most of the buildings of the city collapse while the rescue operation for a single building-collapse takes several days? Though the overall situation in disaster risk reduction and management perspectives is frustrating, there have been some really good initiatives to withstand against the threats.

This study, being exploratory in nature, is intended to draw a picture of the state of Dhaka City with regards to its vulnerabilities to hazards like flooding and earthquakes. The

functional and legal arrangements of the city for proper risk reduction and disaster management have been elaborated. Finally, some activities, which have been felt worthwhile towards the associated disaster risk reduction, have been discussed.

1.2 OBJECTIVES OF THE STUDY

The broad objectives of the study can be stated as to:

- Identify the vulnerabilities of the city to different hazards;
- Identify the functional and legal arrangements for disaster risk reduction and management within the management systems of the city;
- Identify the worthwhile activities regarding disaster risk reduction and management.

1.3 EXPECTED OUTCOME

Once accomplished, this study is expected to provide a total view of the state of disaster risk management in Dhaka City and hence will help realize our vulnerabilities. It is also expected to serve as a guideline for identifying the fields of necessary interventions for proper disaster management at the city level.

1.4 METHODOLOGY

Since this study is exploratory in nature, it is mostly based on secondary information. Disaster Management related books, journals, academic research works, newspaper articles and articles on the Internet were the sources of the necessary information. Almost all the concerned offices were visited by the author to learn about their vested responsibilities and their preparations regarding disasters. Academic researchers, technical experts and disaster management practitioners were consulted for the identification of the activities, which have been felt worthwhile.

1.5 CONSTRAINTS AND LIMITATIONS

Like any exploratory research the major challenge of the study was finding the appropriate information in place. Though meticulous efforts were made, the author admits that the list of the activities may not be comprehensive. Besides, entitling of the particular activities as 'effective' may not be unquestionable since their effectiveness depends on other related components.

CHAPTER 2

NATIONAL DISASTER MANAGEMENT CONTEXT

2.1 NATIONAL HAZARDSCAPE

Cyclones and floods pose the greatest risk to Bangladesh on a country level. Sub nationally, the northern and eastern regions of the country are susceptible to earthquakes while the southeast is particularly vulnerable to cyclones, floods, droughts, and earthquake. Bangladesh is also vulnerable to other natural and man-made hazards, such as riverbank erosion, tornadoes, tsunami, high arsenic contents in ground water, water logging, water and soil salinity, etc. Bangladesh is also at a great risk from global climate change impacts because of its low elevation and exposure to various climate related hazards. Although the magnitude of these changes may appear to be small, they could substantially increase the frequency and intensity of existing climatic events, such as floods, droughts, cyclones etc.

2.1.1 Cyclone and Storm Surge

The Bay of Bengal is the breeding ground for tropical cyclones and Bangladesh is the worst victim in terms of fatalities and economic losses they incur. The global distribution of cyclones shows that only 1% of all the cyclones that form every year strike Bangladesh; but unfortunately, the fatalities they cause here is 53% of the whole world (Ali, 1999).

Table 2.1: List of the Major Devastating Cyclones in Bangladesh.

Date of Occurrence	Nature of Phenomenon	Death toll
11.10.60	Severe Cyclonic Storm	3000
31.10.60	Severe Cyclonic Storm	5149
09.05.61	Severe Cyclonic Storm	11468
28.05.63	Severe Cyclonic Storm	11520
11.05.65	Severe Cyclonic Storm	17279
05.11.65	Severe Cyclonic Storm	873
01.11.66	Severe Cyclonic Storm	850
12.11.70	Severe Cyclonic Storm with a core of hurricane wind	200000
24.05.85	Severe Cyclonic Storm	4264
29.11.88	Severe Cyclonic Storm with a core of hurricane wind	6133
29.04.91	Severe Cyclonic Storm with a core of hurricane wind	138882
19.05.97	Severe Cyclonic Storm with a core of hurricane wind	155

Source: Bangladesh Meteorological Department (BMD), 1998.

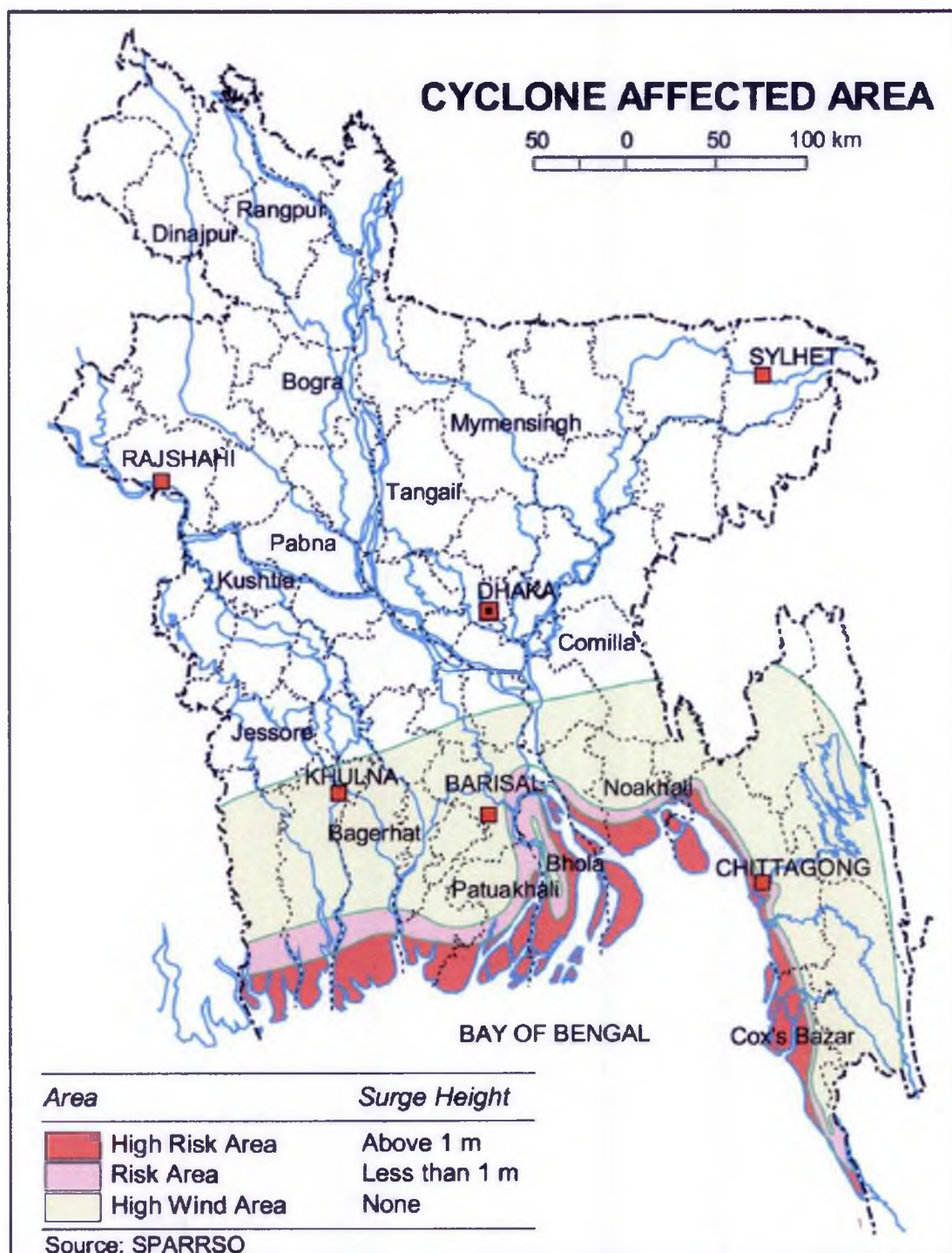


Figure 2.1: Cyclone Affected Areas in Bangladesh.
Source: Banglapedia, 2004.

2.1.2 Flood

Bangladesh is a low land country. Most of it is located within the flood plains of three great rivers—the Ganges, the Brahmaputra, and the Meghna—and their tributaries and distributaries. The river systems drain a total area of about 1.72 million square kilometers in India, China, Nepal, Bhutan, and Bangladesh. Only 8% of this area lies within Bangladesh (ADB, 2005). As result huge inflows of water, which Bangladesh has no control, enter the country. The lack of control is a critical problem because Bangladesh has an agrarian economy dependent on water. At different times and in an unpredictable manner it has too much or too little water. The intricate network of alluvial rivers carries a huge annual discharge and sediment load, causing channel shifting and bank erosion. Withdrawals in upstream areas seriously affect socioeconomic growth, the environment, and the ecology. The habitat of fish, which is a major source of protein for the rural poor, is under threat from the increasing conversion of land to agricultural use. Inland navigation is hindered by blockages in the river delta. Meanwhile, the need for pure water is increasing along with the salinization of the coastal belt and the degradation of ecosystems.

As an example of the above described situation, during the July 2004 event, the Meghna River peaked, and Jamuna and Padma Rivers burst their banks. As a result, 36 million people, 25% of the total population, were affected, and 38% of the whole area of the country was flooded for nearly 55 days (DMB, 2006). To further complicate the scenario, in September of the same year, monsoon rains three times larger than the normal flooded new areas (Asian Development Bank, 2005).

The flood of 1988 during August-September inundated an area of 89,000 sq km of 52 districts of the country and caused a loss of 1,517 human lives. The 1998 flood in Bangladesh with an unprecedented duration of 65 days inundated 53 districts covering about 100,000 sq km and took the lives of 918 people. Beside this, the severe floods of 1822, 1854, 1922, 1955, 1966, 1974, 1987, and 2002 are worth mentioning (DMB, 2006).

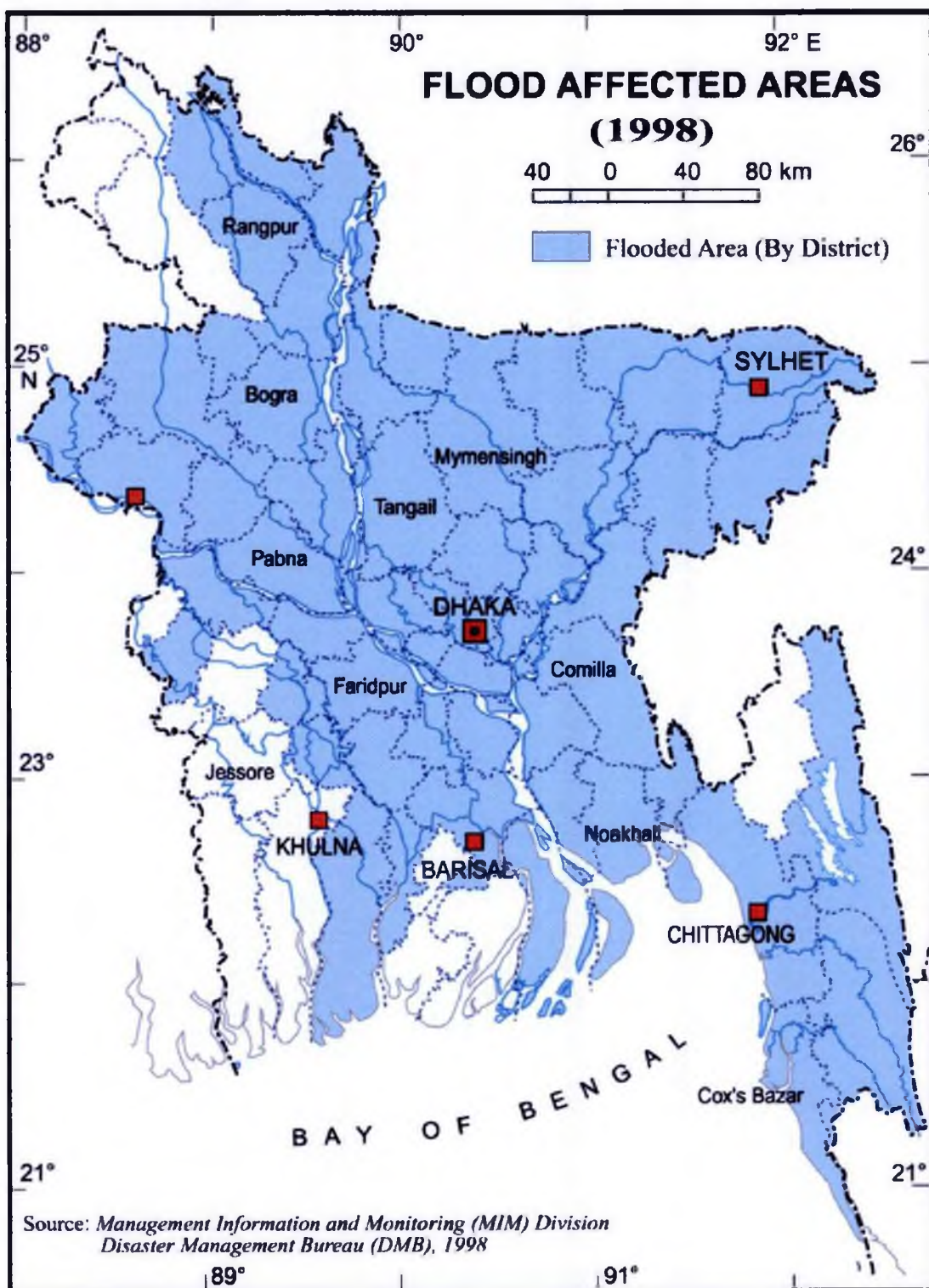


Figure 2.2: Flood Affected Areas in Bangladesh (1998).
Source: Banglapedia, 2004.

2.1.3 Earthquake

Bangladesh lies in the Burma basin, which was formed by the continent-continent collision of India to the north, and subduction of ocean crust beneath the Burma continental crust to the east. Bangladesh is surrounded by regions of high seismicity, which include the Himalayan Arc and Shillong Plateau in the north, the Burmese Arc, Arakan Yoma anticlinorium in the east, and complex Naga-Disang-Haflong thrust zone in the northeast (DMB, 2006).

Table 2.2: List of major earthquakes affecting Bangladesh

Name of Earthquake	Magnitude	Intensity at Dhaka	Epicentral Distance from Dhaka (km)
1869 Cachar Earthquake	7.5	V	250
1885 Bengal Earthquake	7.0	VII	170
1897 Great Indian Earthquake	8.7	VIII+	230
1918 Srimangal Earthquake	7.6	VI	150
1930 Dhubri Earthquake	7.1	V+	250
1934 Bihar-Nepal Earthquake	8.3	IV	510
1950 Assam Earthquake	8.5	IV	780

Source: Choudhury, 2005.

The country has a long history of seismic activity related to its proximity to the Himalayas. Three great earthquakes of magnitudes exceeding 8 were felt in 1897, 1934, 1950 and another 4 earthquakes exceeding magnitude 7 were felt between 1869 and 1950. Major seismic sources are the Meghalaya (8.0), Tripura (7.0), Sub-Dauki (7.3), and Bogra (7.0), all of them with associated earthquakes of expected magnitudes higher or equal to 7.0 (Choudhury, 2005).

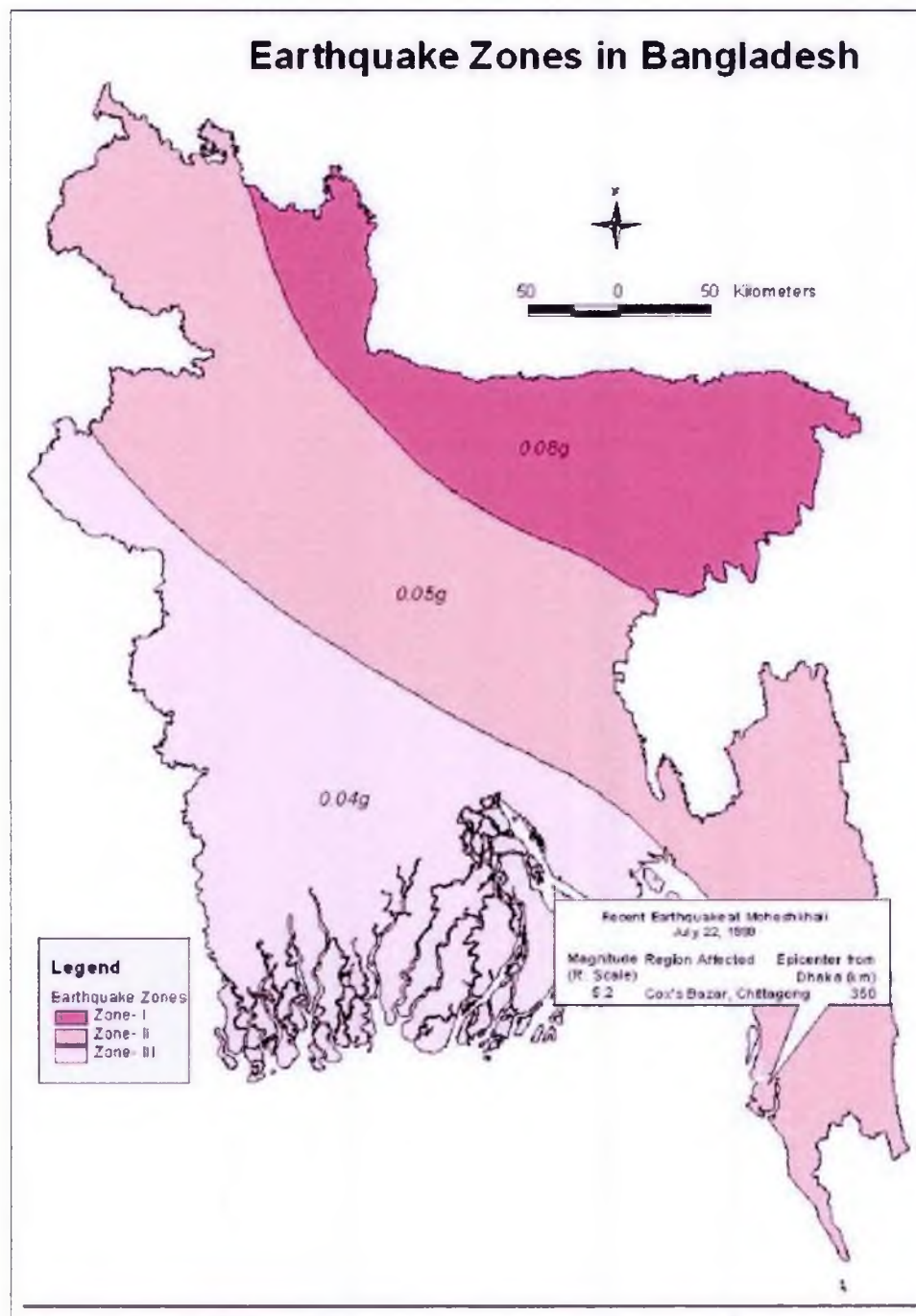


Figure 2.3: Earthquake Zones in Bangladesh.
Source: MIM, DMB, 2001.

2.2 NATIONAL DISASTER MANAGEMENT STRUCTURE

2.2.1 Administrative System

Ministry of Food and Disaster Management (MoFDM) is the national focal point for disaster management in Bangladesh. It manages disasters through its three agencies: Disaster Management Bureau (DMB), Directorate of Relief and Rehabilitation (DRR), and Directorate General of Food. It is assisted by other government agencies, such as Fire Services and Civil Defense Department, Disaster Emergency Centre of Armed Forces Division, Bangladesh Meteorological Department (BMD), Flood Forecasting and Warning Center (FFWC), Bangladesh Police, Rapid Action Battalion (RAB), Cyclone Preparedness Programme (CPP), etc. It has technical and scientific partnership with Space Research and Remote Sensing Organization (SPARRSO), Geological Survey of Bangladesh (GSB), Centre for Environmental and Geographic Information Services (CEGIS), Water Resources Planning Organization (WARPO), Institute of Water Modeling (IWM), Bangladesh University of Engineering and Technology (BUET), etc. At the field level, the Office of the Deputy Commissioner at the district level, the Office of the Upazila Nirbahi Officer at the Sub-district level and the Union Parishad at the lowest level of the administration play crucial roles in disaster management (MoFDM, 2005).

2.2.2 Organizational Structure of Disaster Management

Bangladesh has an elaborate system of disaster management. A series of inter-related institutions, at both national and sub-national levels have been created to ensure effective planning and coordination of disaster management and emergency response events.

A) National Level

- i. National Disaster Management Council (NDMC):** It is headed by the Honorable Prime Minister to formulate and review the disaster management policies and issue directives to all concerns.
- ii. Inter-Ministerial Disaster Management Co-ordination Committee (IMDMCC):** It is headed by the Honorable Minister in charge of the Ministry of Food and Disaster Management (MoFDM) to implement disaster management policies and decisions of NDMC / Government.
- iii. National Disaster Management Advisory Committee (NDMAC):** It is to be headed by an experienced person having been nominated by the Honorable Prime Minister.

- iv. Cyclone Preparedness Program Implementation Board (CPPIB):** It is headed by the Secretary, Ministry of Food and Disaster Management to review the preparedness activities in the face of initial stage of an impending cyclone.
- v. Disaster Management Training and Public Awareness Building Task Force (DMTATF):** It is headed by the Director General of Disaster Management Bureau (DMB) to coordinate the disaster related training and public awareness activities of the Government, NGOs, and other organizations.
- vi. Focal Point Operation Coordination Group of Disaster Management (FPOCG):** It is headed by the Director General of DMB to review and coordinate the activities of various departments and agencies related to disaster management and also to review the Contingency Plan prepared by concerned departments.
- vii. NGO Coordination Committee on Disaster Management (NGOCC):** It is headed by the Director General of DMB to review and coordinate the activities of concerned NGOs in the country.
- viii. Committee for Speedy Dissemination of Disaster Related Warning/ Signals (CSDDWS):** It is headed by the Director General of DMB to examine, ensure and find out the ways and means for the speedy dissemination of warning signals among the people.

B) Sub-national Level

- i. District Disaster Management Committee (DDMC):** It is headed by the Deputy Commissioner (DC) to coordinate and review the disaster management activities at the district level.
- ii. Upazila Disaster Management Committee (UZDMC):** It is headed by the Upazila Nirbahi Officer (UNO) to coordinate and review the disaster management activities at the Upazila level.
- iii. Union Disaster Management Committee (UDMC):** It is headed by the Chairman of the Union Parishad to coordinate, review, and implement the disaster management activities of the concerned union.
- iv. Pourashava Disaster Management Committee (PDMC):** It is headed by Chairman of Pourashava (municipality) to coordinate, review, and implement the disaster management activities within its area of jurisdiction.
- v. City Corporation Disaster Management Committee (CCDMC):** It is headed by the Mayor of City Corporations to coordinate, review, and implement the disaster management activities within its area of jurisdiction.

2.2.3 Legal System

While Allocation of Business of the Rules of Business of the Government assigns roles and responsibilities to various ministries of the government, the Standing Order on Disasters (SOD) assigns roles and responsibilities to relevant government agencies as well as to Disaster Management Committees (DMCs) at all levels. The enactment of a disaster management law is in progress.

The SOD provides detailed roles and responsibilities of all disaster management committees, relevant ministries, divisions, departments, and agencies at all levels for normal period risk reduction and during emergency response periods.

2.2.4 Priority on Disaster Risk Management

The government acknowledges the need for disaster risk reduction as opposed to the earlier concepts of responding after a disaster, as a necessary and cost-effective approach. Thus priority has been to focus on community level preparedness, response, recovery, and rehabilitation. Programs to train people living in disaster prone areas for improving their capability to cope with natural disasters are highlighted.

Bangladesh has created a simplistic model to guide the design of disaster management programs, including development or review of policy and training course material. The model has three key elements and ensures that the move to a more comprehensive risk reduction culture remains central to all efforts.

(1) Defining the Risk Environment – This element of the model promotes the use of scientific analysis (including climate change impacts) as the basis for accurately determining the future risk environment relative to all hazards, all sectors, and all geographical areas. Bangladesh has adopted the process outlined in the International Risk Management Standard AS/NZS: 4360-1999 to guide all community risk assessments.

(2) Managing the Risk Environment – Promotes the design of risk reduction strategies (Community Based Adaptation Programmes) as an outcome of the risk assessment process. This ensures Prevention, Preparedness, Response, and Recovery programs are multi hazard focused and they move from being hazard generic in nature to risk specific. This will enable communities to better understand their changing risk environment and thus become more resilient through proactive risk reduction efforts.

(3) Responding to the Threat Environment – This involves responding to an actual threat situation. It helps Bangladesh disaster management officials to clearly articulate the difference between risk reduction and emergency response and how accurately defining risk environments can influence and enhance emergency response systems and decisions.

2.2.5 Disaster Management Plan

The MoFDM Corporate Plan: Framework for Action 2005 – 2009

This document sets out the priorities and broad strategies for achieving reform within the disaster management sector and ensures that there are strong linkages with the priorities of the government in respect to the achievement of goals associated with national (PRSP) and international drivers such as the MDGs, WCDR, and ISDR. Each of the three operational agencies (Disaster Management Bureau, Directorate of Relief and Rehabilitation, Directorate General of Food) of the Ministry have prepared 2-3 year Strategic Plans based on the Corporate Plan and an Operations Plan detailing the priorities for each twelve month period. These plans are used to assist the MoFDM and its agencies to formulate collaborative partnerships, particularly with NGOs, for sustainable delivery of services relative to each strategy.

This is an administrative document. It is expected to get legal coverage under the draft disaster management act.

The Plan recognizes that there are many interdependent elements that make up an effective disaster management system. These elements are listed below as six strategic focus areas. The critical factor is for each of these focus areas to be viewed as being individual inputs to a bigger picture with the outputs of one or more elements, being inputs to other focus area programs.

Focus Area 1: Professionalizing the disaster management system.

Focus Area 2: Mainstreaming of risk management programming (partnership development).

Focus Area 3: Strengthening of community institutional mechanisms (community empowerment).

Focus Area 4: Expanding Risk Reduction programming across a broader range of hazards.

Focus Area 5: Strengthening emergency response systems.

Focus Area 6: Maintaining and strengthening the national food security system - with a focus on ensuring access to sustainable food supplies.

2.3 NATIONAL LAND USE MANAGEMENT SYSTEM AND RELEVANT LEGISLATION

After the emergence of Bangladesh as a sovereign state in 1971, the Revenue Department of the provincial government of East Pakistan was reconstituted into Land Administration and Land Reforms Division under the Ministry of Law and Land Reforms, which was concerned mainly with policy decisions (Banglapedia, 2004).

The Ministry of Law and Land Reforms was renamed as the Ministry of Land in early 1987. The newly designated ministry focused on policymaking, supervision, and monitoring of land reforms (Banglapedia, 2004).

A separate body, namely, the Land Reforms Board, was set up at the national level under the Land Reforms Board Act 1989 (Act XXIII of 1989). Under Section 5 of the Land Reforms Board Act 1989, the board may perform such functions and discharge such duties in respect of land reforms and land management as the government may entrust to it. The board may also exercise such power and perform such duties as may be entrusted to it by or under any law (Banglapedia, 2004).

The primary function of the board is to supervise the functioning of the field offices and the implementation of land reforms measures. This involves supervision of land administration offices down to the union land office, settlement of agricultural *khas* land to the landless peasants, assessment of land development tax, management of Court of Wards, creation of new union land offices, establishment of record rooms at the district and Upazila levels, their supervision and inspection, preparation of development. Plans for matters relating to land management, their implementation and supervision, and matters relating to the board's establishment, record room, and library are some of the functions entrusted by the Ministry of Land to the Land Reforms Board (Banglapedia, 2004).

It is the responsibility of the Directorate of Land Records and Surveys under the Ministry of Land to prepare and publish maps and update record of rights. The director general, Land Records and Surveys, with the assistance of a number of directors, deputy directors, assistant directors, settlement officers, assistant settlement officers, and a large number of

trained and technical staff, obtains the maps and records prepared and revised under the provisions of the East Bengal State Acquisition and Tenancy Act 1950, and hands them over to the collectors (deputy commissioners). The collectors maintain them and keep them corrected by incorporating the changes due to transfer, inheritance or otherwise (Banglapedia, 2004).

2.4 INTEGRATION OF DISASTER RISK MANAGEMENT IN DEVELOPMENT PROGRAMS

Development planning in Bangladesh, where vulnerability to natural and environmental hazards must be taken into account, has addressed risk reduction into some sectoral plans. For example, extensive river flooding causes disruption and damage to infrastructure, agriculture, and livelihood. The National Water Management Plan underlines the importance of implementing effective non-structural measures to reduce the impact of floods and erosion. Recent policies and plans have recognized the importance of participatory planning that focuses on sustaining people's livelihood. Drought induced famine, global warming, cyclonic storms, and other hazards have required Government to factor in strategic planning into the national development cycle. The National Environment Management Action Plan (NEMAP) takes into account the disaster management and risk reduction as a vital component and need. The Integrated Coastal Zone Management (ICZM) program has built-in components to address risk reduction. However, there remains a need to create a holistic and comprehensive risk reduction culture within national policies and strategies for disaster risk reduction. The Ministry of Food and Disaster Management's Comprehensive Disaster Management Program will begin to develop and strengthen human and institutional capacities, increase public participation in risk reduction activities, and educate policy makers to achieve a wider acceptance of disaster risk reduction concepts to address national and human development problems (MoFDM, 2005).

Disaster risk reduction has been incorporated into the Interim Poverty Reduction Strategy Paper (I-PRSP) as Annex 9 Disaster Vulnerability and Risk Management. The Government strategy acknowledges that disaster management would involve the management of both risks and consequences of disasters that would include prevention, emergency response and post-disaster recovery. It is expected that the final PRSP, known as Medium-Term Macro-Economic Framework (MTMF), will dwell at length on these issues and devise a plan of action. The risk reduction approach has not yet reached the point of becoming mainstreamed in the development process. The National Environment Management Action Plan (NEMAP) formulation process has, however, encompassed disaster risk reduction. The National Adaptation Plan of Action (NAPA) is in the process

of development by representatives of the scientific community under the leadership of the Ministry of Environment and Forest. Bangladesh is represented at the United Nations Framework Convention on Climate Change forums (MoFDM, 2005).

The NAPA will focus attention on three impacts associated with climate change: increasing sea-level rise, changing rainfall patterns, and increases in the frequency and intensity of extreme events. In the World Summit on Sustainable Development, the Bangladesh delegation, lead by the Minister of Finance and Planning, called for greater support from developed nations to address critical issues hindering the economic and social development of the less developed nations (MoFDM, 2005).

CHAPTER 3

DEVELOPMENT AND MANAGEMENT OF DHAKA CITY

3.1 GEOGRAPHICAL SETTINGS OF THE CITY

Dhaka is situated between latitudes 23°42' and 23°54'N and longitudes 90°20' and 90°28'E. The city is bounded by the rivers Buriganga to the south, Turag to the west, Balu to the east and Tongi Khal to the north. The city has three distinct seasons: winter (November-February), dry with temperatures ranging from 10° to 20°C; the pre-monsoon season (March-May), with some rain and hot temperature reaching up to 40°C; and the monsoon (June-October), which is very wet with temperatures around 30°C. Dhaka experiences about 2,000 mm rain annually, of which about 80% falls during the monsoon (Banglapedia, 2004).

Dhaka is situated on the southern tip of a Pleistocene terrace, the Madhupur Tract. Two characteristic geological units cover the city and surrounding areas, viz Madhupur Clay of the Pleistocene age and alluvial deposits of recent age. The Madhupur Clay is the oldest sediment exposed in and around the city area having characteristic topography and drainage. The major geomorphic units of the city are: the high land or the Dhaka terrace, the low lands or floodplains, depressions, and abandoned channels. Low lying swamps and marshes located in and around the city are other major topographic features (Banglapedia, 2004).

The subsurface sedimentary sequence, up to the explored depth of 300 m, shows three distinct entities: one is the Madhupur Clay of the Pleistocene age, characterized by reddish plastic clay with silt and very fine sand particles. This Madhupur Clay unconformably overlies the Dupi Tila Formation of the Plio-Pleistocene age, composed of medium to coarse yellowish brown sand and occasional gravel. The incised channels and depressions within the city are floored by recent alluvial floodplain deposits and are further subdivided into Lowland Alluvium and Highland Alluvium (Banglapedia, 2004).

The Dhaka city area does not show any surface folding. However, a large number of faults and lineaments have N-S, E-W, NE-SW, NW-SE trends recognised from aerial

photography interpretation and the nature of the stream courses. All four sides of the city are bounded by major faults (Banglapedia, 2004).

Geotechnical Characteristics of the Madhupur Clay in Dhaka city and its surroundings vary significantly both aerially and vertically. The evaluated parameters, particularly its low strength and high compressibility values indicate that the clay, to some extent, is problematic for engineering construction. The moisture content and plastic limit results show that Madhupur Clay is normally consolidated to over-consolidated. The clay is normal to active and has intermediate to high plasticity. The compressibility values suggest that the clay ranges from very low to highly compressible at different locations (Banglapedia, 2004).

The Dupi Tila sands aquifer is the main source of water in Dhaka city. Madhupur Clay overlies the aquifer with a thickness of 8 to 45 m (averaging 10 m). The aquifer varies in thickness from 100 to 200 m (averaging 140 m). Groundwater occurs at a depth of 25 to 30 m in the central part of the city. In the periphery the ground water lies at a depth of 15 to 20 m. Under the present conditions the peripheral rivers act as sources of recharge as the Dupi Tila sands are exposed along the riverbeds. Other sources of recharge are vertical percolation of rain and floodwater, leakage from water mains and the sewer system and seepage from standing water bodies within the city (Banglapedia, 2004).

3.2 DEVELOPMENT OF DHAKA AS THE CAPITAL CITY

Dhaka, the capital city of Bangladesh, is located in one of the largest delta systems of the earth formed by the Brahmaputra, Jamuna and the Ganges. The delta makes the region one of the most fertile lands on earth. The Ganges, the Jamuna and Brahmaputra with their tributaries provided an excellent cross-country communication even in the days when roads were few and railways were unheard of. The rivers were divided into branches and tributaries that people would easily travel along by water transports. Situated in the center of the delta Dhaka had a command over all the water routes. It was also comparatively well placed for inland communications. The geographical location of Dhaka with its network of inland waterways made it an important location both strategically and commercially.

The growth and development of Dhaka can be categorized into five periods, e.g. the pre-Mughal period (1205-1610), the Mughal period (1610-1757), the British colonial period (1757-1947), the Pakistan period (1947-1971) and the Bangladesh period (started

from 1971). In the pre-Mughal period people of Dhaka lived in Mahallas and the inhabitants of these Mahallas specialized in specific trade or craft. Water transport was the principal means of communication for the people because there were very few roads. During Mughal period Dhaka flourished so much that its population rose to 900,000 at the end of the Mughal Period. The Mughals introduced road networks and changed some of the physical structures of the city. Dhaka developed as distinctive parts of closed localities of residential quarters and bazars with pleasure gardens and magnificent villas of the nobility.

The defeat of the local ruler of Bengal by the East India Company in the battle of Palassy in 1757, paved the way for British rule in the Eastern part of India, and subsequently started the decline of Dhaka in trade and industry. Its status was further reduced when the East India Company assumed the responsibility of Dewani (Authority for administration and trade) in 1765 and appointed a Council of Revenue and subsequently a collector for Dhaka. Warren Hastings's policy of centralization at Calcutta further reduced the importance of Dhaka, and it gradually diminished in importance, and assumed the position of a district headquarters in 1882. By 1880 this decline had reached its nadir, and most of the former city had either been deserted or fallen victim to the encroaching jungle. Dhaka's population fell from 900,000 in 1765 to 150,000 in 1824. It further diminished to 20,000 by 1937.

A breakthrough in the fortunes of Dhaka came in 1905, when Dhaka was made the capital of the newly formed province of Eastern Bengal and Assam (through the partition of the province of Bengal). In 1905, Lord Curzon founded Dhaka as the capital of the newly formed province. But this euphoria was short lived. The impetus of growth which was bolstered by the creation of Dhaka as a new capital was seriously jolted by the annulment of the partition of Bengal in 1911, when Dhaka reverted back to the status of the district town.

With the end of the British colonial rule Dhaka became the provincial capital of East Pakistan. There was an exodus of people from India into this region while a large section left Dhaka. The Dhaka Improvement Trust (DIT) was established in 1952 to control private development and prepare schemes for planned development of housing, roads, commercial centers, etc.

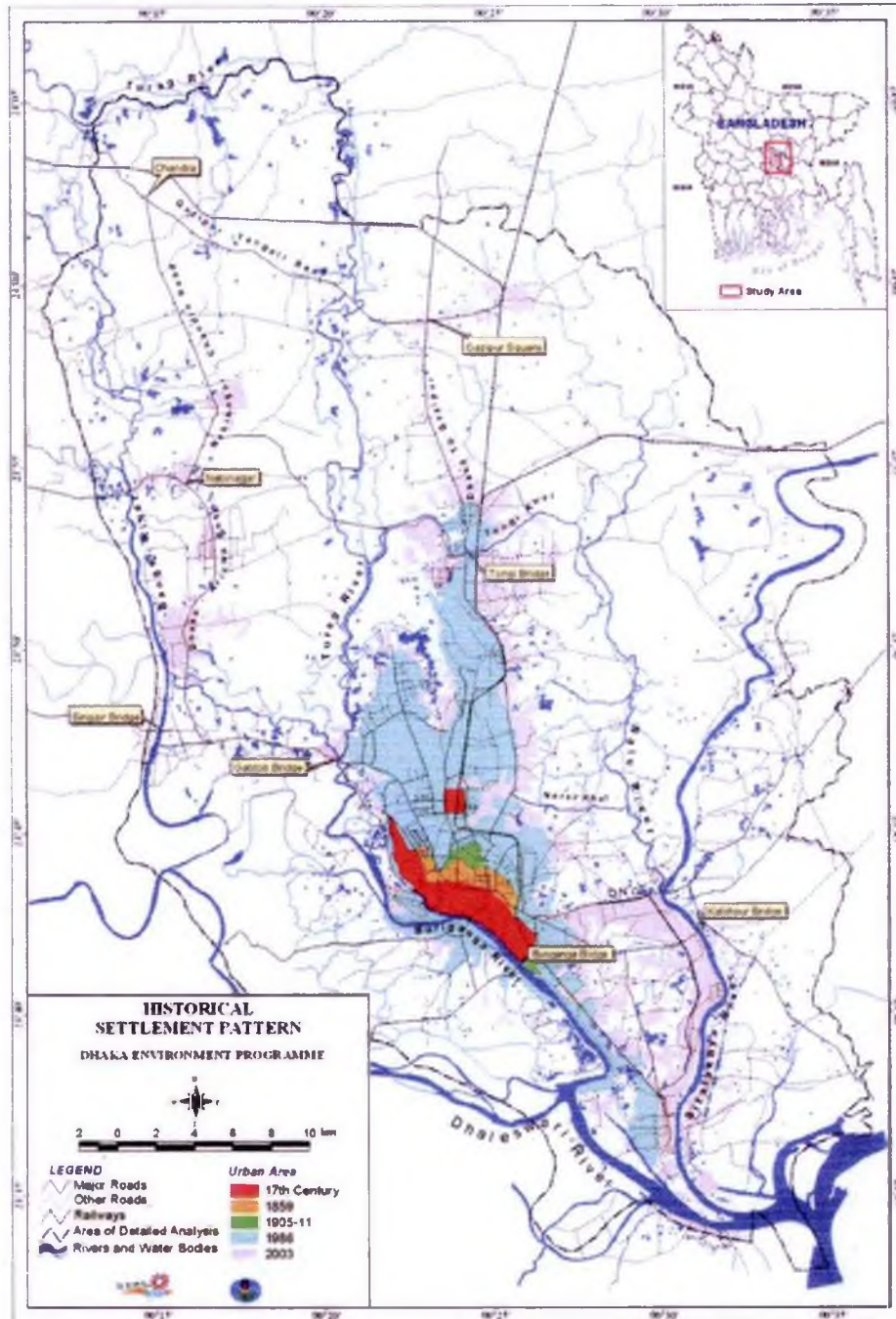


Figure 3.1: Development of Dhaka City (1700 to 2003);
Source: The Dhaka Environment Programme, 2005.

A Master Plan was prepared in 1959 covering an approximate area of 830 sq. km (320 sq. miles) and for a population of 1.5 million. The plan provided proposal for planning, land use, housing and infrastructure. Since its inception the effort of the DIT was geared to provide highly serviced plots to high-income people. On the eve of independence national population had increased to 75 million and the population of Dhaka was 1.2 million.

The last phase, Bangladesh period, marked a major change in the political scene with the emergence of Bangladesh as a sovereign state and Dhaka as the capital city of Bangladesh. Major social, economic, administrative facilities and activities are concentrated in Dhaka. As a result people started to migrate to Dhaka. The table below gives an idea about population trend of Dhaka.

Expatriate Bangladeshi foreign remittance was spent on purchase of urban land particularly in Dhaka. One important phenomenon was the implementation of the flood protection embankment for Dhaka. Owing to lack of any comparable investment in terms of security and return, people bought land. This also blocked development in land.

Table 3.1: Population Statistics of Dhaka (1950-2015).

Year	Population 1950 - 2015	Percentage of urban population (%) 1950 - 2015	Percentage of total population (%) 1950 - 2015	Average annual change 1950-2015	
				Year	Change (%)
1950	417 000	23.5	1.0	1950 - 1955	5.13
1955	540 000	25.0	1.2	1955 - 1960	5.13
1960	697 000	26.3	1.4	1960 - 1965	7.34
1965	1 007 000	27.6	1.7	1965 - 1970	7.63
1970	1 474 000	29.1	2.2	1970 - 1975	7.76
1975	2 173 000	29.2	2.9	1975 - 1980	8.10
1980	3 257 000	25.6	3.8	1980 - 1985	7.17
1985	4 661 000	27.4	4.8	1985 - 1990	7.02
1990	6 621 000	30.4	6.0	1990 - 1995	7.02
1995	9 407 000	34.2	7.6	1995 - 2000	5.72
2000	12 519 000	36.4	9.1	2000 - 2005	4.81
2005	15 921 000	37.3	10.4	2005 - 2010	3.95
2010	19 393 000	37.1	11.5	2010 - 2015	3.21
2015	22 766 000	36.2	12.4	Source: UN 2001	

3.3 SIGNIFICANCE OF THE CITY TO THE NATION

Dhaka is the largest city in Bangladesh and enjoys distinct primacy in the national urban hierarchy. Administrative headquarters and civil employments, financial and banking services, international commerce and business except port functions, are all largely concentrated in Dhaka. Educational, cultural, and research activities are also concentrated in the capital area. A disproportionately large concentration of industrial and various

public sector investments have been made in the area. In spite of the declared governmental policy of decentralized administrative and economic development introduced in the 1980s, the actual development in the huge export oriented ready-made garments industries sector during the eighties shows an overwhelming concentration in Dhaka City. More than 80 percent of the garment industries of the country are located here. In case of several other large industrial sectors, Dhaka has more than 80 percent of the national enterprises. The dominance of Dhaka is even more overwhelming in several of the smaller manufacturing activities, such as rubber produces in which Dhaka contributes nearly 100 percent of the total jobs, furniture (97 percent), publishing (96 percent), footwear (84 percent), leather goods (82 percent) and electrical machinery (72 percent) (Islam 1996).

The unique position of being at once the oldest, historically largest, most centrally located, as well as the capital city, Dhaka has the finest linkages with its immediate rural hinterland and the rest of the country. It attracts migrants from all around the country. In addition to being a permanent destination of migrants, Dhaka also attracts hundreds and thousands of daily commuters and circular migrants from the neighboring rural districts (Islam 1996).

3.4 URBAN LANDUSE PRACTICES IN BANGLADESH

The unstable land-man ratio has made land the most precious resource in Bangladesh, especially in the urban areas. The extremely rapid rise in the urban population in the recent decades, mainly through rural to urban migration, has made the urban land situation more critical. The supply of urban land is highly limited and subject to many competing claims, such as for commercial, industrial, administrative, educational, recreational, military, roads, and most of all residential purposes. Indeed, land for shelter or housing development is increasingly becoming difficult to obtain. As a consequence of this, the urban areas, particularly the large metropolitan cities, are experiencing problems of proliferation of slums and squatter settlements. While the urban population has increased at an abnormally high rate, the ability of urban local governments or development authorities has not improved and hence expansion of urban areas has taken place mostly in a haphazard manner. The most precious of our resources has been allowed to be used or misused in the most careless ways.

A large number of government agencies are concerned with the management of urban land. In case of land policy and administration, the responsibilities of concerned agencies

are not clearly defined. It is even difficult on the part of the agency concerned to apply their own policy as there is no urban land use policy in Bangladesh.

Before 1953, there was no regulation to develop the urban areas of Bangladesh for its planned development (MoLGRDC and ADB 2005). Town Improvement Act was promulgated in 1953 and for planned urban development of big cities, planning and development authorities i.e. RAJUK for Dhaka, CDA for Chittagong, KDA for Khulna, RDA for Rajshahi were established in the years 1987, 1959, 1961, and 1977 respectively through separate ordinances. Accordingly, the prescribed authorities prepared master and structure plans for their own city and took initiatives to develop their cities through the implementation of development projects.

Other than these four big cities, there is no specific land use policy for the other cities. Paurashava (Municipality) is basically responsible for the planning and development in the local level, and mandated to prepare master plan/land and impose building control. The ordinances also empower the Paurashava authority to prepare site development schemes and implement them within their town areas. But practically the problem is that the Paurashavas do not have any town planner and technically skilled manpower to prepare Master Plan/Land Use Plan.

During 1980s when Upazila was selected as a local level administrative unit, the Urban Development Directorate (UDD) prepared Land Use Plan/Master Plan for the secondary towns of Bangladesh, but these were not implemented (MoLGRDC and ADB 2005). Due to lack of legal status and financial constraints the plans remained unimplemented and these towns are now growing in a haphazard manner.

3.5 RELEVANT LEGISLATION

3.5.1 The East Bengal Building Construction Act 1952

The East Bengal Building Construction Act, 1952, (amended 1987) is also considered a legal document for development control. Rules, regulations, and ordinances of the City Authorities are also being exercised for this purpose (Banglapedia, 2004). Every construction requires permission as per provision of 'The East Bengal Building Construction Act 1952 (amended 1987) (EBBC Act 1952)'. The developing agencies are empowered for planning permission and approval of building plans and prevent illegal constructions in the metropolitan areas.

3.5.2 The Town Improvement Act 1953

City area is changing continuously through development activities by different actors like government agencies, private developers, individuals, and others. Planned urban growth is mainly based on the development control measures. Land use control in urban areas of Bangladesh is initiated with the adoption of the Town Improvement Act 1953 (Banglapedia, 2004).

3.5.3 Land Use Planning Rules

Statutory rules control land use according to planning standards. It is based on land use policies including local plans, such as control of residential density, road standards, maintenance providing of infrastructure and services. The acts and the master plans of the cities are the principal legal instruments, which force and exercise planning control and standards.

The land use of metropolitan Dhaka ought to follow the provision of the City Master Plan. Housing, commercial and industrial project buildings that need planning permission, which are generally practiced. It must be in conformity with the land use provision of the Master Plan (Banglapedia, 2004).

3.5.4 Building Construction Rules

According to the East Bengal Building Construction Act-1952 (amended 1987) each and every building within the designated areas of City 'Master Plan' needs approval from the City Development Agencies. As per Acts, the definition of building is: 'Building includes a house, hut, wall, and any other structure where of masonry bricks, corrugated iron sheet, metal tires wood, bamboo, mud, leaves, grass, thatch, or any other materials whatsoever'. The Act has empowered to initiate building rules under section 18, EBSC Act 1952 which has been updated, based on public interest, regularly since 1954, (in 1984, 1996 and 2006). It has been formulated through the Government of Bangladesh exercising the power of the Act. (Banglapedia, 2004).

3.6 RESPONSIBLE AGENTS AND THEIR RELATIONSHIPS

In case of land policy, land reform, urban area extension, declaration of rural to urban areas, the relevant agencies are mainly the Parliament, National Economic Council, Planning Commission, Ministry of Land, Ministry of Housing and Public works and Ministry of Local Government, Rural Development and Cooperatives.

In the case of town planning responsible organizations at the central level is Urban Development Directorate (UDD). In the metropolitan cities, the respective development authorities are responsible for planning and development activities. Urban Land

Management is operated in Bangladesh through various policies, legal, and technical systems.

In the metropolitan cities of Dhaka, Chittagong, Rajshahi, and Khulna, RAJUK, CDA, RDA, and KDA are respectively for planning and development activities and for preparation of Master Plan, Development Plan and building control regulations of the respective cities. In case of housing and real estate development, National Housing Authority (NHA) under the Ministry of Housing and Works and the Ministry of Land are directly responsible.

In case of development control and building permission, Paurashava (Municipality) authority and metropolitan development authorities are responsible. They exercise their power according to Building Construction Act 1952. But in case of Land Title and Registration, Directorate of Land Records and Surveys is responsible (MoLGRDC and ADB, 2005).

3.7 URBAN MANAGEMENT IN DHAKA

3.7.1 Internal Division of the City

Dhaka City Corporation (renamed in 1990) is a self-governing corporation that is associated with the task of running the affairs of the city. The incorporated area is currently 360 sq km divided into 10 Zones and 90 Wards (Dhaka City Corporation, 2006).

The DCC consists of a Mayor, 90 Ward Commissioners, 30 Reserved Woman Commissioners and five "Official Commissioners". The five Official Commissioners are representatives of RAJUK (Chairman), DWASA (Chairman), DPHE (Chief Engineer), Health Services (Director General) and Bangladesh Power Development Board (Chief Engineer) (Dhaka City Corporation, 2006).

Mayor and Ward Commissioners are all elected by direct election, which are held every five years on the basis of adult suffrage. Women Commissioners are elected by Ward Commissioners, which are chosen from the female residents of the City Corporation Area. The population within the Corporation area, according to the DCC website, in 2001 was 84 million people.

3.7.2 Governance Style

The executive power of DCC is vested in and exercised by the Mayor. All executive powers are concentrated at the head office of DCC. The chief executive Officer (CEO) assists the Mayor. The secretary assists the CEO. The custodian of DCC and all other employees are subordinate to him.

Under the CEO, there are 16 departments. Departmental heads are administratively responsible to the CEO for their activities and for discharging their duties. The CEO supervises the functions of departmental heads. The Secretary heads the general Administration and Establishment Department (Dhaka City Corporation, 2006).

The Chief Revenue Officer heads the Revenue Department, which is responsible for the collection of revenue and the assessment of taxes. The Chief Accounts Officer, the Chief Health Officer, the chief Conservancy Officer, and the Chief Engineer are the administrative heads of the Accounts, Health, Conservancy, and Engineering Departments respectively.

Besides these, there are the Slum Development Department, Transport Department, Law Department, Public relations, Protocol Department, Store and Purchase, Urban Planning Development, and Security Department. The DCC administrative set-up is decentralized into ten (10) Zonal Offices. However, as of now, there are no Ward Offices. As such, only Ward Commissioners' Offices; and Ward level Municipal Services are directed, managed, and monitored from the Zonal Offices (Dhaka City Corporation, 2006). The total manpower including temporary/muster roll staff of DCC is 11,006 of which 2,476 staff is on Muster Roll, while 4,918 Officers and Staff work on a permanent basis (Dhaka City Corporation, 2006).

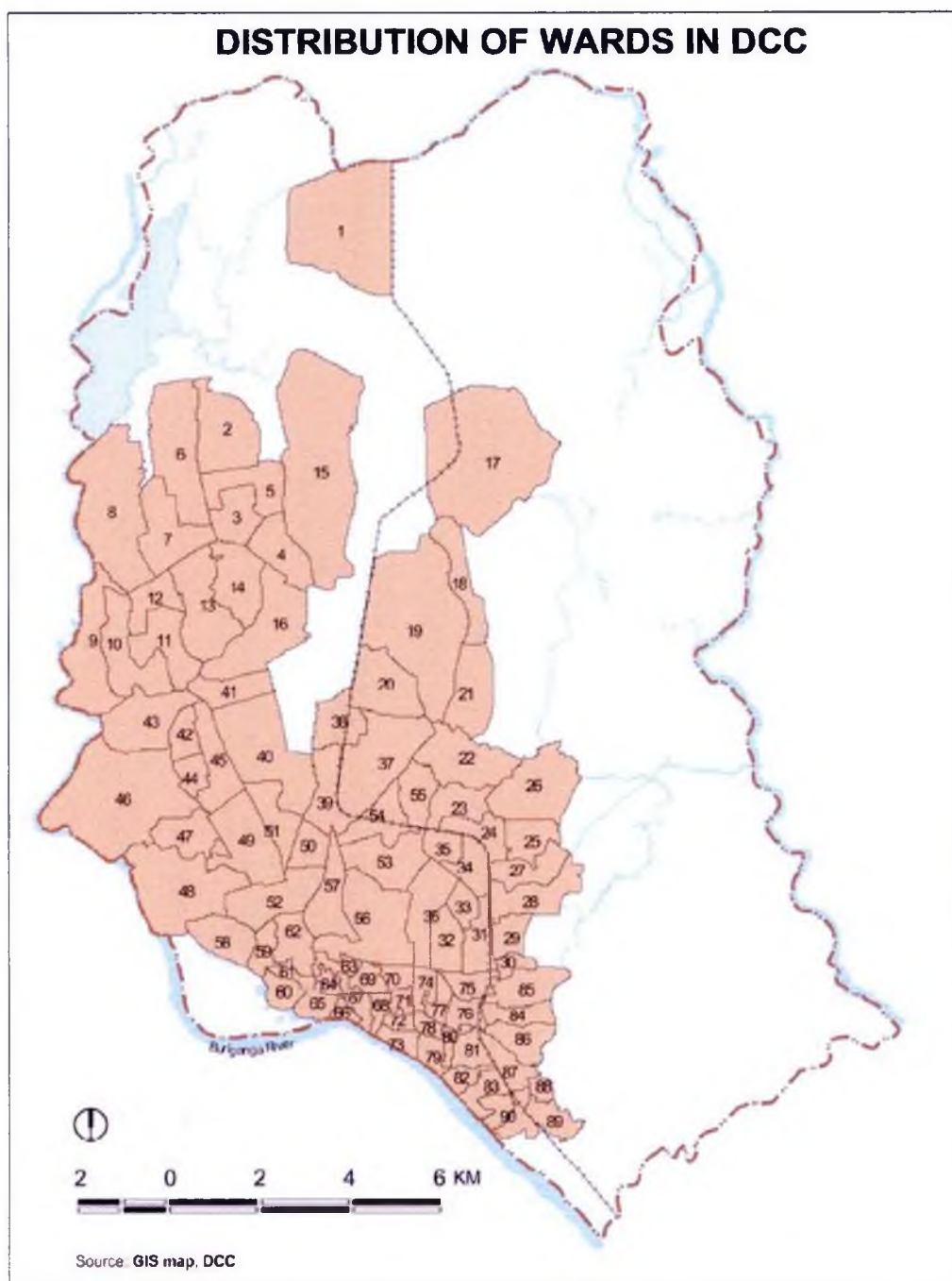


Figure 3.2: Distribution of Wards in Dhaka City Corporation
Source: Dhaka City Corporation

Table 3.2: Services Provided by Dhaka City Corporation.

Category	Services
Building Control	Regulation of Buildings;
Streets	Public Streets, Streets, General provision about streets, Encroachment, Street lighting, Street watering, Traffic control, Public Vehicles;
Public Safety	Civil Defense, Floods, Famine, Dangerous and offensive articles and trades, Burial and burning places;
Trees, Parks, Gardens and Forests	Arboriculture, Gardens, Open Spaces, Forests, Nuisances pertaining to tree and plantation, Tanks and low-lying areas;
Education	Education, Compulsory education, General provision about education;
Culture	Culture, Library, Fairs and shows;
Social welfare	Social welfare;
Development	Development plans, Community development projects, Commercial schemes, Health development project, Slum Development;
Public Health	Sanitation, Removal and disposal of refuse, Unsanitary Buildings, Latrines and Urinals, Birth, Deaths and Marriages, Infectious Diseases, Health and maternity centers, Public Health, Hospital and Dispensaries, Medical aid and relief, promotion of medical education;
Water Supply and Drainage	Water supply, Private Sources of water supply, Drainage schemes, Bathing and washing places, Dhobi ghats & washer men, Public water courses, Public Ferries, Public Fisheries;
Articles of Food and Drinks	Bye laws, Milk supply, Public Markets, Private Markets, Slaughterhouse;
Animals	Animal husbandry, Stray animals, Animal homes and farms, Registration of sale of cattle, Livestock improvement, Dangerous animals, Cattle show, zoos etc., Disposal of carcasses;
Urban Planning	Master Plan, Site Development schemes, Execution of site development scheme.

Source: Dhaka City Corporation, 2006.

3.7.3 Formal Arrangements

Dhaka has a multiplicity of organizations at different levels. As many as 42 organizations of national, sectoral, special, and local levels are effectively involved in planning and development of urban affairs in Dhaka Metropolitan Area (Islam, 1996). The national level agencies are the National Economic Council (NEC), the Planning Commission (PC), the Urban Planning Directorate (UDD) and the Board of Investment (BOI). Each plays an important role in urban development decision making for Dhaka. The special agencies for urban development, which are involved in Dhaka, are the Rajdhani Unnayan Kartripakhya (RAJUK), the Dhaka Water and Sewerage Authority (DWASA), the Dhaka Electric Supply Authority (DESA), the Dhaka Metropolitan Police (DMP), and the Cantonment Board (CB). The various sectoral agencies responsible for extension of services within the city include: Ministries of Finance, Industry, Education, Health, Commerce, Works, Defense, Irrigation, Water and Flood Control, Agriculture, Land, Youth and Sports etc. All have specific sectoral functions. The local level agencies involved with planning and development of Dhaka Metropolitan Area (DMA) are the Dhaka City Corporation (DCC) and the Cantonment Board. Among all these institutions the more comprehensive and obvious responsibilities lie with DCC and RAJUK along

with important roles played by the Housing and Settlement Directorate (presently National Housing Authority, NHA) for housing, Power Development Board (PDB) for electricity, WASA for water and sewerage, Titas Gas and Transmission Company Ltd. for gas, Roads and Highways Department (RHD) for major inter-city roads and the DMP for traffic management and maintenance of law and order.

3.8 EFFECTIVENESS OF CURRENT ARRANGEMENTS

In the context of land use management, Dhaka city has a complex administrative structure with a number of different local and metropolitan authorities. Furthermore, due to overlapping responsibilities and lack of coordination between different national, regional, and municipal government bodies, complex problems in urban land management emerge. With the existing organizational structure for land management, Dhaka as well as other cities and towns in Bangladesh, face daunting problems in providing shelter, urban utility services and decent environment for the growing number of urban dwellers. It has gradually become apparent that the management structure is inefficient to meet the growing need. A number of documents and research findings have indicated that the disappointing performance of the public sector and too much centralized responsibilities of central government agencies are major impediments in this respect (MoLGRDC and ADB 2005).

3.9 FUNCTIONAL ARRANGEMENTS FOR DISASTER RISK MANAGEMENT IN DHAKA CITY

The Standing Order on Disasters (SOD) has the provision of constitution of Disaster Management Committee at the City Corporation level to cope up with the natural Disaster in the concerned City Corporation.

Following the guidelines in the Standing Order on Disaster, the Dhaka City Corporation Disaster Management Committee is comprised of the following officials:

(a)	Mayor	Chairman
(b)	Chief Executive Officer	Member
(c)	Deputy Commissioner	Member
(d)	Superintendent of Police	Member
(e)	Health Officer of the City Corporation	Member
(f)	Representative of Director General, Health Directorate	Member
(g)	Representative of Director General, Agriculture Extension Department	Member
(h)	Representative of Chief Engineer, LGED	Member
(i)	Representative of Chief Engineer, Public Health	

	Engineering Directorate	Member
(j)	Chairman/MD, WASA	Member
(k)	Representative of Water development Board	Member
(l)	Representative of Electricity Supply Authority	Member
(m)	Representative of T&T Board	Member
(n)	One NGO representative nominated by ADAB	Member
(o)	Ward Commissioners	Member
(p)	Secretary, City Corporation	Secretary

(Source: DMB, 2006.)

The Honorable Members of the Parliament of the City Corporation area act as the Advisers in the Committee. The Chairman of the Committee may co-opt more members in consideration of local situation and special conditions. The Committee meets at least four times a year. During disasters the Chairman holds the meeting whenever he finds it necessary.

The City Corporation Disaster Management Committee is vested with the following responsibilities regarding disaster management:

During Normal Time

- To ensure very speedy dissemination of cyclone and flood forecast to all officers, concerned persons/organizations and other persons having the responsibility about it in the City area.
- To determine safe centers and shelter places and distribute responsibility to different persons for rendering different services in those places.
- To arrange for holding mobilization drill from time to time for disseminating warning signals/forecasts, evacuation, rescue and primary relief operations in co-operation with the Disaster Management Bureau.

During Disaster

- To operate emergency operations centre (Information centre and control room) for assisting co-ordination of activities relating to evacuation, rescue, relief, and primary rehabilitation in all places of the city area. If necessary, to conduct rescue operations by using locally available resources and also coordinate overall activities including sending reserve teams to highly affected areas for conducting rescue operations.
- To collect data regarding the damages of disasters in pursuance to the

directives of Disaster Management Bureau and other National authorities and also dispatching it to appropriate authorities including the Ministry of Disaster Management and Relief.

- To formulate plans on a priority basis and arrange for distribution of the resources received from the Ministry, district, or any other authority objectively. To maintain the accounts relating to the materials concerning relief and rehabilitation and dispatching it to the relief-giving authority.

(Source: DMB, 2006.)

CHAPTER 4

IDENTIFICATION OF VULNERABILITIES OF DHAKA CITY

4.1 HAZARDS AND ASSOCIATED VULNERABILITIES

The main natural hazards affecting Dhaka include floods, which are associated with river water overflow and rain water stagnation, earthquakes, and tornadoes.

Dhaka's topography is a huge issue related to flooding as the elevation of the City varies from 0.5 m to 12 m, with 70% of the total area within 0.5 to 5 m; these low lands, act as temporary detention basin for flood water (Choudhury, 2005).

As a consequence, Dhaka is usually flooded by the rivers surrounding the City. Major recent events take account of the 1987 and 1988 flood that lasted for two to three weeks and affected close to 250 sq km; the 1998 with a duration of six to eight weeks and an affected area of 168 sq km; the 90 sq km flooded in 2004 during a time span of two to three weeks (Choudhury, 2005). It is important to notice that the reduced impact is associated to mitigation works done in and around the city.

In addition to flooding, the city can be severely affected by earthquakes as it has already happened in the past. Intensities of VI, VII, and VIII have already been registered in the city. The national building code of Bangladesh (BNBC 1993) includes three seismic zones, and Dhaka is located on the second one with a zoning coefficient equivalent to the 15% of the gravity ($z=0.15g$) (Choudhury, 2005).

According to the results of the Earthquake Disaster Risk Index (EDRI) project, major earthquake risk is associated with the high vulnerability of the building stock due to both poor materials and poor construction processes (Choudhury, 2005).

4.2 FOR EARTHQUAKE

4.2.1 Seismic Micro-zonation Considering Geomorphology

Background

This study was conducted by A. S. M. Maksud Kamal of Department of Geology, University of Dhaka and Saburoh Midorikawa of Department of Built Environment, Tokyo Institute of Technology.

Methodology Used

As seismic microzoning accounts for the response of near surface sedimentary deposits, and geomorphology reflects the surface geology, the responses of an earthquake's ground shaking are evaluated based on geomorphic units. The geomorphic map has been prepared using almost pre-urban aerial photographs of 1954.

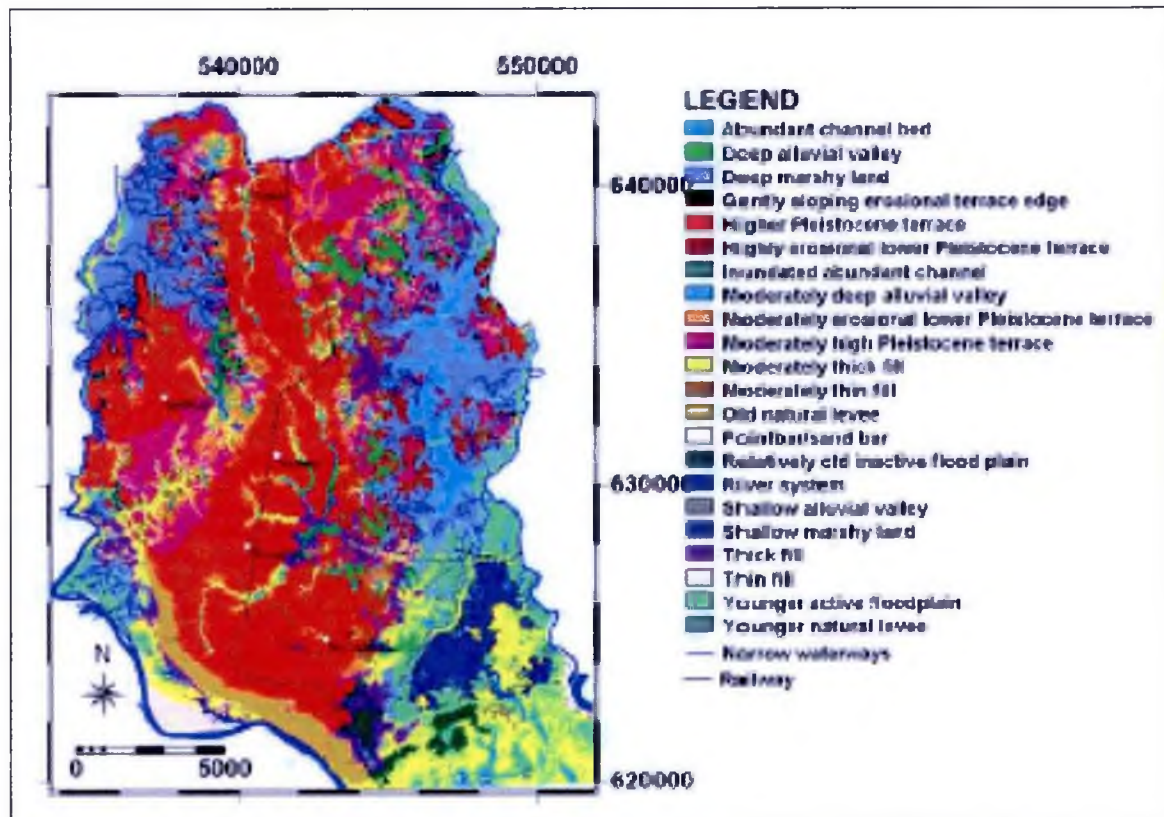


Figure 4.1: Geomorphological map of Dhaka city area with the information of fill thickness.
Source: Kamal *et al.*

The ground modifications by urbanization are delineated till 2002 using high-resolution satellite images as well as borehole information. This information was then integrated into a geomorphic map. To determine the soil response, 187 microtremors are recorded on all geomorphic units and horizontal-to-vertical (H/V) spectral ratio technique of Nakamura (2000) has been applied to calculate fundamental period and amplification

factor of the sites. By averaging the H/V spectral ratios, Representative Spectral Signature (RSS) has been developed for each geomorphic unit.

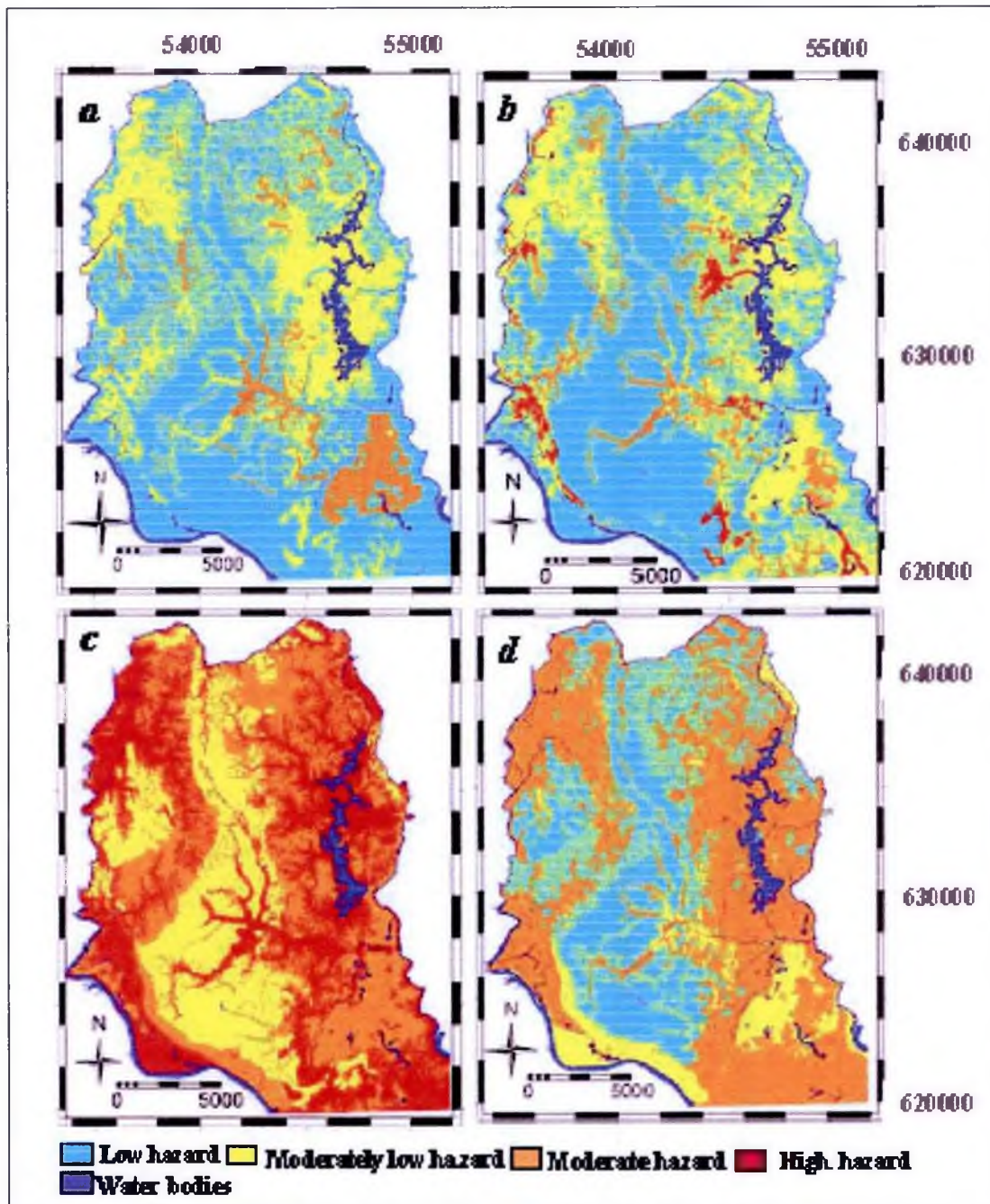


Figure 4.2: Vulnerability Map for Different Storied Building in Dhaka City (In the Figure “a” represent the vulnerability for 2-5 storey buildings, “b” represents vulnerability for 6-8 storey buildings, “c” represents vulnerability for 9-14 storey buildings and “d” represents vulnerability for 15-20 storey buildings)

Source: Kamal *et al.*

Considering the altitudes, the building stock in Dhaka has been differentiated into four groups: low, moderately intermediate, intermediate and high rise buildings. Their fundamental modes of vibration correspond with 0.2-0.5, 0.5-0.8, 0.8-1.4 and 1.4-2.0

seconds respectively. The hazard potentials have been ranked into low, moderately low, moderate and high based on the amplification factors of different soil, as, 1-2, 2-3, 3-5, and >5 respectively measured from RSS. The ground shaking microzoning developed for the building stock demonstrates that the buildings between 9-14 storeys are at elevated risk, which spatially covers one-third of the study area. In combating seismic risk, incorporating the findings of microzoning in the design of new constructions and fixing retrofitting in the existed vulnerable structures is highly recommended.

4.2.2 Seismic Micro-zonation Considering Soil Amplification and Liquefaction

Background Information

Seismic Micro-zonation of Dhaka City was carried out as a part of the M.Sc (Eng) thesis titled “Seismic Damage Scenario for Dhaka City” by Md. Gazi Ferooz Rahman, a student of the Department of Civil Engineering, Bangladesh University of Engineering and Technology. This thesis was supervised by Professor Dr. Mehedi Ahmed Ansary of the same Department.

Methodology Used

Seismic hazards due to local site effects such as soil amplification and liquefaction can be estimated by combining the available soil parameters with the current hazard models. For Dhaka City, a soil database of 253 boreholes, in and around the city, was created and then was utilized to develop site amplification and soil liquefaction potential assessment. Both of these site effects were integrated in GIS platform for combined hazard assessment.

Three past historical earthquakes were used as scenario events namely the 1885 Bengal Earthquake, the 1897 Great Indian Earthquake, and the 1918 Srimangal Earthquake. Intensity values obtained for these events were calibrated against attenuation laws to check the applicability of the laws for this study. Using these laws, bedrock Peak Ground Acceleration (PGA) values were obtained. Finally, a bedrock PGA value for the scenario events was selected. PGA values were also converted into intensity values to integrate the effect of site amplification as well as liquefaction.

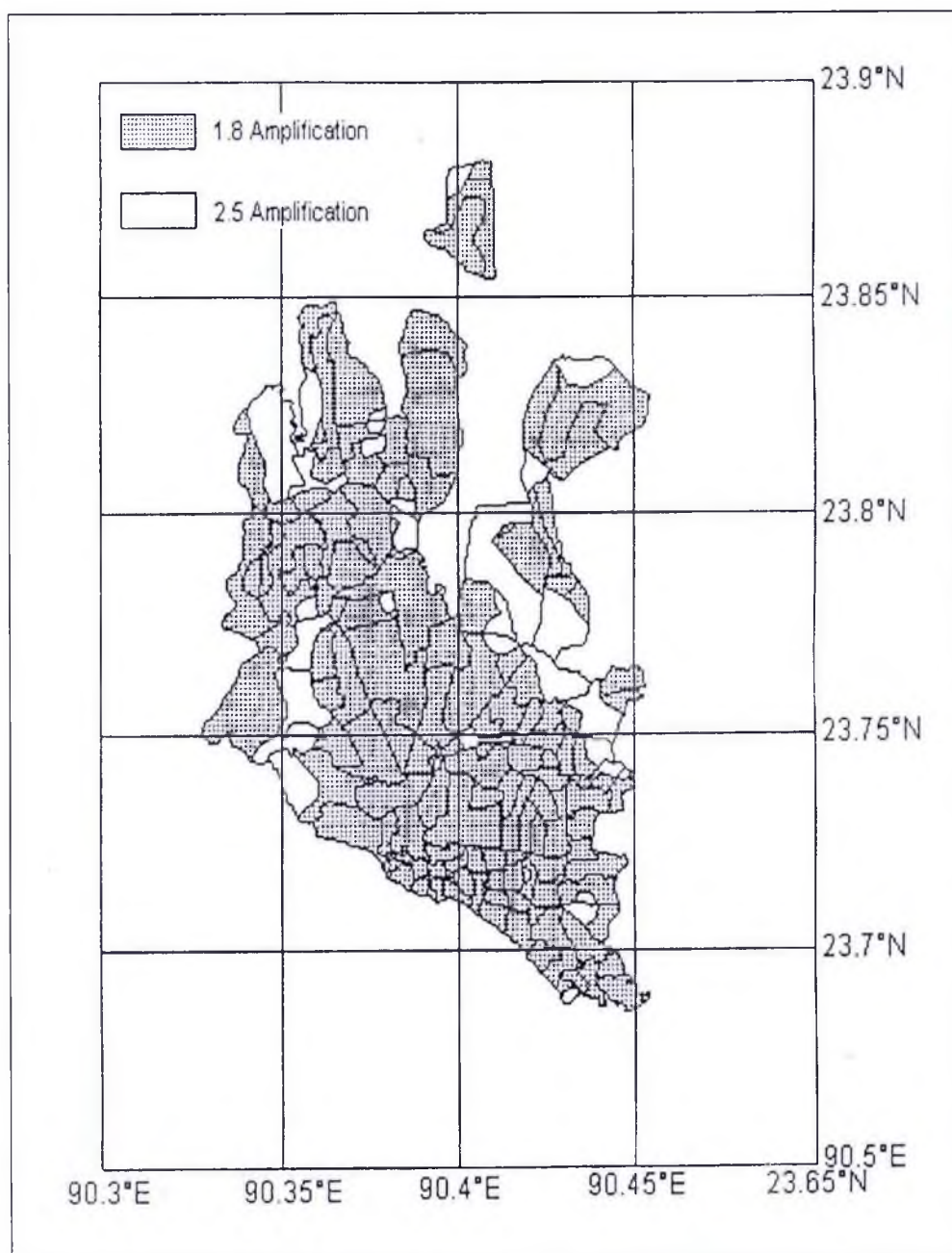


Figure 4.3: Map of Dhaka showing 1.8 and 2.5 times amplified areas.
Source: Rahman, 2004.

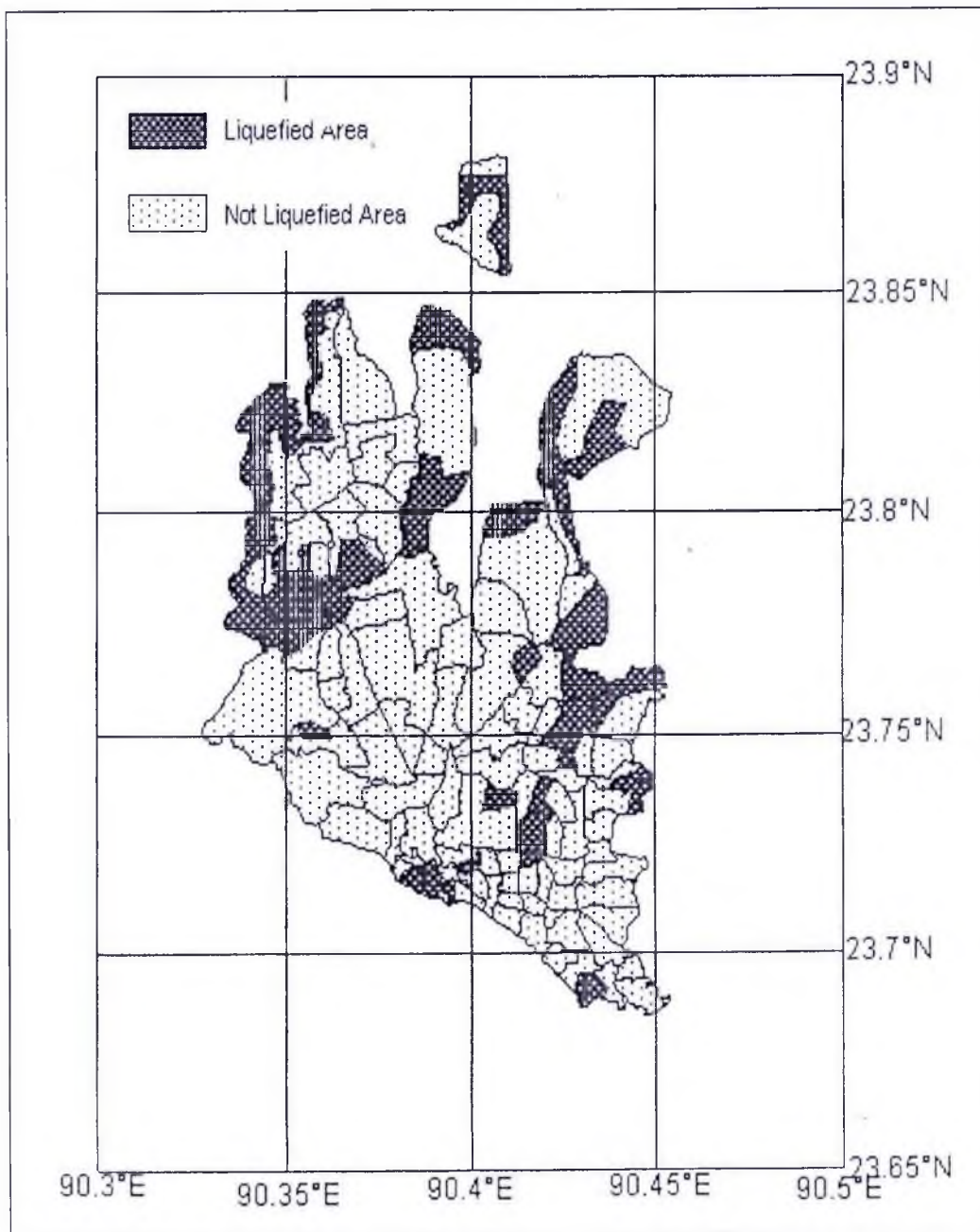


Figure 4.4: Map of Dhaka showing liquefied and non-liquefied areas.
Source: Source: Rahman, 2004.

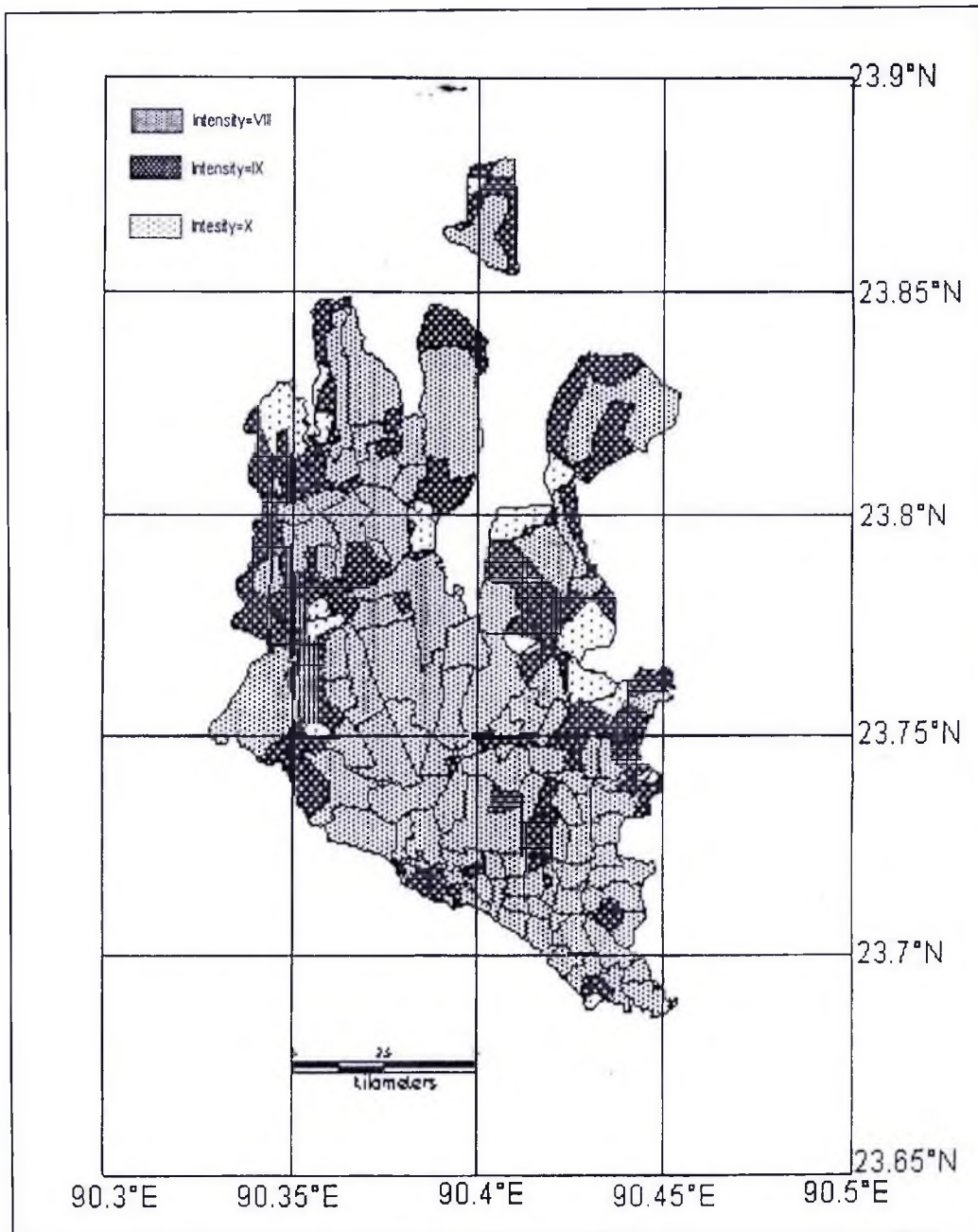


Figure 4.5: Combined Seismic Hazard Intensity Map for Dhaka.
Source: Rahman, 2004.

Significance of such Activities

The very first step of disaster mitigation is to recognize the existence of the hazard itself. Such effort as Seismic Micro-zonation would benefit engineers, city planners, emergency personnel, government officials and anyone concerned with the potential consequences of seismic activity in Dhaka. This would provide useful information regarding earthquake hazards for a given site and should be an integral part of the whole process of economic and social development in Bangladesh. It constitutes a fundamental means which should guide officials at the national and regional levels in the formulation of development strategies in seismically active zones, land-use management, revision and enforcement of appropriate building codes and formulation of plans for mitigating measures against earthquake risk affecting the region considered.

4.3 FOR FLOODING

After the flood of 1998 a study was conducted (Mohit *et al*, 2002) to delineate the effect in different wards of the city. It took into account the damage to five major sectors, namely: Housing, Education, Road, Industry, and Shopping and categorized the damage zones into four groups i.e. No-Damage Zone, Low Damage Zone, Moderate Damage Zone, and High Damage Zone. The findings of the study are presented in the table below:

Table 4.1: Dhaka City Wards on the Basis of Damage in 1998 Flood.

Category of Damage	Ward Numbers	Total Wards	Percentage
No Damage	1, 7, 10, 12, 13, 14, 16, 33, 36, 43, 44, 45, 47, 49, 52, 56, 57, 62, 69, 71, 72, 74, 77, 79, 81, 88.	26	28.9
Low Damage	2, 4, 6, 8, 9, 11, 15, 17, 19, 24, 29, 30, 31, 32, 35, 38, 39, 40, 41, 42, 50, 51, 53, 54, 55, 58, 59, 60, 61, 63, 64, 65, 66, 67, 68, 73, 78, 79, 80, 82, 83, 84, 86, 87, 90.	45	50.0
Moderate Damage	5, 20, 23, 25, 34, 37, 46, 76, 85.	9	10.0
High Damage	3, 18, 21, 22, 26, 27, 28, 48, 75, 89.	10	11.1

Source: Mohit *et al* 2002.

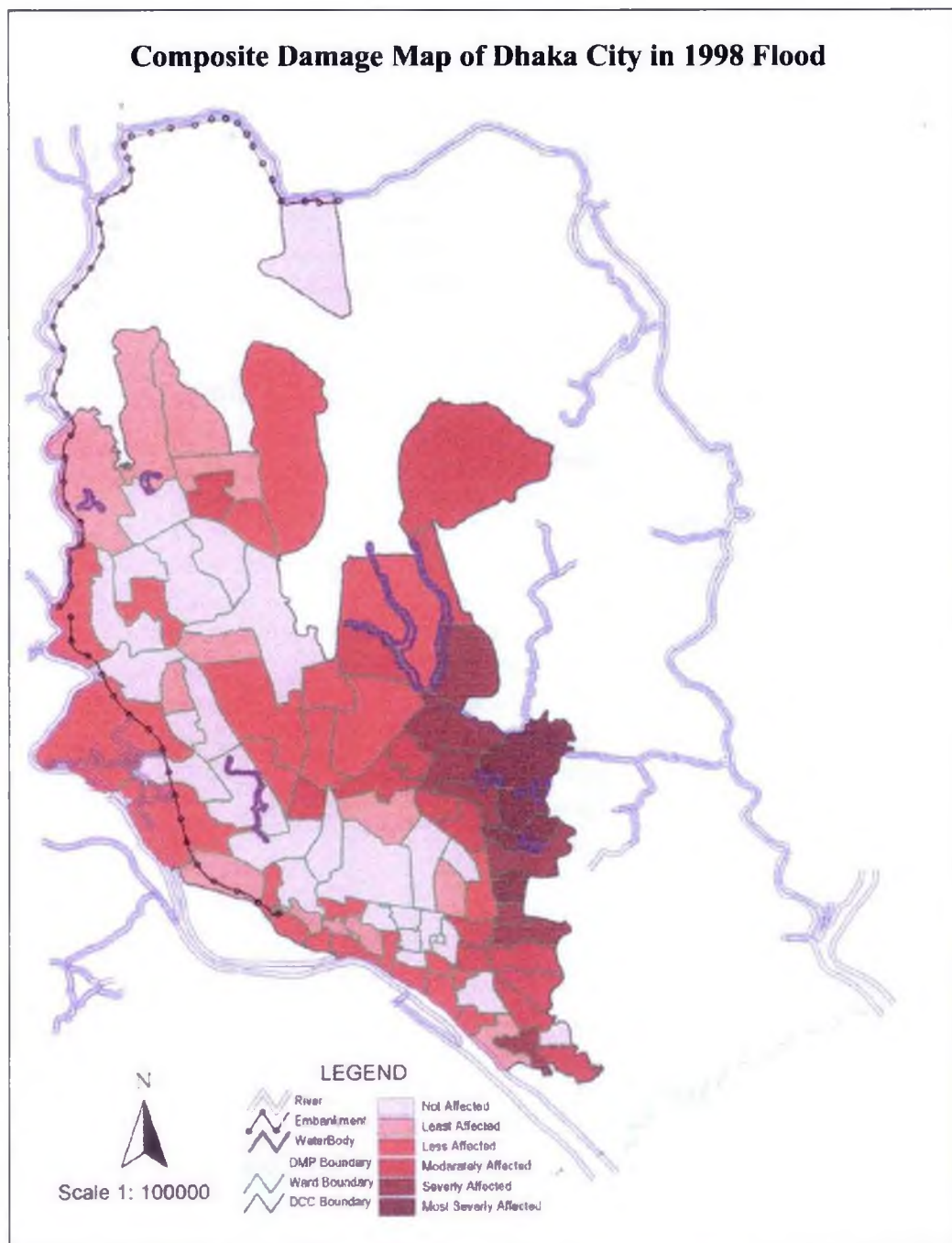


Figure 4.6: Composite Damage Map of Dhaka City in 1998 Flood
Source: Mohit *et al* (2002)

CHAPTER 5

POLICY MEASURES FOR DISASTER RISK MANAGEMENT

5.1 CITY POLICIES ON VULNERABILITY ALLEVIATION

Dhaka Structure Plan (1995-2015), as a part of the Dhaka Metropolitan Development Plan (DMDP), identifies the order of magnitude and direction of anticipated urban growth and defines a broad set of policies considered necessary to achieve over all plan objectives. It considers the micro environmental aspects of Dhaka, both in its existing urban form as well as for future development to keep the city free from all sorts of natural and man made hazards (DMDP, 1995).

DHAKA STRUCTURE PLAN (1995-2015)

As a part of the Dhaka Metropolitan Development Plan, it provides a long-term strategy for the 20 years for the development of the greater Dhaka sub-zone with a population target of 15 million. The plan consists of a written report and policy documents with support maps of appropriate scale. It identifies the order of magnitude and direction of anticipated urban growth and defines a broad set of policies considered necessary to achieve overall plan objectives. It considers the micro environmental aspects of Dhaka, both in its existing urban form as well as for future development to keep the city free from all sorts of natural and man made hazards. The plan recognizes the positive and sustainable role of green belts, preservation of high quality wet and agricultural lands and existing rivers in and around the city limits and their continuous upgrading and evaluation and thus recommends for building a circular waterways round the city. The plan also earmarks a number of retention ponds around the city limits for retaining rain water as well as for maintains an ecological balance too and a healthy environment.

Key Policies of Dhaka Structure Plan (SP) 1995-2015

The broader strategies of Dhaka Structure Plan 1995-2015 and their different aspects are given below:

URBAN STRATEGIES

- Land Consolidation
- Accelerated Development
- Planned New Area Development
- Long Term Planned New Area Development Opportunities
- Rural and Special Areas Policies
- Areas of High Agricultural Value
- Flood Flow Zones
- River Pollution Control

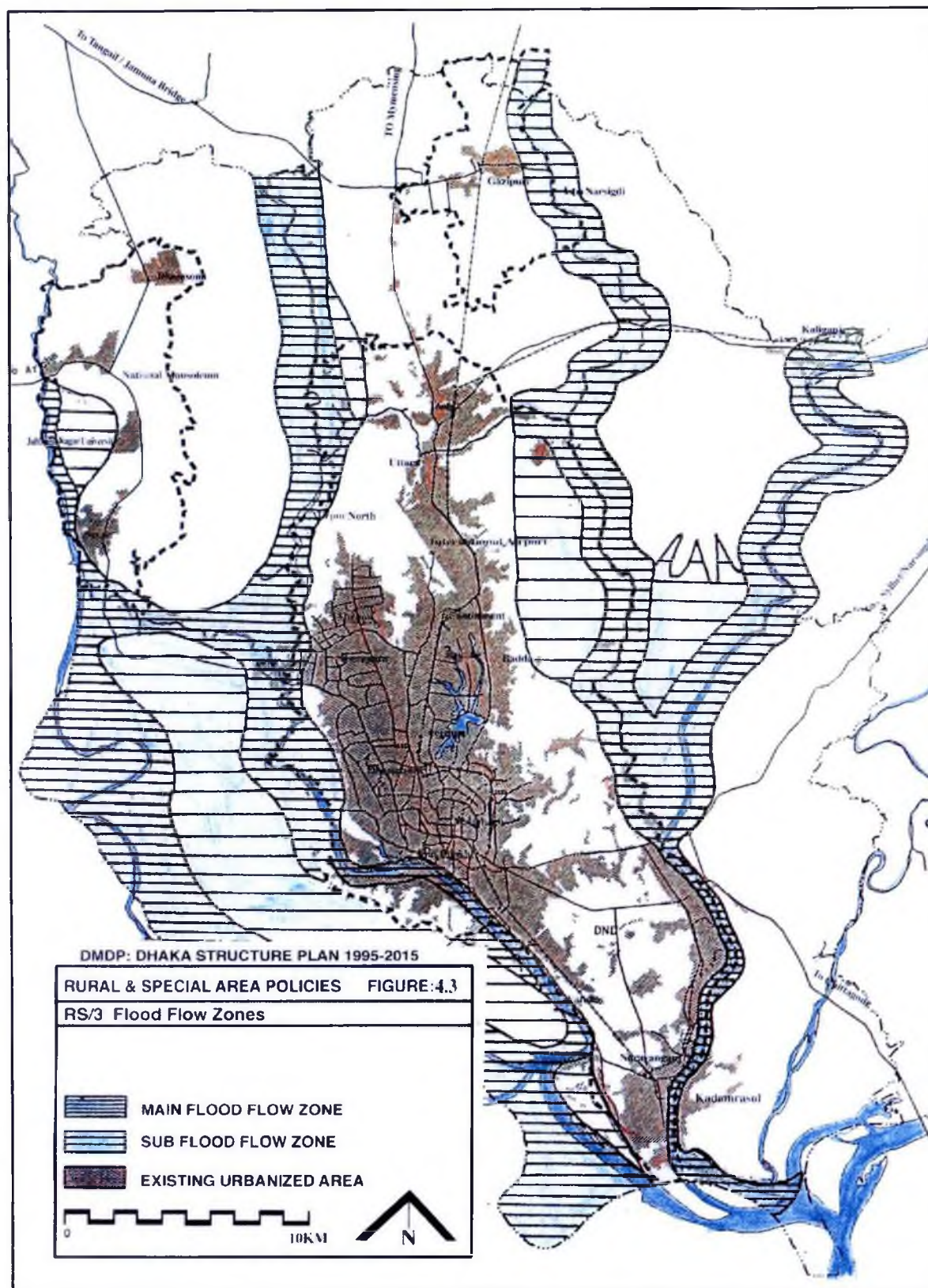


Figure 5.1: Provision of Flood Flow Zones in the Dhaka Structure Plan
Source: DMDP, Volume I (Structure Plan)

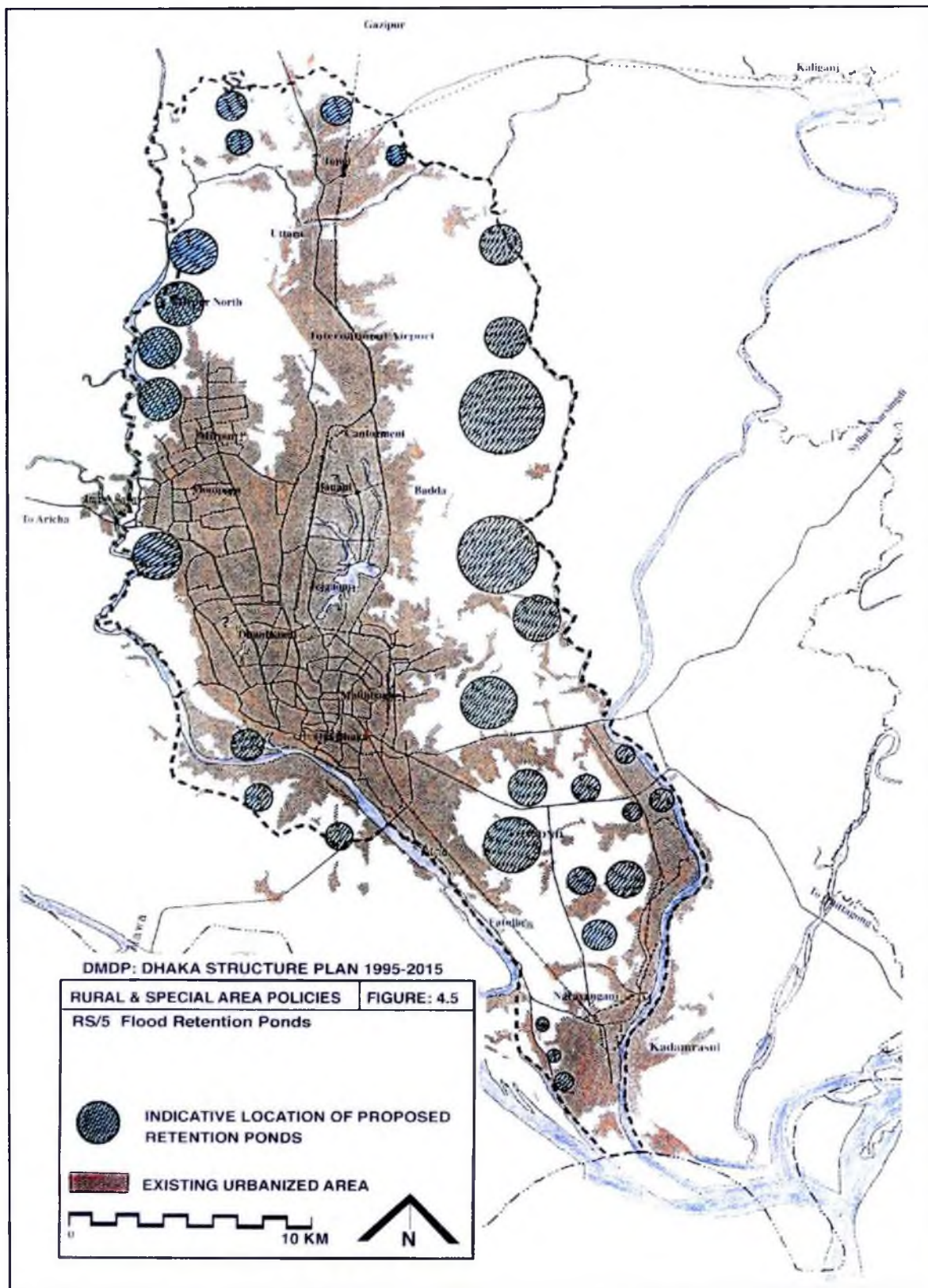


Figure 5.2: Provision of Flood Retention Pond in the Dhaka Structure Plan
Source: DMDP, Volume I (Structure Plan)

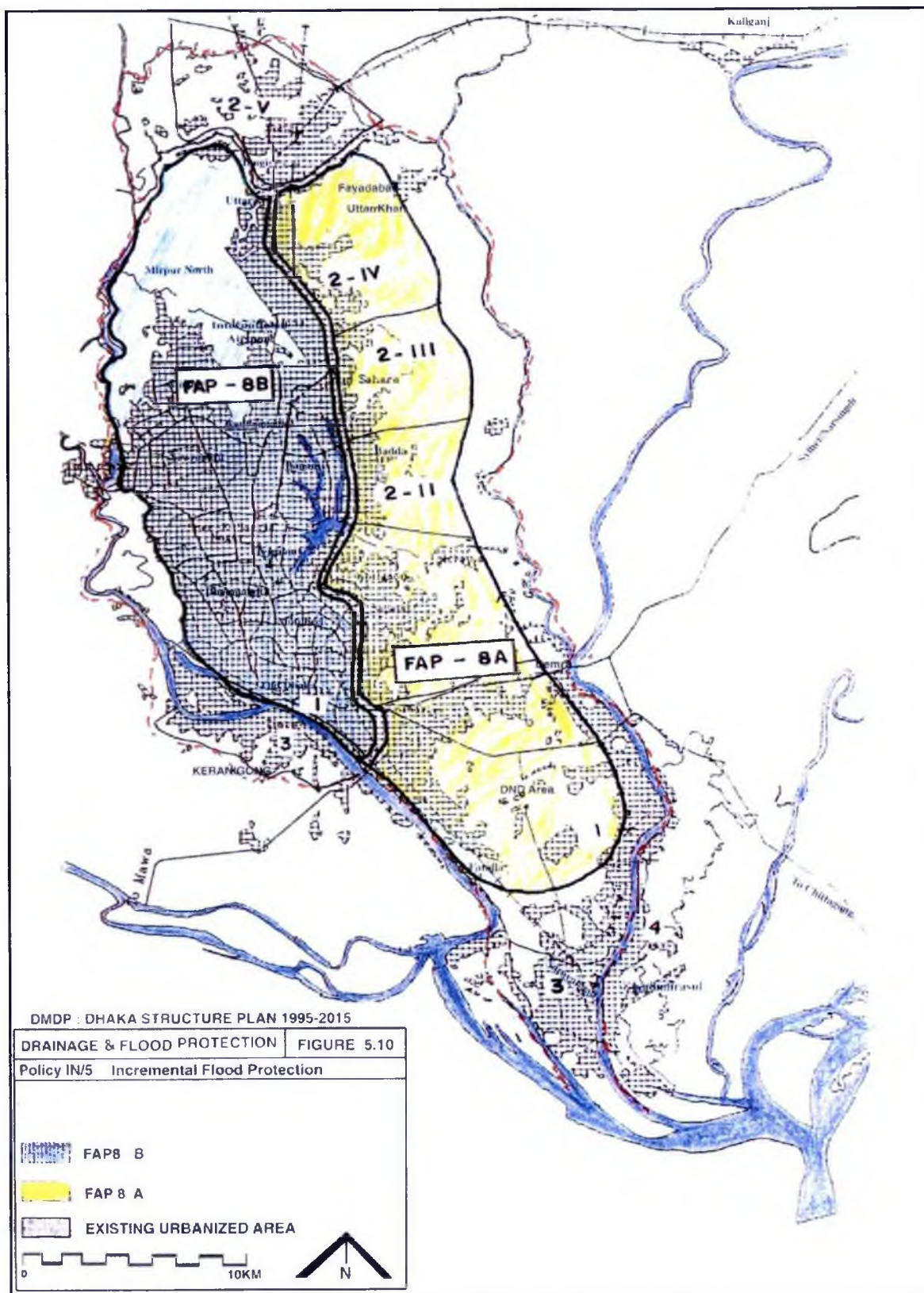


Figure 5.3: Incremental Flood Protection under Flood Action Plans
Source: DMDP, Volume I (Structure Plan)

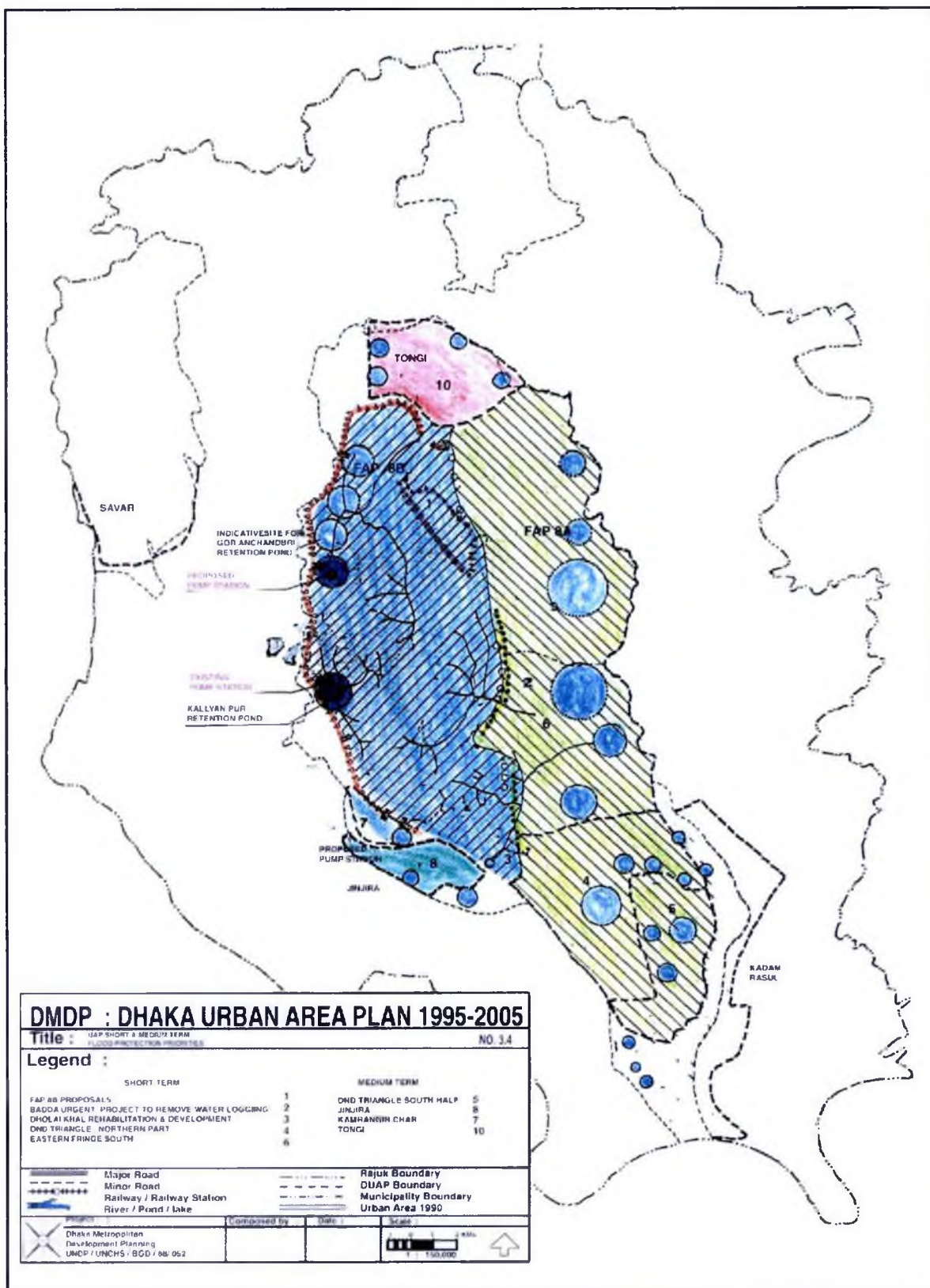


Figure 5.4: Short and Medium Term Flood Protection Priorities
Source: DMDP, Volume II (Urban Area Plan)

- Flood Retarding Ponds
- Infrastructure Consolidation
- Fringe Area Growth Acceleration
- Flood Protection Works
- Infrastructure Initiatives
- Community Based Development Initiatives
- Priority Satellite Town/Dhamsona
- Long-term Satellite Town
- Purbachal (Yusufganj) New Town Project
- Special Incentive Zone (Economic Base)

SOCIO-ECONOMIC SECTOR

- Industrial Estates
- Foot Loose Industries
- Polluting Industries
- Informal Sector Activities
- Dispersal of Commercial Activities
- City Open Space

INFRASTRUCTURE SECTOR

- Incremental Network Development
- Eastern By Pass
- Commuter Rail Network
- Subway Development Program
- Water Transport Development Program.

Source: DMDP, Volume 1, 1995.

Considering urban floods, the plan earmarks a number of retention ponds around the city limits for retaining rainwater as well as for maintaining an ecological balance and a healthy environment. The plan keeps the provision of controlling Land development within the flood plain designated areas in order to avoid obstructions to flood flow, which might otherwise lead to adverse hydraulic effects.

5.2 THE BANGLADESH NATIONAL BUILDING CODE (BNBC)

Though formulated back in 1993, the Bangladesh National Building Code has been brought under the gazette notification of Bangladesh Government just in November 2006. The BNBC has been made mandatory to comply with in any building construction under The Building Construction Act of 1952 to ensure accountability in the management of overall building construction and safety of the buildings. The Code comprehensively requires classification of buildings as per usages, structural design, load assessment, foundation, precautionary measures, safety aspects, fire exit, air ventilation and other provisions.

The purpose of the BNBC has been stated as:

“...to establish minimum standards for design, construction, quality of materials, use and occupancy, location and maintenance of all buildings within Bangladesh in order to safeguard, within achievable limits, life, limb, health, property and public welfare. The installation and use of certain equipment, services and appurtenances related, connected or attached to such buildings are also regulated herein to achieve the same purpose.

...The expressed intent of this Code is to insure public safety, health and general welfare insofar as they are affected by the construction, alteration, repair, removal, demolition, use or occupancy of buildings, structures or premises, through structural strength, stability, means of egress, safety from fire and other hazards, sanitation, light and ventilation.”

The Building Construction Act of 1952 provides for punishment with seven years' imprisonment or a fine of Tk. 50,000 or both in case of violation of the BNBC and the Building Construction Rules of 2006 (BNBC, 2006). The code clearly keeps provisions for earthquake resistant measures in any building. It also elaborates the requirements for building construction considering flood and surge.

5.3 THE COMPREHENSIVE DISASTER MANAGEMENT PROGRAM

The Comprehensive Disaster Management Program (CDMP) contains an urban risk research component on urban earthquakes. The objective is to facilitate an expansion of mitigating programs through initiating studies to obtain an in-depth knowledge about the earthquake threat and related risks in the urban areas recommending mitigation measures for Dhaka and some selected cities in Bangladesh.

5.4 CONTINGENCY PLAN BY BANGLADESH ARMED FORCES

Bangladesh Armed Forces Division (AFD) played a significant role in all past disaster management in the light of the tasks assigned in the “Standing Order on Disaster, 1999” circulated by Ministry of Food and Disaster Management. Recently, Bangladesh Armed Forces, in consonance with the national initiative, chalked out a contingency plan for Dhaka city. According to the AFD's contingency plan, the city is divided into eight sectors with predefined tasks after an earthquake. AFD will also activate “Disaster Management and Relief Monitoring Cell” at Prime Minister's Office after an earthquake.

CHAPTER 6

CAPACITY BUILDING IN DISASTER RISK MANAGEMENT

6.1 RESEARCH AND TRAINING

6.1.1 Disaster Research, Training and Management Centre (DRTMC) at Dhaka University

Background

The need for the establishment of this centre at Dhaka University was very strongly felt in the aftermath of the great deluge of September 1988 when most of the country went under water due to an unprecedented flood. Speakers specifically raised the issue of establishment of the centre at Dhaka University during a seminar on floods held on the 15th October 1988 and organized jointly by the Department of Geography, Bangladesh Geographical Society and the Centre for Urban Studies. In May 1989, the Centre was formally created at the Department of Geography and was endorsed by the Academic Council on 17 June 1989 and the Syndicate of the University Dhaka on 22 June 1989. The centre is presently located in the Department of Geography and Environment of the university.

Objectives

The main objectives of the centre as described in the constitution of the Centre will be the following:

A. Disaster Monitoring

One of the major functions of the centre will be to maintain a current inventory of disaster situations, the needs created in such areas, the nature, magnitude and effectiveness of assistance delivery and the longer term rehabilitation and reconstruction requirements of affected areas. The main purpose of such an inventory is:

- to provide data for disaster planning and preparedness
- to provide data for responding to acute situations
- to provide data sets for research and
- to provide appropriate information bases for extension and other training programs and academic curricula.

B. Research

The centre will provide an interdisciplinary forum for research into the causes of disasters, the needs created by different disasters, the appropriate response strategies, the short and long term impacts of disasters upon populations, economics and environments, and overall management strategies for different types of disasters. Special emphasis will be accorded to the impacts disasters have upon women because of the heavy burden they are usually required to bear both during the emergency phase and the reconstruction phase of disasters.

C. Training and Extension Services

The centre will design and implement a series of short extension courses and training seminars dealing with various aspects of disaster forecasting and early warning systems, disaster mitigation and management and longer term reconstruction and rehabilitation strategies. Such courses will target government personnel engaged in disaster, response and non-governmental agencies involved in disaster assistance. The center will also address the development of appropriate communication strategies for village level self-help hazard mitigation activities. This activity will require close interaction with non-governmental agencies active in disaster, prone areas.

D. Curriculum Development

While there exists courses in the curriculum that address, in whole or in part, some aspects of disaster response and natural hazard occurrence, no systematic attempt has yet been made at any Bangladesh University to create an integrated set of disaster-specific courses leading to a undergraduate or graduate specialization in disaster studies. Given the physical nature of Bangladesh and the recurrent frequency of natural disasters, it is highly appropriate that the University begins to provide such specialized professional training to at least a small group of students.

Ongoing Projects

1. Cyclone Disaster Mitigation: Exploring the Local Geographical Knowledge and People's Wisdom.
2. A Perspective of Flood 1998 in Bangladesh.
3. Coastal Land Use Change and Environmental Degradation: A Study of the Chittagong Belt.
4. Flood Extent and Damage Assessment of Savar Thana.
5. Monga/Food insecurity in the Northern Regions of Bangladesh: Nature, Causes and its Effect to the Livelihood.

Completed Projects

Table 6.1: Projects Completed by DRTMC.

Sl.	Title of the Project	Working Area	Funded by
1	Disaster Preparedness Training and Hazard Mitigation Strategies: Exploring the Local Geographical Knowledge and People's Wisdom in the Disaster-prone Coastal Areas of Bangladesh	Chokoria, Moheshkhali	Bangladesh Freedom Foundation (BFF)
2	Impact on Magurchara Test Oil Rig Explosion on Environment	Magurchara	Dhaka University
3	Perceived Awareness of Land Degradation/ Desertification Along the Northern Bank of Ganges.	River Basin of Ganges	Dhaka University
4	Drought in Bangladesh: A Study of Northwest Bangladesh	Northern Part of Bangladesh	Dhaka University
5	Groundwater Arsenic Disaster in Bangladesh: A Geo-environmental Analysis	Jhenaidah	Dhaka University
6	Brickfields as Environmental Threat: A Study Around Dhaka City	Gazipur, Savar	Dhaka University
7	Study of Noise Pollution in Dhaka City	Dhaka City	Dhaka University

Training on Disaster Management

This Centre has arranged different training programs for the students of Dhaka University who come from the coastal regions of Bangladesh and the community people (Imam of Mosque, School and College teachers, UP Chairmen and Members) in the coastal regions (Moheshkhali, Kutubdia, Chakaria etc.) of Bangladesh. About 350 students and 400 community people from different disciplines have participated in the training program and successfully completed the course.

Grants on Disaster Related Research

This Centre has been providing financial support to the students of Dhaka University. Each of them got Tk.5000 for doing research mostly on disaster related topics. The centre also approves 2 research grants per year for research scholars.

Publications

DRTMC has been publishing a newsletter namely **DURYOG BARTA**. This is a half yearly publication and it publishing research based article In this past ten years the Centre has published the following training manual on disaster management and books

1. *Natural Hazards in Bangladesh* written by Professor Nazrul Islam.
2. *Disaster in Bangladesh* by Dr. Khandaker Nizam Uddin

3. Training Manual on *Cyclone Management in the light of Indigenous Knowledge and Innovative Ideas*
4. *Duryog Barta* (Half Yearly Regular Publication)

Disaster Related Library

This Centre has an equipped library with national and international disaster related books, Journals, Encyclopedia of disaster, Research reports, Magazine etc and this library consisting about 10, 000 different disaster related publications.

(Source: DRTMC Profile, 2006)

6.1.2 Briefing Sessions for Professionals on Earthquake Disaster Management

Background

Disaster Management Bureau, with the help of different international funding agencies and local administration and other organizations, has been conducting various types of training sessions, seminars, workshops and other public awareness programs throughout the country. As a continuation of such programs the Bureau, with the funding from the UNICEF, undertook a 5 year-long project titled “The Rights-based Planning and Monitoring: Disaster Preparedness”. These briefing sessions were a part of this project.

Details of the Briefing Sessions

Year round briefing sessions in Dhaka have been conducted for professionals from RAJUK (Capital Development Authority), City Corporation, Public Works Department (PWD), Armed Forces, Fire Service and Civil Defense, Ansar (Community Police) and Village Defense Police (VDP).

Each day-long session took place between 09.00 AM to 05.00 PM. Eight (8) resource-persons from different relevant fields were selected to conduct each session for 50 participants.

The briefing sessions had a module in common on earthquake disaster management and public awareness and there were some special topics in each of them for the targeted group.

Nine (9) broad aspects and their contents that were covered during each of the sessions are:

1: Introduction to earthquake disaster management

- Policy of Bangladesh Government for reducing natural disasters;
- Objectives of Ministry of Food and Disaster Management (MoFDM);
- Objectives of the briefing session.

2: General concepts on earthquake, earthquakes in different countries and earthquakes in Bangladesh context

- Nature and characteristics of earthquakes;
- Causes of earthquakes;
- Major earthquakes around the world;
- Recent earthquakes in and around Bangladesh;
- Seismic activities in Bangladesh.

3: Preparation for reducing earthquake disaster loss: Roles and responsibilities of emergency service providing agencies and volunteers

- What is disaster-preparedness;
- Potential loss due to earthquakes
- List of different agencies that can provide support during earthquake disasters;
- Roles and responsibilities of various government and non-government service providing agencies to reduce the potential loss likely to be incurred by earthquake disaster;
- Equipments and machineries that might be necessary for earthquake preparedness;
- How to do the coordination for disaster preparedness;
- How to raise public awareness regarding earthquake.

4: Building Code: Objective, extent and content

- Background of Bangladesh National Building Code (BNBC) 1993;
- Objectives of BNBC 1993;
- Content of BNBC 1993;
- Extent of BNBC 1993;
- Types of different physical infrastructures;
- Guidelines that have been followed in preparation of the BNBC 1993;
- How to enforce BNBC 1993.

5: Response to earthquake: Rescue operations and coordination

- What does response operation to earthquake mean;
- How to observe the situation and fix the priorities;
- How to collect and disseminate information;
- Guidelines for rescue operation, first aid, health services and fire fighting;
- Guidelines for providing shelter and collection and distribution of food, water and other necessary goods;
- Provisions for waste disposal and cremation;
- How to keep disciplines and restrain price-hikes;
- How to keep the transportation and communication system working;
- How to do the coordination between rescue parties and volunteers.

6: Recovery and rehabilitation

- How to regain normalcy in disaster-stricken areas;
- How to accelerate the recovery and rehabilitation works;
- How to conduct the welfare activities for the affected people;
- Decisions to be made for recovery and rehabilitation.

7: First aid to earthquake-affected people

- Types of human injuries as a result of earthquake;
- Detailed knowledge/ideas about first aid;
- Necessary qualities of a first aid provider;
- How first aid can help in different kinds of injuries.

8: Outline for emergency response drill for earthquake

- How to conduct emergency response drill;
- Participants of the drill;
- Lessons from the drill.

9: Guidelines for public awareness regarding earthquake

- What is public awareness and why;
- What are the matters that the people should be aware of regarding earthquake;
- How public media can help raising public awareness.

Prospects of Such Activities

This type of programs should be carried out more extensively among the community people. Initiatives should be taken to arrange such sessions targeting every Ward of the city. Provision for some hands-on experience should be made through mock exercise.

And it would have been more useful if the sessions were conducted over a few days instead of only one day so that people would get sufficient time to realize. It is expected that conducting this kind of programs regularly and more extensively will definitely contribute to the overall earthquake disaster management in Dhaka City.

6.1.3 Guidelines for Earthquake Resistant Building Design

Background Information

There has been an increasing concern about the seismic vulnerability of the built environment in the urban areas of Bangladesh, specially that in Dhaka City. Some incidents of recent building collapse in and around Dhaka City have provided impetus to such concern, especially about the low quality of building construction. Bangladesh Earthquake Society (BES), since its foundation, has been working on raising awareness among all groups of people and professionals involved with such concerns through organizing seminars, workshops and through publications regularly. "Guidelines for Earthquake Resistant Non-engineered Construction" and "Earthquake Resistant Design Manual" are two of their kinds that BES has brought out with a view to reducing seismic vulnerabilities of the built environment.

Details of the Manuals

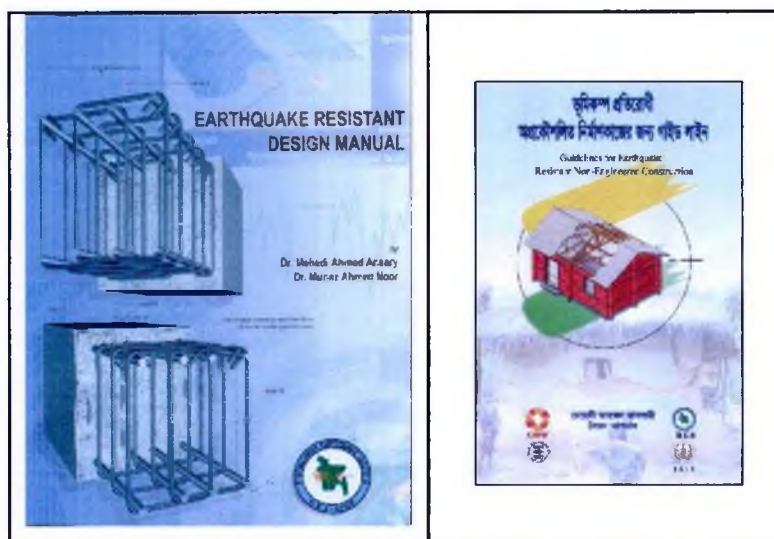
1. Guidelines for Earthquake Resistant Non-engineered Construction

This is basically the Bengali version of the "Basic Concepts of Seismic Codes, Volume 1, Part 2 (1980)" published by International Association for Earthquake Engineering (IAEE). CARE-Bangladesh and USAID provided the financial support in publishing this guidebook in the year 2004.

Most of the household buildings in Bangladesh are still being constructed without consulting an engineer or an architect and thus leaving them greatly vulnerable to earthquakes. Even Dhaka, the capital city is largely occupied with non-engineered structures, which are thought to be causing huge human casualties once even a medium scale earthquake strikes the city.

Since the practice of non-engineered construction can not be stopped all at once as it is the question of affordability of the people, and at the same time vulnerability reduction is a burning concern, this guidebook can be of great help. This book illustrates in very simple local language and with detailed sketches how bits of more effective and intelligent efforts could reduce the earthquake vulnerability of the buildings to a

remarkable level. Beside tips on constructing less vulnerable new buildings, techniques on how the existing non-engineered structures can be strengthened through repair and restoration have been elaborated in this guidebook.



Box 6.1: Covers of the Earthquake Resistant Construction Manuals.

2. Earthquake Resistant Design Manual

This is a comprehensive bilingual (Bengali and English) publication targeted to fulfill the lack of awareness among engineers, architects and other professionals involved in the design and construction of buildings about the design and detailing principles to ensure that the building is safe against earthquakes. Bangladesh Earthquake Society with the financial assistance from the Canadian International Development Agency (CIDA) brought out this 185 page guidebook in the year 2006.

This guidebook is deemed to be useful in the sense that the engineered construction works that are being conducted do not always take into account the seismic vulnerabilities that they might be subjected to. This is because of the lack of awareness that an earthquake may take place anytime now. Even on the part of those who feel it necessary to construct earthquake resistant buildings may have felt the need of proper guidelines from the experts. In this respect, Earthquake Resistant Design Manual seems to be a very helpful tool for the professionals.

Prospects of Such Guidelines

The purpose of these guidebooks is to reduce the seismic vulnerability of structures and thus it can play a significant role in reducing the overall risk of human casualties and property damage. The effectiveness of these tools is yet to be measured since it has not been long since they got published. Yet considering the characteristics of Dhaka city and

from the expert opinions it is expected that these tools, if properly followed, will positively contribute in the overall risk reduction process of the city.

6.1.4 Other Training Programs

- The Disaster Management Bureau (DMB) is the entrusted public institution to provide training courses for members of disaster management committees at the district, sub-district, union, and grass-root levels. The Bureau trains representatives of civil societies i.e. teachers, religious leaders, youth volunteers.
- The Bangladesh Public Administration Training Center (BPATC) is the apex training institution offering skills-based training, including disaster management, to government staff and officials.
- Bangladesh Meteorological Department (BMD) and Space Research and Remote Sensing Organization (SPARRSO) also impart training on disaster management.
- The National Defense College and all the training institutes belonging to the army, navy, and air services are providing disaster management training for their military personnel.
- Non-governmental organizations, academic institutions, and UN/donor agencies have been pro-active in conducting short-term in-country training initiatives for a variety of disaster management risk reduction stakeholders. Regionally, the Asian Disaster Preparedness Center in Thailand and the Asian Disaster Reduction Center has offered training to Bangladesh officials engaged in policy development or program implementation and management. For example, the Asian Disaster Preparedness Center (ADPC) in Bangkok, Thailand played a lead role in the Asian Urban Disaster Mitigation Program in which Bangladesh was a stakeholder. The MOFDM is also engaged with the National Society for Earthquake Technology – Nepal (NSET) in the Program for Enhancement of Emergency Response (PEER). Bangladesh was invited to join PEER based on three factors: high seismic vulnerability, need to improve disaster response capacity, and the interest of the government to participate in the program (MoFDM, 2005).
- World Food Program, ADPC, the Disaster Management Bureau in concert with UNICEF and a variety of national/international non-governmental agencies have also undertaken training activities in disaster risk reduction.

6.2 ACADEMIC PROGRAMS

6.2.1 Postgraduate Programs in Disaster Management at BRAC University

Background

The concept of such programs arose principally from the demand expressed by several non-governmental organizations (NGOs). The course is expected to satisfy the need for training staff members of national and international NGOs involved in disaster management in Bangladesh. Other possible sources of students could be government departments relating to health, environment, fire service, armed forces, etc. Over the long term, the course may attract students from other countries, particularly in the South Asian region.

Because the course is multi-disciplinary in nature, students are drawn from a broad range of disciplines that produce graduates working in the field of disaster management in various capacities and roles, including the social sciences, public administration, law, engineering, architecture, planning, geology, geography and meteorology. Additionally, as the course is practice-oriented, in lieu of academic qualifications, professional and practical experience of prospective students is taken into consideration for admission.

Program Structure

Presently there are three programs, namely: Certificate, Diploma and Master's. After completing the first semester one will get a Certificate in Disaster Management; after completing first two semesters one will be awarded the Diploma in Disaster Management and when one accomplishes the whole three semesters along with the dissertation he/she will be qualified for the Master's Degree. Each of the semesters comprises of 15 credits. In each of the first two semesters there are two 2 credit foundation courses, two 3 credit core courses, one 3 credit elective course and one field study that carries 2 credits. In the third semester, for the students who will pursue the Master's Degree, there are two 3-credit core courses and a 9-credit dissertation.

Course Contents

The contents of the courses have been designed with emphasis on three main aspects:

1. Pre-disaster preparedness and vulnerability reduction.
2. Post-disaster response, relief and rehabilitation.
3. Disaster mitigation and long-term development (Pre-disaster and Post-disaster).

These aspects are presented and reviewed from the perspectives of various disciplines in the form of foundation courses, core courses, field studies, electives and individual student projects. Because this program is run in Bangladesh, which is a particularly disaster-prone region, most of the course contents are based on experience and information relating to this context. A wide variety of case studies on disasters and disaster management particularly from Bangladesh are covered within the course contents.

Prospects of Such Programs

Postgraduate Programs in Disaster Management at BRAC University offer the opportunity of in-depth understanding of disaster and its management. It provides a good institutional support for education towards disaster management. The special urban characteristics that Megacities hold and the inherent vulnerabilities associated with them can be better understood through these programs since there are certain relevant courses. The resource persons for the programs are chosen from all across disaster management fields, which include renowned academicians, researchers and practitioners so that students get the best orientation to all the prospective sectors of their contribution. The programs are currently run under the department of Architecture, which can also be regarded as positive since the connections between disaster management and built environment are likely to be better understood here. Above all, introduction of such programs can be regarded as taking the whole disaster management activities in Bangladesh one step ahead by helping produce qualified disaster managers.

(Source: BRAC University, 2006)

6.2.2 Bangladesh University of Engineering and Technology (BUET)

In the Department of Urban and Regional Planning at BUET, Natural Hazards and Disaster Management is taught at the undergraduate level. This course with a greater extent is also offered at the post graduation level. A considerable number of research works on various aspects of disaster risk management has been carried out under this department.

The Department of Civil Engineering of the same university has produced a good number of quality research works on earthquake and the related issues considering Dhaka and the whole country as well.

CHAPTER 7

RISK COMMUNICATION AND AWARENESS RAISING ACTIVITIES

7.1 FLOOD FORECASTING AND WARNING FOR DHAKA BY FFWC

Background Information

Flood Forecasting and Warning Centre (FFWC) was established as a permanent entity in 1972. FFWC received UNDP/WMO assistance from 1981 to 1986 and 1989 to 1992; technical & financial assistance from DANIDA (1995 to 1997). Currently it is implementing a 5 year consolidation and strengthening programme with DANIDA support. The key consultant to FFWC is Danish Hydraulic Institute (DHI). FFWC Operates "Flood Information Centre" as focal point in connection with Disaster Management both for Cyclone and flood (FFWC, 2005).

Earlier before 1990, forecast for six locations viz. Bahadurabad, Sirajganj, Aricha, Goalando, Bhagyakul and Hardinge Bridge on the Padma-Brahmaputra-Jamuna system were issued by Co-axial Correlation, Gauge to Gauge relation and Muskingum-Cunge Routing Model. After the devastating flood of 1987 and catastrophic flood of 1988, it was deeply realized that the forecast formulation should be introduced in the form of river modeling. In view of the above, the simulation model MIKE 11 developed by Danish Hydraulic Institute (DHI) was installed at FFWC and a special version of MIKE 11 FF conceptual Hydrodynamic model is in operation for forecast formulation (FFWC, 2005).

The General Model (GM) developed under MIKE 11 was adapted to real time operation in which boundary was extended to near to the Indian border on all main rivers. A Supermodel now is in operation at FFWC covering entire northern flood affected area of Bangladesh. The Supermodel covers about 82,000 km² of the entire northern area of the country. The area is subdivided into 107 sub-catchments. It includes 195 river branches, 207 link channels, 40 Broad Crested Weirs. The total river length modeled is about 7270 km (FFWC, 2005).

Details of the Activity

Data collection

The real time hydrological data is collected by SSB wireless, fixed and mobile phones from the BWDB hydrological network. Water level data from 86 stations and rainfall data from 56 stations are collected for the forecasting of flood situation of the country for up to the following 72 hours. For Dhaka, data from 8 river stations around the city are taken into account (FFWC, 2005).

Water level data for non-tidal stations are collected five times daily at 3 hours interval in the day time (6 AM to 6 PM); but for tidal stations, water level data are collected every hour. Rainfall data is collected daily on a daily basis beginning at 9 AM. The data collection at FFWC is generally completed by 10.30 AM everyday (FFWC, 2005). Very limited water level and rainfall and forecasts from Indian stations are also collected through BMD by tele-printer link and also from the Internet.

Essential information

Estimation of water level at the boundaries and rainfall for the catchments are required to be input to the model up to the time of forecast (24h, 48h and 72h). For the rainfall estimation satellite picture from NOAA satellite, collected at SPARRSO, is used. In addition, a dedicated land line RADAR link with BMD is used which provide information very frequently (five minutes interval) from four stations at Dhaka, Rangpur, Cox's Bazar and Khepupara.

Forecast calculation

Collected water level and rainfall data are put into the computer database and checked. The water level and rainfall estimation is prepared. The basis for water level estimation is considering trend hydrograph extrapolated up to the period of forecast from previous few days' levels, response characteristics of rivers, effect of rainfall on water level and available water level and forecast data from the upstream. Rainfall estimation is based on previous 2 days' rainfall and analysis of collected information. It takes 30-40 minutes for the calculations to be completed once the data is input into the model.

Dissemination

Daily forecast bulletins are prepared on the basis of the output from the model for up to 72 hours for important locations and region-wise flood warning messages. The forecast bulletins are disseminated to more than 100 different offices including the President's and PM's Secretariat, individuals, news media, foreign missions, donor agencies and NGOs. Whenever the forecast river stage crosses the danger level, the concern field offices are informed so that appropriate measure can be taken before the occurrence of hazards.

Besides, the daily updates on the river situation at all the 86 stations and the rainfall data are available at the website www.ffwc.gov.bd. For Dhaka City an inundation map is produced for the next 24, 48 and 72 hours based on the river situation around the city.

The FFWC is considering incorporating the drainage system of Dhaka in the existing model since Dhaka is now more subjected to flooding due to drainage congestion. This will certainly help to give a more accurate forecast about the flooding in the city area.

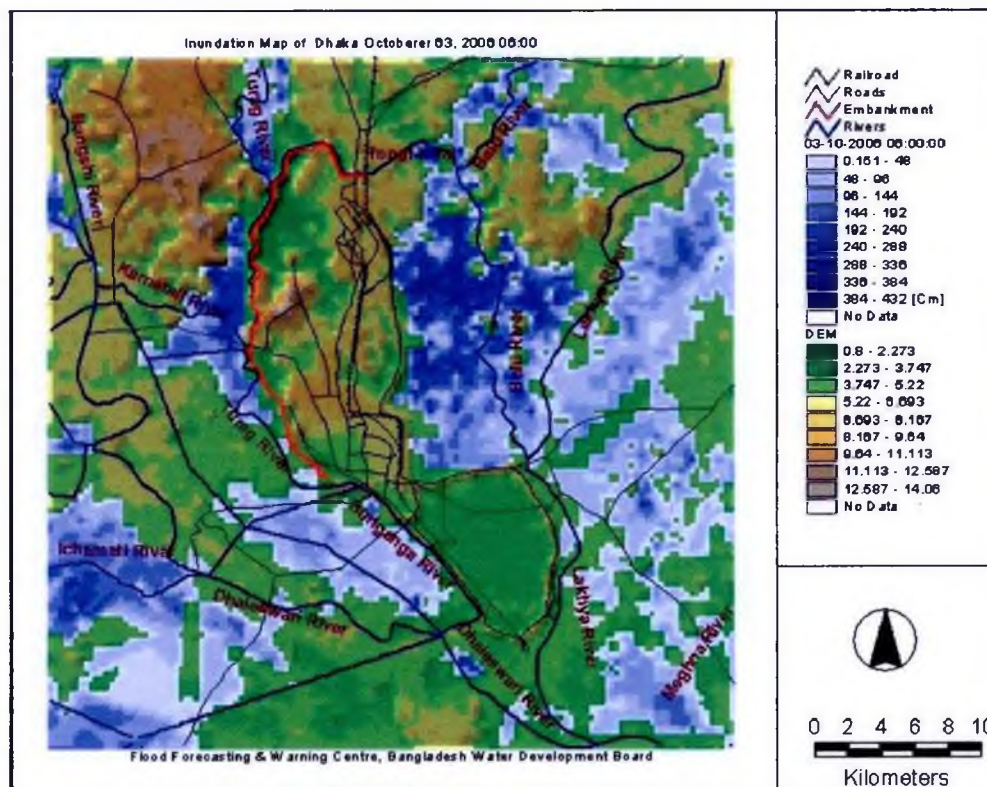


Figure 7.1: Forecasted Inundation Map of Dhaka for the Following 24 Hours.
Source: FFWC

Significance of Such Practice

The focus of flood forecasting is to make people aware about an imminent flood beforehand so that the loss is minimized. The western part of Dhaka is now free from river flood because of the construction of embankment while the eastern part still suffers from river flooding. Thus flood forecasting and warning is deemed useful for avoiding any unexpected situation. Besides, construction of embankments for flood protection is questioned because of the various associated effects such as water logging inside the embankments. In this regard a non-structural measure like flood forecasting and warning may prove itself to be a sustainable solution and can be replicated in other megacities where flood is a concern. Other than for river flooding, drainage congestion due to heavy rainfall triggering flood can be forecasted taking into account the drainage network, which is being thought of for Dhaka.

7.2 COMMUNITY-BASED EARTHQUAKE RISK MANAGEMENT IN DHAKA CITY

Background Information

The Community-based Earthquake Risk Management Project initiated by BDPC and Oxfam, GB is the first of its kind in Bangladesh that calls for preparedness action at community level. This is about preparing the urban communities for earthquake hazard through organizing the communities and activating the service providers (organizations responsible for responding to earthquake hazard).

Being a pilot initiative, the project was intervened in 16 communities / wards of Dhaka City that were selected based on their receptivity and vulnerability through community participation.

It features the various approaches of empowering the communities through linking with service providers (SPs), raising peoples' awareness, enhancing communities' capacity and activating the service providers. The success of this initiative was involving the Ward Commissioners who played the lead role for organizing community activities and ensuing peoples participation.

Details of the Activity

A. Selecting Communities

Step 1: Stimulating awareness through leaflets inserted in daily newspapers in order to assess community's response.

Step 2: Making community inspection for verifying their response to step 1 with regard to community's risk associated to earthquake through observation and triangulation method.

Step 3: Analyzing findings and selecting 16 communities at primary stage that met the selection criteria.

Step 4: Conducting participatory vulnerability assessment (PVA) for identifying 8 most receptive and vulnerable communities for capacity enhancement.

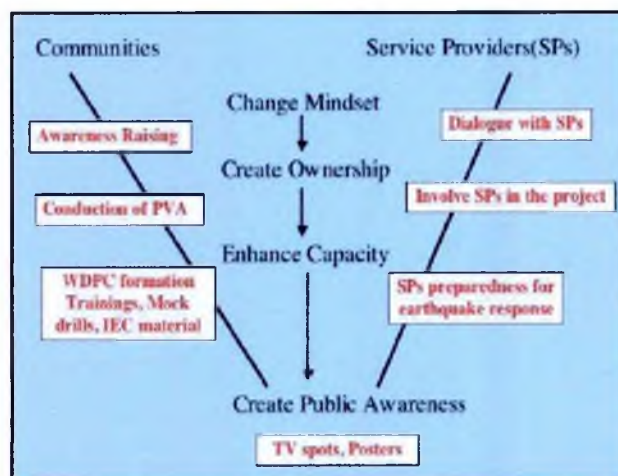


Figure 7.2: Methodology Used in the Project

B. Linking Communities and Service Providers (SPs)

Step 1: Changing the mindset through sensitizing the service providers and the communities and bringing them together in a central level workshop to start the dialogue.

Step 2: Creating an ownership through involving the ward commissioners for organizing sensitization meetings in their respective wards and conducting Participatory Vulnerability Assessment (PVA) in the community with people's participation

Step 3: Enhancing the capacity of the community.

Step 4: Raising awareness amongst a wider range of the public, which included development and distribution of leaflets and posters.

C. Sensitizing on Earthquake

Step 1: Bringing the Communities and the Service Providers Together

The day long workshop on “Community Based Earthquake Risk Management for Dhaka City” held on 14 October 2004 was very effective for initiating a dialogue with the community people and the service providers.

Step 2: Initiating the Dialogue with the Service Providers (SPs)

This workshop provided the opportunity for an open discussion among the service providers, community representatives and the Ward Commissioners to look at the present situation with regard to preparedness and response capabilities for earthquake disaster from their perspective.

Step 3: Sensitizing People at Community Level

Sensitization meetings at the community level not only changed the mindset of community people regarding earthquake hazard but also provided a great opportunity to get the Ward Commissioners directly involved in project activities.



Box 7.1: Activities in Photographs (1. Sensitizing people at community level; 2. Shop owners participating in PVA; 3. Blood grouping program; 4. Volunteers presenting WDPC work plan; 5. Community mock drama; 6. National mock exercise)

Source: Safer Cities 15, ADPC.

D. Conducting Participatory Vulnerability Assessment (PVA)

Conducting Participatory Vulnerability Assessment (PVA) of communities was very effective in making people realize what was the status of their community with regard to risk

at earthquake. The PVA especially the mapping exercise generated a lot of enthusiasm among the community people as it provided scope for them in identifying their community's vulnerability and capacity. The PVA exercise helped to indicate the main risk areas of respective communities, and also helped in identifying receptive communities based on the assessment of their participation and interest. Conducting PVA in the primarily selected 16 communities not only provided baseline information on their vulnerability and capacity, their perception related to earthquake preparedness and response, but also helped in identifying the 8 most receptive communities. At the end of the project period, conducting post PVA in the same 16 communities helped in assessing project impact in terms of people's level of awareness.

E. Enhancing the Capacity at Community Level

Step 1: Recognizing the Need for Getting Communities Organized and Capacitated

This was the outcome of the workshop held earlier in cooperation with Dhaka City Corporation. The Ward Commissioners took the initiative in forming the Ward Disaster Preparedness Committee (WDPC).

Step 2: WDPC and Volunteers Training

The training was planned on the basis of time constraints of community people and existing fund. As such the daylong session mainly aimed at improving their knowledge on earthquake disaster; motivating them for preparedness to cope with earthquake and producing a work-plan for WDPC. The WDPC training topics were:

- Introduction on Disaster
- Earthquake and Bangladesh
- Earthquake Disaster Management in Bangladesh
- Community based Disaster Risk Management
- Awareness on Risk Reduction
- Earthquake and Service Providers and
- WDPC work-plan.

Step 3: Blood Grouping Program

The aim of this program, facilitated by SHANDHANI on of the SPs, was to promote blood donation by community people in time of an emergency. Community people voluntarily came forward for blood grouping and getting their name enlisted in the register as potential

donors. This initiative will help community people mobilize required blood from within the community in time of emergency.

Step 4: Participation Service Providers in Community Coordination Meetings

Through participating in community coordination meetings, the SPs not only discussed their role with regard to response in time of an earthquake disaster but also explained their limitations referring to some recent building collapse incident. However they assured about refining their respective response plans through testing their plans in National Mock Exercise.

Step 5: Integration with National Mock Exercise

The National Mock Exercise was held at Dhupkhola Math in Dhaka on 12th April 2005. A total of 17 Government Departments (Service Providers) and 150 community people participated in this event. It was indeed a timely and successful event for activating the service providers and testing their respective contingency plan and generating public awareness on emergency response after an earthquake disaster.

Integrating Ward 81 in the mock exercise was very effective in ensuring the linkage with the community and the service providers. Ward 81 was one of the 8 selected receptive communities, where project activities had been undertaken. The WDPC took the responsibility of mobilizing community people for participating in the National Mock Exercise. Ward 81 took pride in participating in such a National event. The demonstration was so realistic that during Media coverage in the TV channels, general public at first thought that an actual earthquake had struck the city.

Effectiveness

The implementation of this project was very timely in generating public awareness (June 2004 – May 2005) considering some recent incident of building collapse (Shakahri Bazar, June, 2004 and Savar, April 2005) that have created great sensation among the people of Dhaka City making them concerned about their safety. In addition the Indian Ocean Tsunami in December 2004 also changed people's perception about earthquake as being a far off disaster in the region.

(Source: Safer Cities 15, ADPC)

7.3 EARTHQUAKE AWARENESS WORKSHOPS AT SCHOOLS

Background Information

Implementation of any action plan on earthquake risk reduction as such cannot be achieved unless consideration of earthquake safety starts becoming a part of the society's culture. This prompted the project to work on an experimental basis with two of the schools of Old Dhaka: Armanitola Government High School and Narinda Government High School where the workshops took place on 9th February 2006 and 7th March 2006 respectively. The teachers and students of these schools have, on their own initiatives, taken several actions to try to assess and reduce the risk of their neighborhoods. The enthusiasm and potential of these groups have been identified as positive and such school community works are being considered to be promoted throughout the city.

These workshops were conducted under the project named Earthquake Vulnerability Assessment and Community Awareness Project, which was funded by the Ministry of Science, Information and Communication Technology, Government of Bangladesh and USAID, Bangladesh. Department of Civil Engineering, Bangladesh University of Engineering and Technology (BUET) took the responsibility of implementing the project. Presently the extension of the project is under process, which is being financed by the University of Tokyo, Japan.

Details of the Workshops

The purposes of the School Awareness Workshop were:

- To promote the earthquake awareness through students and staffs of schools;
- To establish School Earthquake Safety Committee;
- To conduct preparedness and mitigation programs to reduce the loss of lives and properties due to earthquakes;
- To conduct earthquake drills and first aid training.

Series of meetings were conducted to inform and explain the goals and objectives of the workshop to the headmasters and the school supervisors of the two schools before the workshops. A unique team of urban planners, civil engineers and first aid specialists took care of the whole process.

The workshops comprised of structured discussions, multi-media presentations and interviews and finally a structured questionnaire survey was conducted to evaluate the feedback from the participants.

Following are the topics that were discussed during the workshops with multimedia presentations:

- Vulnerability of the country;
- Vulnerability of the city and the area specifically;
- Formulation of school based emergency action plan;
- Need for preparedness;
- Keeping provision for emergency exit;
- How to reduce the earthquake disaster risk within the school premises;
- How to respond when earthquake first strikes;
- What to do after the first shaking stops;
- How to provide first aid;
- What emergency stuffs should be preserved at home;
- What are the good practices for construction of buildings etc.



Box 7.2: Slides from the Presentation in the Workshops.
Source: Department of Civil Engineering, BUET.



Box 7.3: Photographs from the Workshop Sessions.

Source: Department of Civil Engineering, BUET.

Prospects of Such Workshops

The focus of the program lies with the building of a disaster resilient school environment as well as developing the knowledge of reducing earthquake disaster risks at the household level. Schools being the very first place of formal learning have ever-lasting impacts on the students. Thus, such programs at the school level help realize them the necessity of creating a sustainable living environment through taking measures of risk reduction. This practice should be made a compulsory part of the academic curricula at the school level, which will ensure a much wider participation.

(Source: Department of Civil Engineering, BUET)

7.4 RISK COMMUNICATION

7.4.1 Ministry of Food and Disaster Management

Bangladesh is in the process of developing a fully functional disaster risk information management system at the moment. The Ministry of Food and Disaster Management has programs developed in cooperation with donor and non-governmental agencies which are disseminating public information on disaster preparedness and response to specific hazards.

The Comprehensive Disaster Management Programme, which is under the management of the Ministry of Food and Disaster Management, is operating a Disaster Management Information Center (DMIC) to respond to the need for a more effective, better coordinated, information management system i.e. collection, analysis, dissemination, and reporting. The DMIC promotes partnerships, enhance coordination and is a source of information for policy advocacy in mainstreaming disaster risk management into the development planning process.

The Disaster Management Bureau (DMB) has been able to introduce disaster management messages and awareness programs into primary and secondary school curricula up to grade 12. In 1997, the DMB was successful in mandating that all children from grades 6 to 8 be required to read a chapter on disaster management as part of the school curriculum.

Besides all these, the ministry in collaboration with other stakeholders publishes posters, leaflets, and booklets for public circulation on how to prepare and respond to different emergency situations. It also brings out rallies on national and international events on disaster.

7.4.2 NIRAPAD

The Network for Information, Response and Preparedness Activities on Disaster (NIRAPAD) is a non-governmental organization initiative developed to provide rapid information on major and localized disasters in Bangladesh. The Disaster Management Bureau, in cooperation with UNICEF, issues a newsletter on disaster management events.

7.4.3 Disaster Emergency Response Group

The Disaster Emergency Response Group (DER) is another forum for sharing information. The DER group, chaired by World Food Program and composed of representatives of the

Government, donor agencies, and the NGO community, seeks to provide timely information on major and localized disasters and in undertaking joint field level needs assessments.

7.4.4 Universities and Other Research Organizations

Considerable number of research works has been being carried out at the university level and by different research organizations regarding the risks of different hazards, especially earthquake and urban flooding. The findings of these research works are shared through seminars and conferences and further disseminated by newspapers and electronic media.

Agencies such as the Flood Forecasting and Warning Centers (FFWC), the Bangladesh Meteorological Department (BMD), Centre for Environmental and Geographic Information Services (CEGIS), Institute of Water Modeling (IWM), and the Space Research and Remote Sensing Organization (SPARRSO) have particular interest in this information for early warning dissemination and collaborative linkages with regional and international organizations (MoFDM, 2005).

CHAPTER 8 RESPONSE AND RECOVERY ACTIVITIES

It has been stated earlier that in Dhaka there are no specific plans to mitigate and cope with the effects of disasters. No particular organizations are vested with the responsibilities of responding to the needs that rise from an emergency situation. Regarding rescue and response, services are provided on ad-hoc basis where various government, non-government and community organizations take part.

8.1 RESPONSE AND RECOVERY FOR FLOOD

During the 1998 flood in Dhaka, a study was conducted to

- Identify who take the initiative to set up emergency shelters;
- Identify who take the responsibility to operate, manage and provide services to the shelters; and
- Assess the problems associated with the present informal system of emergency shelter provision.

Regarding the original use of the shelters, the study revealed the following:

Table 8.1: Statistics of Original Use of Flood Shelters.

Original use of shelter	Number	Percentage
School	200	66.4
College	28	9.3
Madrasha	3	1.0
Community Center	12	4.0
Residence	20	6.6
Office	6	2.0
Factory	5	1.7
Institution/Hospital	3	1.0
Other	24	8.0
Total	301	100

Source: Maniruzzaman *et al*, 2002.

39.22% of the respondents informed that the shelter was opened at the request of local political leaders; 7.8% cited directives from higher authorities; 15.7% had pressure from the shelter seekers and 25.5 percent did it out of their sense of duty (Maniruzzaman *et al*, 2002).

43.14% of the shelters were reported to be managed by local political leadership, 25.49% by NGOs and the rest was managed and operated by the shelter-seekers (Maniruzzaman *et al*, 2002).

According to the study the local government bodies, NGOs and individuals abundantly provided relief materials including food and medical supplies. Water supply and sanitation provisions were better in shelters managed by the NGOs while the contribution of the concerned government agencies in these regards was insufficient (Maniruzzaman *et al*, 2002).

8.2 RESPONSE AND RECOVERY FOR COLLAPSED BUILDING

Collapsed building gives a bit of the idea of the consequence of an earthquake while the real scenario could be much critical than the assumption. Three recent incidents of building collapse, one in the older part of the city (Shankhari Bazar, February 2004); one in the heart of the city (the Phoenix Tragedy, February 2006) and the other on the fringe (the Spectra Tragedy, April 2005), merely demonstrated the nature of an earthquake disaster.



Box 8.1: Recent Building Collapses in Dhaka (Clockwise: Shankhari Bazar, June 2004; Savar, April 2005; Tejgaon, February 2006).
Source: The Daily Star.

Following is a local newspaper report after the completion of the rescue operation of the Phoenix Tragedy in Dhaka:

“...The 119-hour-long rescue operation was coordinated by the 14 Independent Engineers Brigade who deployed arrays of rescue equipment and more than 700 personnel since the collapse of the multi-storey Phoenix building on February 25.

...The army was joined by 120 personnel of the Fire Service and Civil Defense, Dhaka City Corporation, Bangladesh Rifles, Rapid Action Battalion (RAB), Police, Roads and Highways Department, RAJUK and the district administration. Some private construction companies also helped by sending their excavators to the site.

...From day one hundreds of rescuers painstakingly cut through floor after floor of the collapsed building. They were often forced to use bare hands fearing that vibration from the chipping hammers could trigger further collapse and reduce the chances of finding live people trapped inside.

...According to Brigadier General Nizam Ahmed about 2,500 truckloads of concrete debris were removed from the site and dumped on an open space 500 meters from the spot. He said the operation was relatively easier than the Savar Spectrum building tragedy due to its location next to a wide road in the middle of the city, where accessibility is much better...”

(Source: The Daily Star, March 03, 2006).

CHAPTER 9

CONCLUSION

From all the discussions made in earlier chapters, one thing is clear that earthquake is the most apprehended disaster for Dhaka. Though a good number of activities have been elaborated in this study as part of proper disaster risk management initiatives, the fact is that instead of an integrated approach, most of these activities have been developed in discrete manners. Some very important activities, such as the seismic micro-zonation of Dhaka, have been laudably done at the academic research level, but there is no initiative to integrate them with the policy making process. The BNBC has at last been designated as law after a long time since it was first formulated in 1993, but getting the benefits from it still lies with the proper enforcement of the law.

Disasters are getting newer dimensions everyday. Diseases like Avian Flue and SARS are the latest addition in the list. The recent demonstration of these two diseases has made the professionals around the world ponder over developing newer strategies to tackle the newer disasters. Dhaka being highly dense with unplanned and uncontrolled development remains very much vulnerable to such biological hazards. Besides, secondary hazards like fire, which is most likely to be triggered by an earthquake, will be hard to bring under control because of the poor accessibility to buildings and the least preparedness.

Dhaka is the hub of all the administrative, trade and commerce activities of Bangladesh. If a major disaster strikes Dhaka the impacts will not remain within the city limit; rather it will paralyze the whole country. But it seems like the policy makers will not come to sense until and unless a disaster situation occurs.

Disaster risk management is not an independent task. It has to be started by integrating it to planning and development process and it has to be mainstreamed through proper institutionalizing, capacity building, awareness raising and above all ensuring proper enforcement of the policies. Time and again experts have warned about the impending disasters in Dhaka and this is high time the decision makers paid heed to those warnings. Otherwise, Dhaka might be the next to be in the list after Gujarat (2001), Bam (2003) and Muzaffarabad (2005).

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