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## **CHAPTER 20: INSTITUTIONAL DEVELOPMENT FOR MASS RAPID TRANSIT (MRT)**

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### **20.1 Introduction**

This chapter discusses organizational and institutional issues on the development of MRT and its sustainable operation in Dhaka. MRT is composed of two transport systems in Dhaka: one is rail-based MRT (hereinafter referred to as MRT.) and the other is bus-based MRT, so called BRT. Although we focus on rail-based MRT system, BRT system is also considered in some extent to establish overall institutional framework.

As discussed in the previous chapters of this report, development of MRT system in Dhaka is essential theme to improve current traffic congestion and its chaotic situation tangled up by various transport modes in the city. The MRT system, however, will not function without comprehensive public transport network. For the development of MRT system in Dhaka, the governments took an initiative by restructuring DTCTB and rename it to Dhaka Mass Transit Authority (DMTA). It is a significant step toward the implementation of MRT. However, its functions and roles are not yet decided.

We took a study of previous experiences of MRT development and operation in other countries, such as Delhi and Kolkata in India, Bangkok in Thailand and Jakarta in Indonesia, and identified key issues in the institutional system in MRT development and operation. The overall institutional development framework was proposed, as a result of discussions held with various stakeholders.

### **20.2 Issues Related to MRT Organizations**

#### **20.2.1 Organizations Settings for MRT Development**

In general, there are four types of organizations for the development and operation of MRT, i.e., from policy making to actual operation. These organizations are;

- a) Governmental organization to formulate public transport policy and plan and determine development projects, such as MRT,
- b) Governmental regulatory organization to regulate the MRT system in safety, service level, fare, etc.,
- c) MRT operation body to provide daily services of MRT, including implementation Program, implement the project, and provide the MRT service.

- d) Private sector Concessionaire -To receive concession agreement with the MRT operating company for various operation and maintenance of the MRT.

### 20.2.2 Current Organization Setting for MRT in Dhaka

MRT system is completely new in Bangladesh, and therefore, there is no agreement in the Government toward organization setting for MRT development and operation. In the STP proposal, there are two types of MRT system to be developed in Dhaka: one is rail-based (MRT) and the other is bus-based MRT (BRT). It is, however, still uncertain whether one unified organization would be responsible for both MRT and BRT or two organizations would be responsible for MRT and BRT, separately. Under such circumstances, there have been discussions on organization setting among the stakeholders. The major points discussed were as follows:

- a) *Whether a new organization to be established apart from the DTCCB (to be renamed to DMTA)*— establishment of a new organization outside the DTCCB or a new organization within the DTCCB.
- b) *What organizational formation in the future*—It is difficult and time consuming process in establishing a new organization in Bangladesh government system. A sub-organization (department) with the function of the MRT operation might be set up within the existing DTCCB's organization framework at the initial stage, and an independent organization will be established in the future. Furthermore, the future continuity of the BRT will influence the organizational framework, whether the BRT will be replaced by the MRT, or both will co-exist in complementary relation in the network. This must be discussed in the development framework of overall public transportation network system in Dhaka in the future. This shall also be discussed in relation to F/S of a BRT proposed by the STP.
- c) *Organizations for operation of BRT and MRT Systems.* At initial stage the MRT operating company might treat with both BRT and MRT; this will be separated into two exclusive organizations for BRT and MRT in the future, when the operation size grows.

The Cabinet approved on 5th October 2009 on renaming of DTCCB to DMTA and reorganization of its Board member. As a result, the chairperson of the Board will be changed from Mayor of DCC to Minister of MOC; and additional authority of MRT development will be given to DTCCB. This change will lead DTCCB to fulfill two major functions: one is a coordinator of overall transport policy making and the other is a development of MRT. However, the detailed roles of DMTA in terms of MRT were not clarified at the Cabinet's approval. From its naming as Dhaka Mass Transit Authority, it seems some government officials consider that DMTA would be in charge of MRT development and operation.

### 20.2.3 Issues Related to Organizations Pertinent to MRTA

Based on the above-mentioned reform from DTCB to DMTA and organization options in the process of MRT development, the following issues can be identified:

(1) Enhancement of Capacity of DMTA as Planning Coordination Agency

Provision of urban transport network will become more complicated, which includes roads and expressways, BRT, Rail-based MRT and other public transportation modes. It surely makes DMTA's task more complicated and extensive, with more planning work and coordination among the stakeholders. DMTA has to be involved in decision making process such as project approval by Planning Commission. More careful coordination with stakeholders and monitoring of all projects, not only of the organizations under MOC but also of those outside the MOC especially RAJUK and DCC, are necessary.

In order for DMTA to function as designed and expected, DMTA shall have to enhance its capacity by proper recruiting and allocation of qualified staff, and strengthening of authority.

(2) Policy Formulation and Establishment of Legal and Institutional Framework for MRT Development and Operation

From the stages of preparation work of F/S, D/D, and Implementation programs of the MRT project, policy framework and resulting legal framework shall be established in the following, but not limited to:

- a) DMTA Act as regulatory body (Revision of DTCB Act, 2001)
- b) Act of MRT Operating Company
- c) Asset ownership of the MRT
- d) Infrastructure (including stations, depot)
- e) Rolling stock and others
- f) MRT Act and related regulations
- g) Regulation related to private sector involvement, including concession for MRT operation
- h) Regulation related subsidy by the government to the MRT project at operation phase

(3) Clear definition of DMTA as Government Organization for Policy and Plan in Transport Sector, not as MRT Implementation Organization

The new DMTA is expected to cover two functions of transport. One is planning and coordination in transport sector, and the other is MRT implementation, which are thought to be different. Consequently, it is difficult for DMTA to fulfill its double functions in a clear manner, even with the option of setting up two separate divisions in DMTA. Legal framework about DMTA shall be reviewed among the stakeholders to clear its functions of policy making and planning.

## (4) Clear Demarcation of Roles of Regulatory Body and MRT Implementation Organization

Implementation and operation of the newly introduced MRT System shall comply with the rules and regulations which are to be set by the governmental regulatory body. The rules and regulations stipulate safety operation, service level and fare structure of the MRT. Even when the MRT operating organization contracts out the operation of MRT to a private sector concessionaire, the organization still shall be the MRT operator. And the regulatory body and operator should not co-exist in the same organization.

## (5) Gradual Development of MRT Operating Organization

MRT includes the modes of BRT and rail-based MRT. Implementation and operation of these modes are different in character and it is unclear that an organization will be able to handle both modes of BRT and rail-based MRT. Accordingly, there will be option to separate the implementation organizations for BRT and rail-based MRT as the size of the operation grows in the future.

## (6) Consensus Building among the Stakeholders

Before giving a go-sign to the MRT project, there must be agreement among all the relevant stakeholders for a smooth commencement of the project. It is expected that the DMTA should take initiatives for consensus building among the following stakeholders:

- a) MOC/ DMTA (the former DTCCB)
- b) Bangladesh Railways (BR)
- c) RAJUK
- d) BRTA/ BRTC/BIWTA/ BITWC/ Other public transport service operators
- e) DCC & Upazilas surrounding DCC
- f) DMP
- g) Ministry of Finance
- h) MOC
- i) GIBR (Government Inspector of Bangladesh Railway)

It is expected that DMTA shall coordinate and conclude the consensus among such stakeholders. In order for that, DMTA must analyze the status of stakeholders in the following aspects.

- a) Overall stance on the MRT project: Alignment, relation with land use and urban development projects
- b) Financial Sharing : Financial burdens among the stakeholders
- c) Asset ownership: Infrastructure and rolling stock
- d) Operational relation: Among various public transport service providers

## 20.2.4 Measure to Improve Viability of MRT project

### (1) Mechanism for Realization of Integrated Intermodal Operation of Public Transport

Improved intermodal transport system or connection of public transport modes with the MRT, based on the user needs, is vital to facilitate people's modal shift to the MRT. The intermodal mobility is improved by not merely physical improvement of transport facilities but soft components such as a common ticketing system, an integrated timely operation for easier and shorter transfer among the modes. For integrated intermodal operation, the relevant organizations and public transportation operators should be cooperated to establish the following measures:

- a) Rational fare structure for each public transportation mode,
- b) Introduction of joint-ticketing system,
- c) Reviewing of rational and efficient bus service routes with MRT system,
- d) Adjustment of operation timetables to minimize transferring time loss,
- e) Joint campaign for promotion of users' manners,
- f) Proposal of justifiable subsidies and various support from the government, and
- g) Other issues arising in the operation

### (2) Non-rail business for financial viability

Financial viability is crucial for a sustainable operation of the MRT project. Most MRT projects have financial difficulties in revenue with only fare-box revenue. Furthermore, in Dhaka, affordable fare of the MRT is expected to be low taking account of the current fares of various public transport modes, rickshaws to route buses in Dhaka. Under such circumstances, urban development along the MRT and around its stations is considered to be a good financial source for the project. Such non-rail business should be incorporated in the scheme of MRT project through development by RAJUK, DMTA, and the private sector who will be involved in the MRT project.

## 20.3 Overall Institutional Setup for MRT

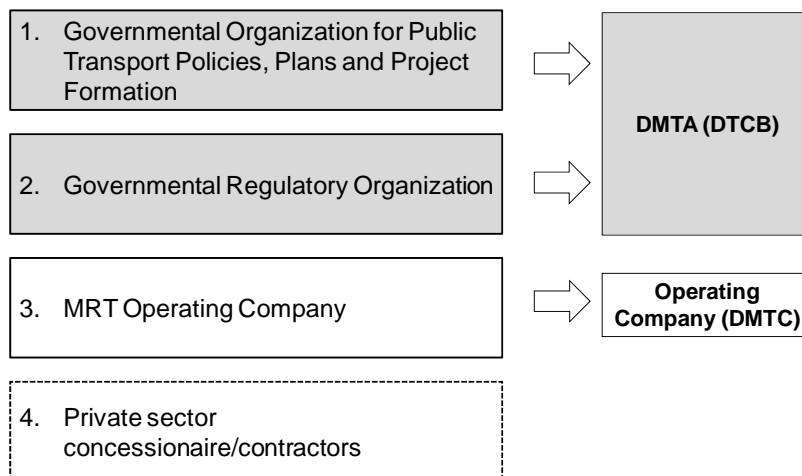
### 20.3.1 MRT Implementation and Operation: DMTA and DMTC

The JICA Study Team proposed two organizations to be setup for MRT; one is the DMTA (Dhaka Mass Transit Authority) by restructuring of DTCB, and the other is newly established MRT operating company, DMTC (Dhaka Mass Transit Corporation).

DMTA should perform the functions that the former DTCB was mandated, including formulation of transport policies and plans and the coordination among the related organizations. Also, DMTA should be responsible for decision making of public transport

development projects including MRT and BRT, and regulate public transport operating organizations. DMTA itself may implement a part of the MRT project, e.g. infrastructure development, in accordance with the appropriate financial sharing with DMTC (Figure 20.3-1). DMTC is an independent organization in charge of MRT project implementation and operation.

*Major functional organizations for MRT*



**Figure 20.3-1 Basic Roles of DMTA and DMTC**

*Source: JICA Study Team*

### 20.3.2 Other Stakeholders in MRT Development and Operation

In addition to DMTA and DMTC mentioned above, the following organizations have important functions for MRT development and operation.

- (1) Executive Committee on National Economic Council (ECNEC), Planning Commission, Ministry of Planning

ECNEC in Planning Commission of the Ministry of Planning is the organization which will approve the MRT project under the project approval system in the Government of Bangladesh. ECNEC is composed of Prime Minister as Chairman, Minister of Ministry of Finance as Alternate Chairman, and Ministers of the Council of Ministers as members.

- (2) Economic Relations Division (ERD), Ministry of Finance

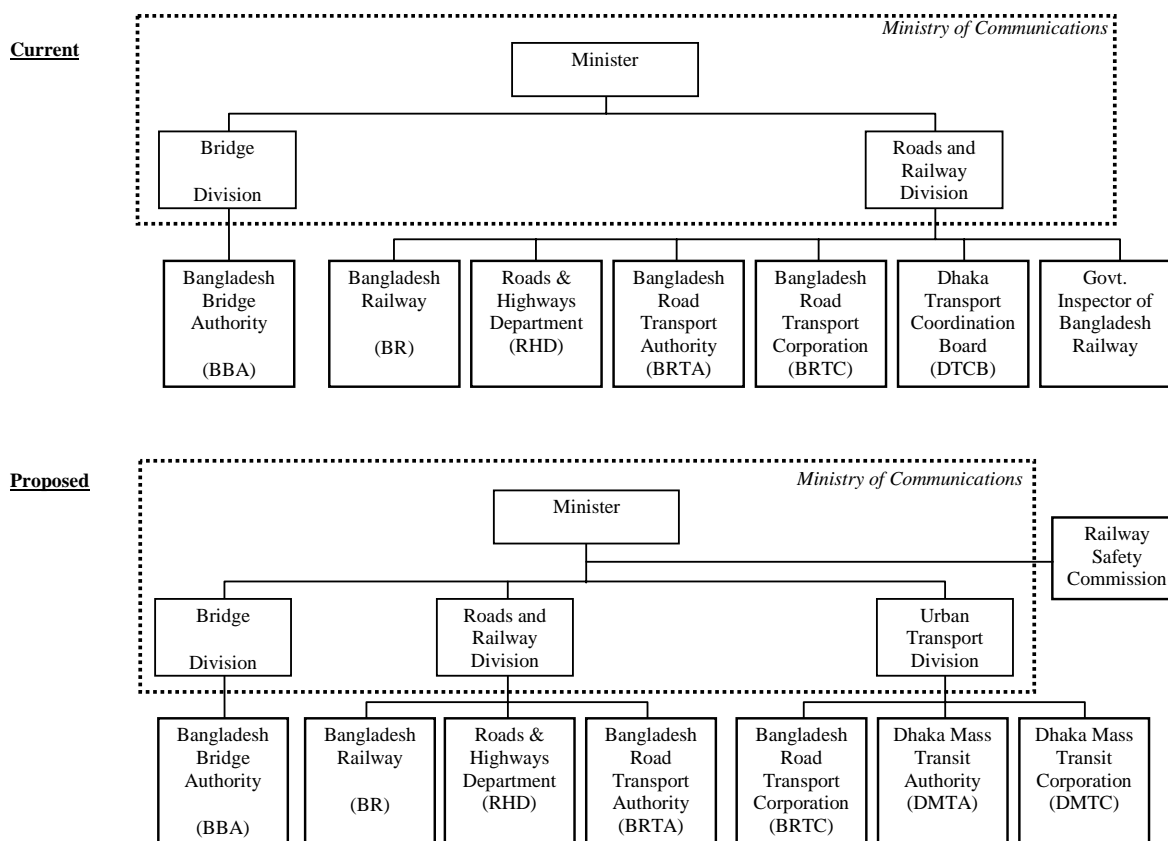
Economic Relations Division (ERD) of the Ministry of Finance is the Government's aid coordinating authority, reasonable for mobilization of external resources. For implementing MRT project with foreign assistance, ERD will take charge of loan request and management.

- (3) Ministry of Communications (MOC)

MOC supervises the activities of DMTA and DTCB. At present, there are two divisions in MOC, i.e. Bridge Division and Roads and Railways Division. DTCB is attached organization

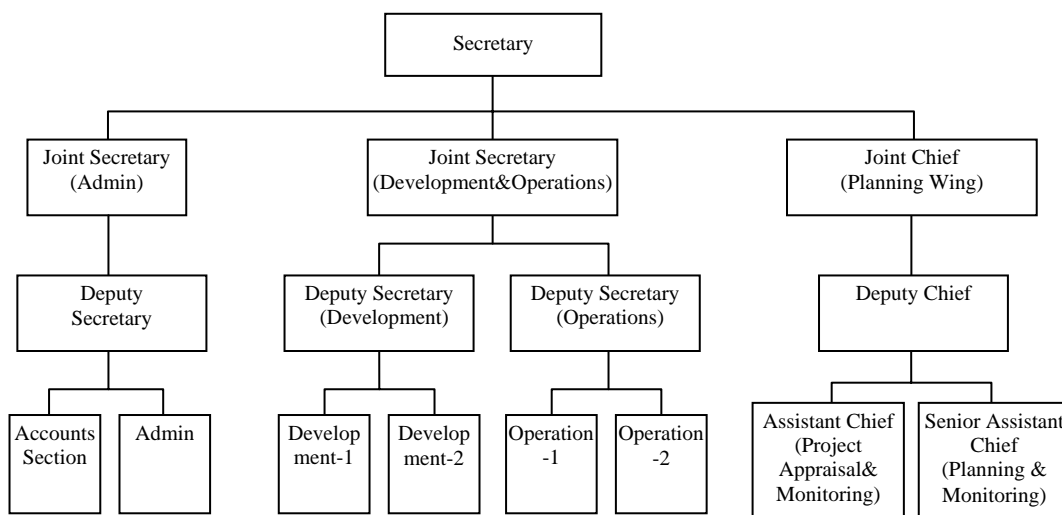
to the Roads and Railways Division with other five organizations (see Figure 20.3-2). Each Division is headed by the Secretary, who is the channel of the connecting the attached organizations with the Minister.

Urban transport is becoming important issues in recent years not only in Dhaka but also in other major cities in Bangladesh such as Chittagong. The Government needs to take initiatives to solve the urban transport problems. In this context, we proposed the idea of establishing a new **Urban Transport Division** in MOC headed by a Secretary, which has been discussed with relevant stakeholders. Figure 20.3-2 and Figure 20.3-3 show proposed organization structure of the Urban Transport Division in the MOC. It will deal with the urban transport development and management in Dhaka by guiding DMTA and BRTC. In future, DMTC will be established under the Division to be responsible for operation of MRT. Under DMTC a new BRT operating company would be established in Dhaka. Furthermore, the Division is expected to cover other cities by establishing similar organization to DMTA.



**Figure 20.3-2 Current and Proposed Organization Structure of MOC and its Relationship with the Organizations Attached to MOC**

Source: JICA Study Team



**Figure 20.3-3 Proposed Organization Structure of Urban Transport Division, MOC**

Source: JICA Study Team

(4) GIBR (Government Inspector of Bangladesh Railway)

GIBR is the organization under MOC and it is responsible for inspecting all sections of railways of BR. The position of GIBR is lower than the General Director of the BR. The post Joint Secretary of GIBR is usually filled by an official from BR, and the person is supposed to return to BR after serving the position in several years. Therefore, GIBR has no autonomous power, so that the safety measures are not properly taken.

BR has been conducting a Railway Sector Investment Program under a technical assistance of ADB, which includes a component of Institutional Support for Railway Reforms, with the strengthening of GIBR. In the draft report of the Railway Sector Investment Program, it was recommended that GIBR should be renamed to RSC (Railway Safety Commission) headed by the Chief Commissioner Railway Safety (CCRS) at the Additional Secretary level, and RSC will work directly under the Minister.

We support these recommendations proposed by ADB. It is expected that the Government should make actions to strengthen GIBR as an autonomous organization. After reorganizing GIBR, it should expand their duties and be responsible for the safety inspection of expected MRT as well.

## 20.4 Institutional Setup Options of DMTA and DMTC

Based on the above discussions, we identified two options for implementation and operation of MRT project, shown as follows:

(1) Option 1: Setup DMTC at the same level as DMTA

In this option, DMTC will be established at *the same level of organization as DMTA*.



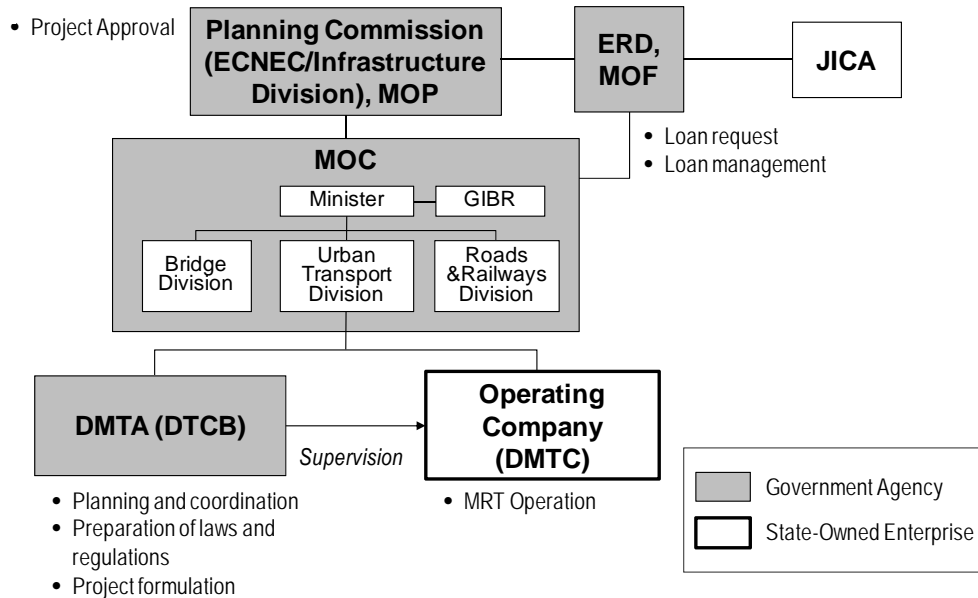
- a) Pros: DMTC, which would have heavy responsibility, will be a stronger organization than that proposed in Option 2. MOC can check both organizations of DMTA and DMTC to properly fulfill their respective duties.
- b) Cons: Communication, coordination and administrative procedures between DMTA and DMTC are made through the MOC; consequently the process will be complicated and time consuming. There is a possibility that decisions are made between DMTC and MOC without consulting with DMTA. DMTA might face difficulties in supervising DMTC activities.

(2) Option 2: Setup DMTC under DMTA

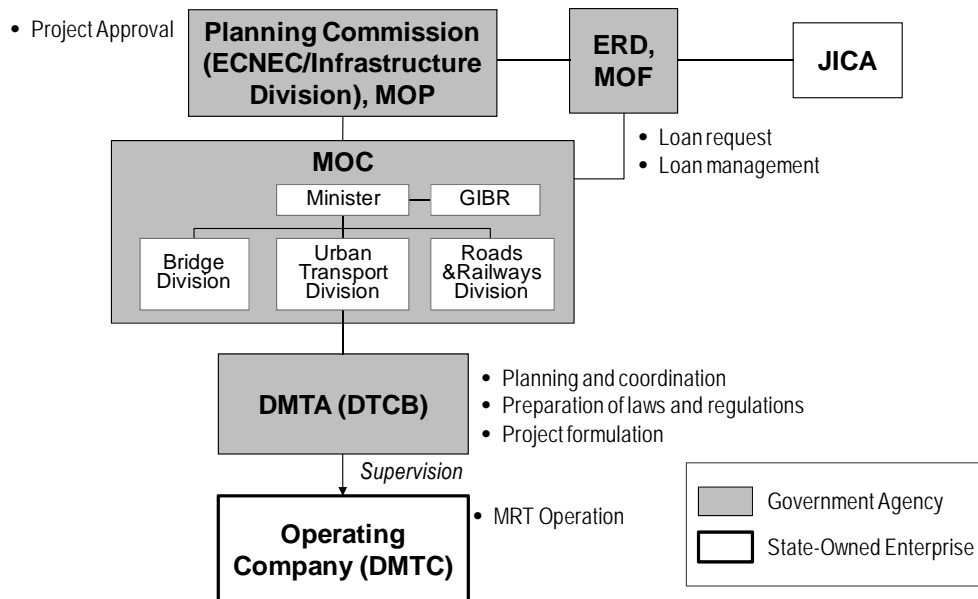
In this option, DMTC will be established *under DMTA*.

- a) Pros: DMTA can supervise the DMTC activities easily, since DMTA can communicate with DMTC directly without MOC.
- b) Cons: DMTC will become weaker and lower level organization. DMTC's views and opinions from the commercial viewpoints would not be fully considered in the top level decision making.

**Option 1**



**Option 2**



**Figure 20.4-1 Options of Institutional Setup for MRT Development**

Through intensive discussions with the Secretary of MOC and DTCB officials, we proposed the option 1 as appropriate structure for MRT development and operation. Even under this structure, it is possible for DMTA to assume the responsibility of regulating and supervising MRT operations according to the DMTA Act.

In order for both DMTA and DMTC to fulfill their duties properly and to communicate with each other smoothly and effectively under the structure of Option 1, establishment of the Urban Transport Division in MOC is the key. In order to functionalize the relationship between the two organizations, a close supervision by the Secretary of the Urban Transport Division is necessary.

## 20.5 Execution Agencies of MRT Project

### 20.5.1 Roles and Responsibilities of DMTA and DMTC

There are several types of executing agencies of MRT development and operation in foreign countries, in terms of construction, and operation and maintenance (O&M). With careful examination of other cases, we came up with three options as the framework of organizational setup for MRT in Dhaka.

#### (1) Option A: Full Responsibility by DMTC

It is a single responsibility throughout the phases of construction and O&M. DMTC, the MRT operating company, will be responsible for entire works during the construction and O&M phases including construction and maintenance of infrastructure, development and maintenance of E&M, and procurement and maintenance of rolling stock.

- a) Pros: A single executing agency is responsible for the entire MRT project. Construction/procurement and O&M are consistently done by DMTC.
- b) Cons: All cost and risks will come under responsibilities of DMTC, although the subsidy from the government has to be allocated to DMTC.

#### (2) Option B: Division of Responsibility between DMTA and DMTC

Infrastructure construction and O&M will be provided and maintained by DMTA, while E&M and rolling stock will be provided and maintained by DMTC. The infrastructure maintenance could be contracted out to DMTC during O&M phase, though the responsibility should be under DMTA.

- a) Pros: Huge amount of infrastructure construction cost and maintenance cost will be separated from the responsibilities of DMTC, which can operate on a commercial basis.
- b) Cons: Coordination between the two executing entities is necessary during construction phase. It might increase the difficulties in project implementation..

#### (3) Option C: Phased Shift of Responsibility to DMTC

During the construction phase, DMTA will be responsible for entire works including construction of infrastructure and E&M and procurement of rolling stock. During the O&M phase, DMTA will be responsible for only the infrastructure maintenance, although it can be contracted out to DMTC. The assets of E&M and rolling stock will be transferred to DMTC, and DMTC will be responsible for the maintenance.

- a) Pros: a special project organization can be established under DMTA during the phases of project preparation and implementation, and then the human resources and assets can be shifted to DMTC later on (Figure 20.5-1).

- b) Cons: Consistency between construction and O&M is ensured only for infrastructure. The transfer of assets and staff to DMTC might create complexity in the procedure.

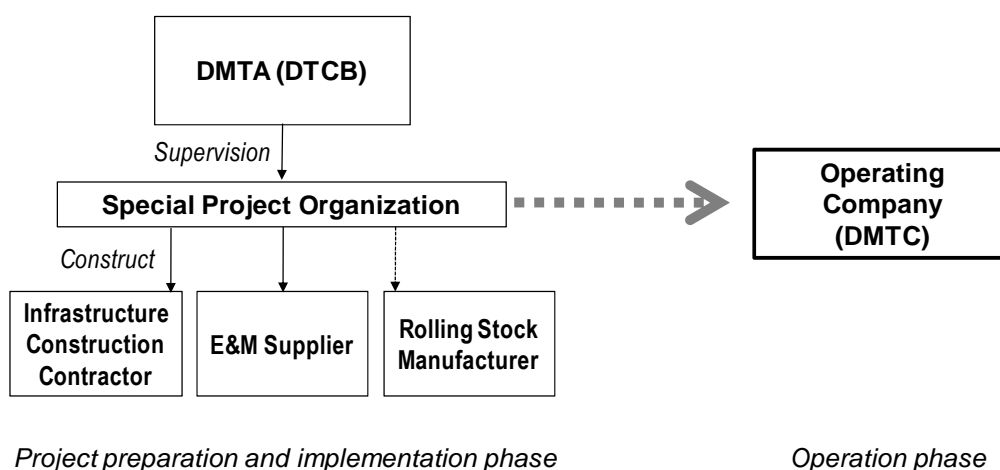
In Options B and C, in which DMTA will become an executing agency, the Special Project Organization should be established temporally under DMTA during the project implementation period without hiring permanent staff (Figure 20.5-2). It would ensure transparent financial flow of the project implementation. This scheme has been widely practiced in Bangladesh. The maintenance work of infrastructure under the responsibility of DMTA can be contracted out to DMTC based on the agreement.

		DMTA (DTCB)	Operating Company (DMTC)
<b>Option A</b>	Construction	(not execute the project)	<ul style="list-style-type: none"> <li>Infrastructure construction (Structure, Track)</li> <li>Development of E&amp;M</li> <li>Procurement of rolling stock</li> </ul>
Delhi Metro Bangkok MRT Manila LRT	O&M		<ul style="list-style-type: none"> <li>MRT operation and maintenance of infrastructure, E&amp;M and rolling stock</li> </ul>
<b>Option B</b>	Construction	<ul style="list-style-type: none"> <li>Infrastructure construction (Structure, Track)</li> </ul>	<ul style="list-style-type: none"> <li>Procurement of rolling stock</li> <li>Development of E&amp;M*</li> </ul>
Singapore MRT	O&M	<ul style="list-style-type: none"> <li>Maintenance of infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>MRT operation</li> <li>Rolling stock maintenance</li> <li>Maintenance of E&amp;M</li> </ul>
<b>Option C</b>	Construction	<ul style="list-style-type: none"> <li>Infrastructure construction (Structure, Track)</li> <li>Development of E&amp;M</li> <li>Procurement of rolling stock</li> </ul>	(Assets to be transferred or leased to Operating Company.)
Bangkok SRT Airport Rail Link Jakarta MRT	O&M	<ul style="list-style-type: none"> <li>Maintenance of infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>MRT operation</li> <li>Maintenance of rolling stock</li> </ul>

\*E&M may be developed together with infrastructure by DMTA (DTCB), depending on the evaluation of financial sharing.

**Figure 20.5-1 Demarcation of Responsibilities for MRT Construction and O&M between DMTA and Operating Company (DMTC)**

Source: JICA Study Team



**Figure 20.5-2 Demarcation of Responsibilities for MRT Construction and O&M between DMTA and Operating Company (DMTC)**

The options of the MRT project executing agencies should be decided together with the financial matter and risk sharing between the government and the operating company. The structure of execution agency of MRT should be determined in the stage of feasibility study, with the detailed analysis of technical aspects and cost estimation.

### **20.5.2 Establishment of DMTA**

The Cabinet approved on 5th October 2009 on renaming and restructuring of DTCCB to DMTA. One of the major changes was that the chairperson of the DTCCB Board would be replaced from Mayor of DCC to Minister of Communication, and new board members would be added.

In the end of December 2009, the Committee completed draft DMTA Act, 2009, and submitted it to MOC. MOC distributed the draft act to related organizations, including BRTA, DCC, RHD, BR, RAJUK, BRTC and DMP, to obtain their comments on it. The draft DMTA Act, 2009 will be finalized after incorporating the comments from the relevant organizations.

Major points to be changed from the DTCCB Act to the draft DMTA Act, 2009 are as follows:

- a) The Board of the DTCCB was not functioning well. Thus, the draft DMTA Act, 2009 clearly mentioned the functions of the DMTA board and frequency of the board meetings to be held.
- b) In Dhaka, various organizations have implemented transport-related projects. In order to avoid the duplication of the measures, as well as the physical overlapping of the structures, DMTA has to coordinate with other agencies in implementation of transport projects. In the DMTA Act, it is stipulated that all transport-related organizations have to implement their projects and/or take measures according to the directions provided by the DMTA.
- c) The following new functions related to MRT development (including both rail-based MRT and BRT) were mentioned in the DMTA Act, 2009:
  - i. Preparation of standards, regulations and guidelines related to MRT
  - ii. Determination and formulation of MRT projects
  - iii. Implementation of the MRT project partly by organizing Special Project Organization
  - iv. Monitoring and supervision of MRT operating organizations

### **20.5.3 Further procedure for the establishment of DMTA**

There are two major steps in the procedure to establish DMTA as follows:.

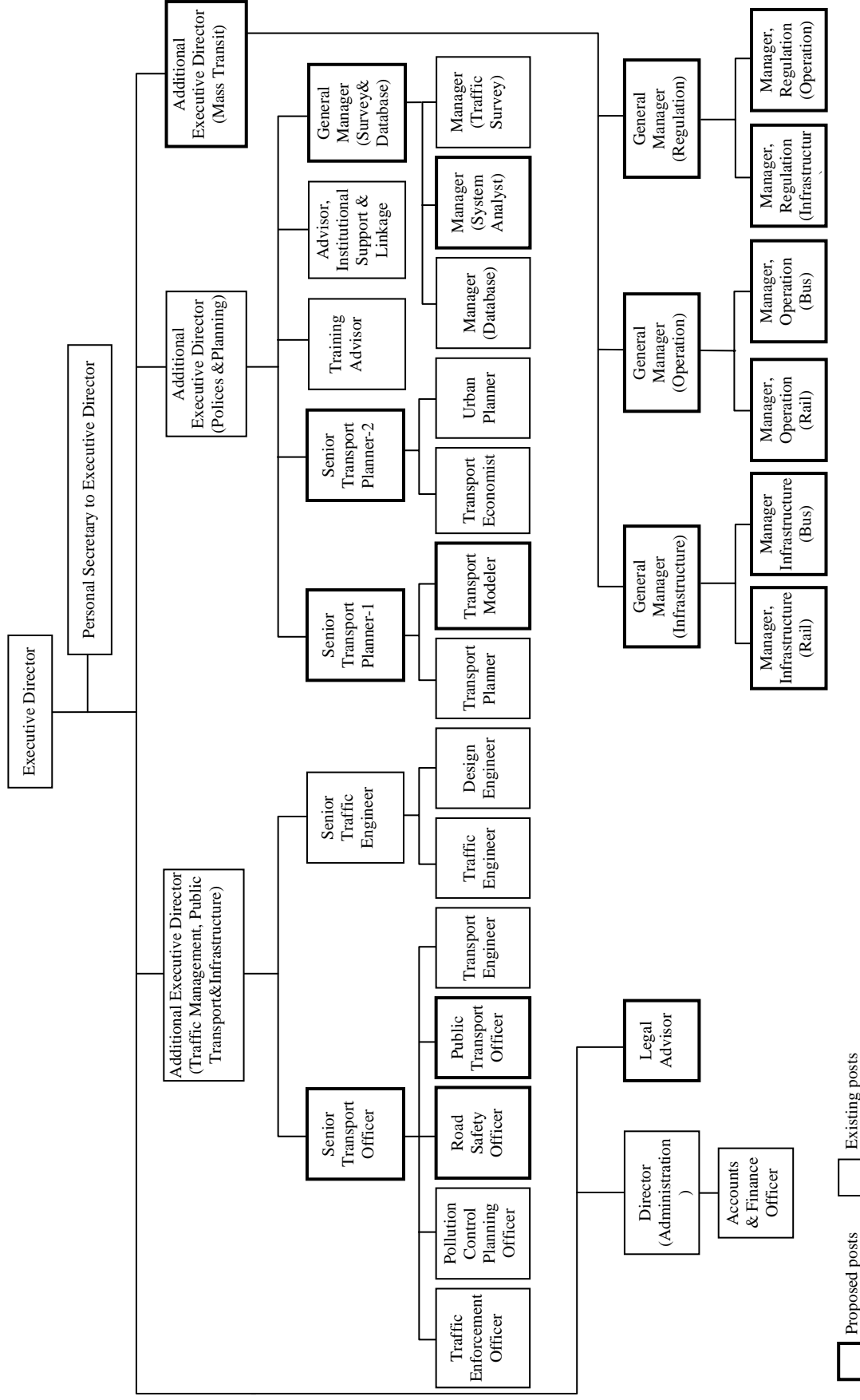
- (1) Step 1: Enactment of DMTA Act, 2009 (revision of DTCCB Act, 2001)
  - a) Finalization of the draft DMTA Act, 2009 at the ministry level by incorporating the comments made by the related organizations;
  - b) Review of the draft DMTA Act, 2009 and its approval by the Ministry of Law;

- c) Review of the draft DMTA Act, 2009 and its approval by the Cabinet; and
  - d) Final approval by the Parliament
- (2) Step 2: Authorization of DMTA organization structure and staffing
- a) Preparation of the draft DMTA organization structure and staffing including the required posts and grades, job descriptions, qualifications, and salary scale;
  - b) Review and approval by the Ministry of Communications;
  - c) Review and approval by the Ministry of Establishment;
  - d) Review and approval by the Ministry of Finance; and
  - e) Review and approval by the NICAR (National Implementation Committee for Administrative Reforms/ Reorganization)

The first step is expected to be completed by July 2010 at the Parliament; and step 2 will take several more months after the approval on the DMTA Act, 2009.

#### **20.5.4 Organization Structure of DMTA**

We proposed DMTA organization structure based on review of the original structure of DTCB when it was established under the DUTP. The proposal has been revised several times under discussions with DTCB officials. The proposed DMTA organization is shown in Figure 20.5-3.



Proposed posts   
  Existing posts

Figure 20.5-3 DMTA Organizational Structure (Proposed)

## 20.6 Establishment of DMTC as Operation Company of MRT

### 20.6.1 Functions of DMTC

The function of DMTC is still uncertain, because it is not determined whether DMTC is an organization under Urban Transport Division or under DMTA. In this section, therefore, we assume that DMTC would be a single organization to be responsible for MRT construction and O&M. The major functions of DMTC are as follows:

- a) Development and maintenance of infrastructure including civil engineering structures and track;
- b) Development/procurement, operation and maintenance of facilities including E&M, rolling stock, stations and station facilities, and depots; and
- c) Business development and management at stations and surrounding areas.

### 20.6.2 Legal Framework of DMTC

In the legal framework of Bangladesh, the following four types of entity can be considered for DMTC.

- a) Type 1: Government organization (e.g. BR)
- b) Type 2: Government corporation, known as statutory organization (e.g. BRTC)
- c) Type 3: State-owned enterprise (e.g. DPDC, DESCO)
- d) Type 4: Private enterprise

Type 1 and Type 2 are entities to be established in accordance with the *government administrative system*, while Type 3 and 4 are entities incorporated *under the Companies Act*.

As for Type 3, Dhaka Power Distribution Company Limited (DPDC) and Dhaka Electric Supply Company Limited (DESCO), established under the policy on Power Sector Reforms in Bangladesh (PSRB), are successful examples in Bangladesh. DESCO started as 100% government-owned entity, but later on, a part of the shares were offered to the private sector. Management of these companies has been significantly improved after the corporatization.

Considering that DMTC should pursue its operation in a commercial-orientated manner, and learning from current efforts to corporatize BR, Type 1 of government organization is not appropriate as the entity of DMTC.

By the same token, private companies operating MRT in other developing countries have been facing some difficulties in operation by their own finances, and therefore, it is essential that the public sector would provide some sorts of responsibility and risk sharing in operation of MRT to ensure the public benefit and sustainability. For the reason, Type 4 of private enterprise as DMTC entity would not be a successful option in Bangladesh.



Consequently, Type 2 and Type 3 are potential options as DMTC entity. In the comparison of these two, we think Type 3 of state own enterprise as an appropriate entity of DMTC. The reasons are as follows:

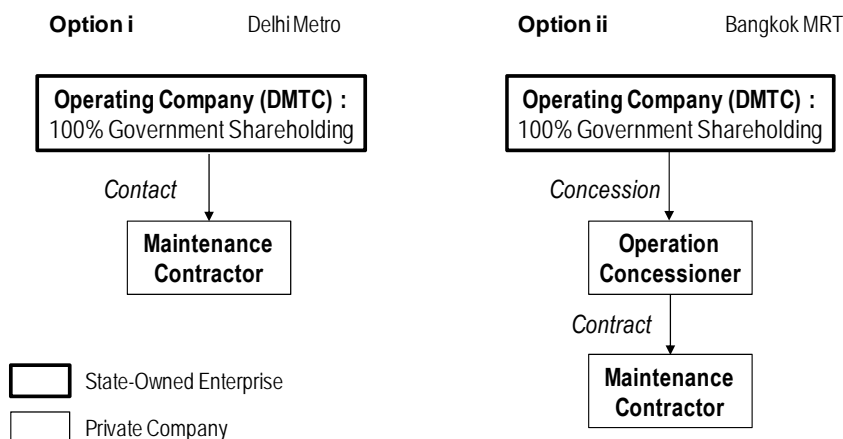
- a) Staffing and salary structure can be decided according to its own decision, not influenced by the government system. It will enable state own enterprise to recruit capable staff;
- b) Under shareholder's monitoring, governance of state own enterprise can be more transparent;
- c) The state-owned enterprise would follow its own Memorandum and Articles of Association, not the government administrative procedure. Thus decision can be made more quickly;
- d) Management of state own enterprise becomes more efficient with better business capacity and more freedom in commercial activities than the government corporation; and
- e) Flexibility in fundraising is ensured by utilizing the private sector investment. It will enhance the opportunities to do non-rail business such as development along the MRT corridor and around the stations.

*The state-owned enterprise could start as a 100% government-owned enterprise and then part of the share could be transformed to the private sector as the case like DESCO.*

### **20.6.3 Operation Options**

There are two options of MRT operation according to the degree of private involvement. First is the operation conducted directly by DMTC; this is similar to the operation in Delhi Metro. The other is the operation conducted by a private company under a concession contract; this is similar to the operation like Bangkok MRT (Figure 20.6-1).

*The possibility of the private sector involvement in MRT operation should be examined in the feasibility study by determining the detailed project costs and the fare structure. The possibility of non-rail business development should be also considered.*



**Figure 20.6-1 Operation Options**

Source: JICA Study Team

#### 20.6.4 Business Model of MRT Operation

MRT business models are thought to be the following three types: (1) integrated management and implementation of construction, management and maintenance by DMTC, (2) separate management and implementation of construction, operation and maintenance by DMTC, and (3) private entrustment by full-contract out to the private sector. The type MRT business model should be decided during the course of feasibility study.

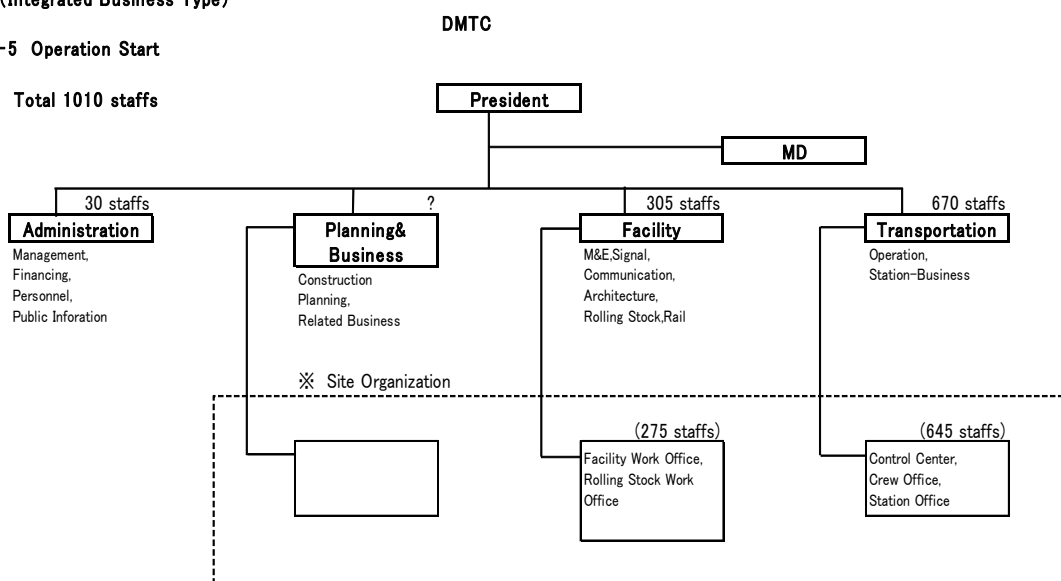
##### (1) Organizational Structure in Integrated Business Model

This section illustrates an organization structure in the case of full responsibility of MRT construction, management and maintenance by DMTC (Integrated Business Type). The integrated organization is typically composed of (1) *administration division* to manage the entire company; (2) *civil engineering division* in charge of construction; (3) *facility division* in charge of maintenance of facilities and vehicles; (4) *transportation division* in charge of train service and station operations; and (5) *planning & business division* in charge of development and parking lots around stations.

The number of staff needed for full operation in Line 6 with 22 km is more than 1,000. The planning & business division is excluded from the estimation of the number of staff, since a detailed study is necessary to define the viable non-rail business activities and their scales. Many staff are required for operation and maintenance of transportation and facility (Figure 20.6-2).

CASE-1 (Integrated Business Type)

Phase-5 Operation Start



**Figure 20.6-2 An Example of Organization Structure of the Integrated Business Model at Full Operation Phase**

(2) Partial Contract-out Business Model

In case of separation business model, appropriate companies should be selected to perform the work properly, based on the scope of outsourced work, fundraising, business prospect after commencement of service, and the project schedule.

It is considered to be appropriate that *the DMTC provides the infrastructure, vehicles, rails, electricity and all other facilities, and that only management, operation and maintenance be entrusted or contracted to private company(ies).*

In this business model, the government may have to assist the entrusted operating company in fundraising and staffing with a view to future expansion.

**20.6.5 Business Operation Plan of DMTC**

Table 20.6-1 summarizes business operation plan of DMTC in the four phases after the establishment.

**Table 20.6-1 Business Operation Plan of DMTC**

Phase	Planning	Preparation of Construction	Construction/ Commissioning	Operation
Target Year	2011-2012	2013	2014-2018	2018
Source of Funds for Operation	National Budget	National Budget /Loan	National Budget /Loan	Operating Revenue /Subsidy

Phase	Planning	Preparation of Construction	Construction/ Commissioning	Operation
Interim Operating Assets	-	-	Rolling Stock E & M Facility	Rolling Stock E & M Facility
Department/ Number of Employment	Planning (30) Administration (15)	Civil (30) Facility (35) Administration (36)	Civil (60) Facility (80) Transport (10) Administration (36)	Planning & Business Facility (305) Transport (670) Administration (30)
Key Task	1. Preparation of Establishment (Regulation) 2. Financial Plan	Role & Responsibility in accordance with Regulation	1. Employee Training Program 2. Business Plan	Detailed Business Plan & Management Structure

Source: JICA Study Team

Note: Detailed organization structure at each phase is illustrated in Appendix.

### 20.6.6 Issues of MRT as Business

#### (1) Improvement of Financial Viability

- a) MRT construction requires a **huge capital investment**, which becomes a heavy burden to the railway operator in financing and repayment by fare-box revenue. Consequently, it is better to **cover the whole construction cost with public funds** as is normally practiced in Europe and the United States. This will help financially viable railway business.
- b) Financial viability is important to run the MRT business, and at the same time, to provide mobility for those transport weak people who do not have private cars, the **fare for the MRT must be affordable** to them, taking account of the prevalent bus fares and living expenses of ordinary citizens.
- c) Accordingly, it is highly likely that public subsidies or management assistance will be required to cover operating costs. It is necessary to establish a **subsidy system** in advance of construction and after full validation by a feasibility study.
- d) Urban development along the MRT and around its stations is considered to be a good financial source for the project. Such non-rail business should be incorporated in the project scheme of the MRT project through development by RAJUK, DMTA, and the private sector who will be involved in the MRT project.

#### (2) Improvement of ridership

In order for better operation, it is necessary to attract maximum numbers of passengers on the MRT. It is also necessary to increase revenue in cooperation with those involved in transportation and urban planning. Specific measures include the following:

- a) Integrate public transport system of MRT and bus system, including routes, fare, transfer system, etc.
- b) Develop convenient, user friendly intermodal facilities; and

- c) Revitalize and redevelop along the line and around the station in order create attraction and inducement of rail users.

### (3) Public Service Obligation (PSO)

In transport sector, public service obligation (PSO) is an arrangement in which a governing body or other authority offers an auction of subsidies and permit the winning company exclusively to operate a specified service for a specified period of time, in case of the private sector involved. The PSO is done in public transport cases where the operation is not profitable but is a socially desirable being available for users. In the case of Dhaka MRT, it might not be profitable enough because of fare setting to meet the affordability of users.

In many cases, PSO has been introduced a way to privatize former government owned transport. The infrastructure is often separated from the operation, and may be owned by the governing body or by a third party. The authority may also maintain the ownership of the vehicles such as rolling stock. For this, the idea of PSO should be studied to the MRT in Dhaka.

## 20.7 Regulatory Framework

### 20.7.1 Laws related to Railway operation

The legal system of regulating railways in Bangladesh includes the Railways Act, 1890 (Act IX 1890). This Act provides the framework for implementation, and the related codes, rules and manuals. These rules and codes cover management and service of the Bangladesh Railway, and does not cover other transport mode such as rail based mass rapid transit (MRT) in Dhaka. The MRT will be the first transport mode electrified in Bangladesh; and laws and regulations should be enacted newly to assure safety and convenience of transportation by electrified railway. It is also necessary to establish new technical standards to be complied.

### 20.7.2 Laws and regulations required for MRT Development

The following laws and regulations should be established by making newly or amending existing laws, regulations, and standards.

- a) DMTC Act: Purpose, investors, articles of incorporation, administration committee, officers and employees, accounting, supervision and subsidy, penalties, etc.
- b) Urban Rapid Railway Business Act: Provisions on the railway operator, license application, licensing standards, approval of construction, inspection of railway facilities, confirmation of vehicles, use of rails, fares, etc.
- c) Urban Rapid Railway Structure Regulations: Rails and structures, electric facilities, safe driving facilities, vehicles, etc.
- d) Standards and other:
  - i. Railway Technical Standards

- ii. Driving Regulation: Driving regulation for safe driving
- iii. Design standards for railway structures,
- iv. Standards for vehicle inspection and track maintenance,
- v. Safety measures to be complied with to prevent accidents
- vi. Provisions on treatment of road facilities and buried objects
- vii. Regulations on placing substations
- viii. Fares setting
- ix. Others

## 20.8 Next Steps for Realization of MRT

### 20.8.1 Establishment of Steering Committee

To make a basis for the information sharing and consensus building among the stakeholders for establishing legal frameworks and institutional setup, it is proposed to establish MRT Steering Committee with the following members:

- a) Secretary, Roads and Railways Division, Ministry of Communication - **Chairman**
- b) Additional Secretary, Bridge Division, Ministry of Communication
- c) Additional Secretary, Local Government Division, Ministry of Local Government, Rural Development and Cooperatives
- d) Division Chief, Physical Infrastructure Division, Planning Commission, Ministry of Planning
- e) Additional Secretary, Economic Relations Division, Ministry of Finance
- f) Director General, Bangladesh Railway
- g) Chief Executive Officer, DCC
- h) Chief Engineer, Bangladesh Bridge Authority
- i) Police Commissioner, Dhaka Metropolitan Police (DMP)
- j) Chairman, RAJUK
- k) Director General, Department of Environment, Ministry of Forest and Environment
- l) GIBR (Government Inspector of Bangladesh Railway)
- m) Representative, Department of Civil Engineer, BUET
- n) Managing Director, DPDC
- o) Managing Director, DESCO
- p) Managing Director, Dhaka WASA
- q) Director, Flood Management Division, Institute of Waster Modeling
- r) Director General, Fire Service and Civil Defense, Dhaka
- s) Executive Director, DTCB (future DMTA)- Member Secretary

### **20.8.2 Actions to be taken by the Steering Committee**

The Steering Committee shall take the following actions for the realization of the MRT. More detail descriptions are included in Appendix.

- a) Determination of the MRT project framework:
- b) Conduct Feasibility Study
- c) Consensus making and coordination among Stakeholders
- d) Financial detailed scheme design
- e) Project Preparation
- f) Detailed Enhancement measures
- g) Preparation of DMTC setup
- h) Formulate Project scheme for Public-Private Partnership, if necessary
- i) Monitoring of regulatory revision

## CHAPTER 21: OVERALL PROJECT IMPLEMENTATION PROGRAM

### 21.1 Introduction

#### 21.1.1 Procedure for Implementation Program

##### (1) Procedure

In order to establish a realistic and effective implementation program, the overall project implementation program is formulated in this chapter.

Figure 21.1-1 shows the procedure for formulating implementation program. This flow diagram is based on analysis of government revenue and expenditure and Donor's involvement, forecast of GDP and cost estimate of projects and programs.

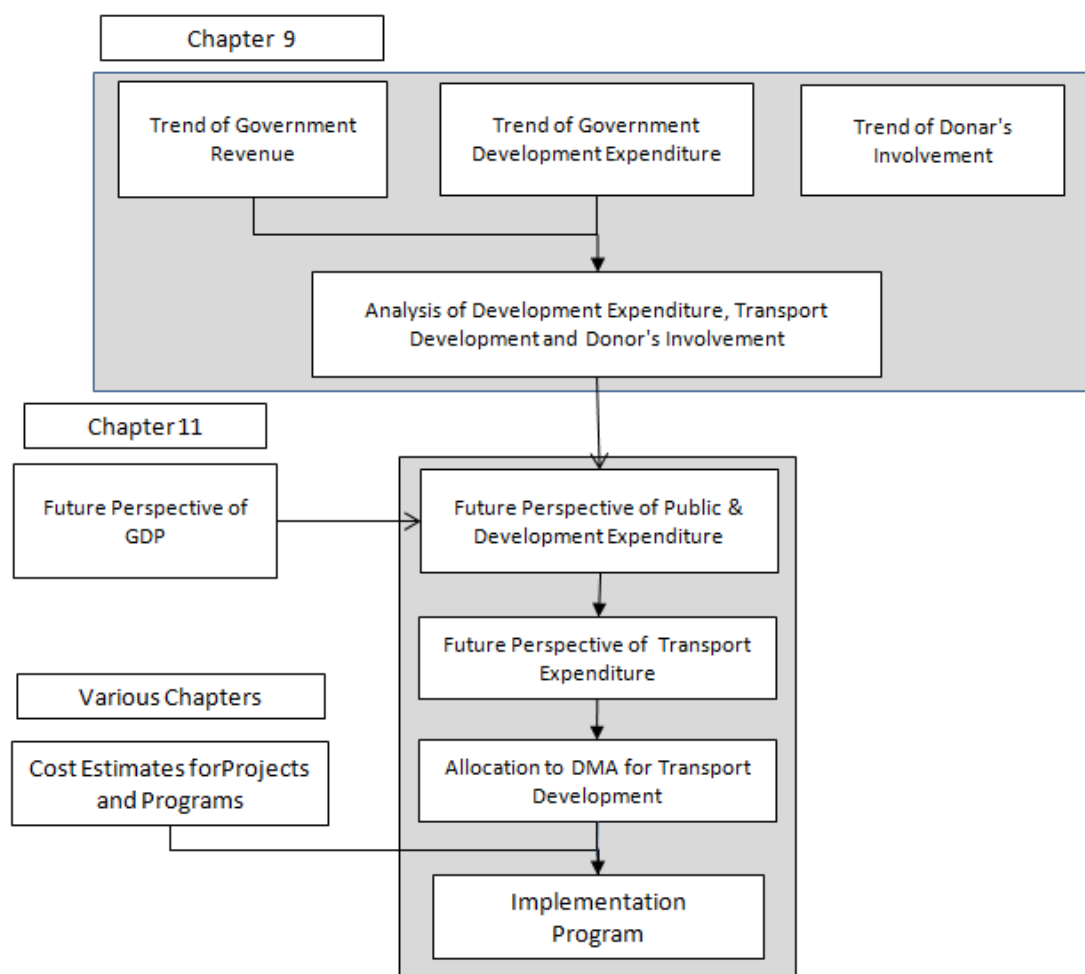


Figure 21.1-1 Procedure for Formulating Implementation Program



## (2) Implementation Framework

To establish overall implementation program of the projects and programs proposed by DHUTS, the framework was set up in terms of time schedule, project priority and budgetary considerations.

The total planning period is 16 years from 2010 to 2025, which is divided into the following three (3) phases:

- a) Short Term Period: 2010 - 2015
- b) Medium Term Period: 2016 - 2020
- c) Long Term Period: 2021 – 2025

**21.1.2 Estimation of Budget**

As the flow diagram as shown in Figure 21.1-1, the government budget is estimated as following steps.

## (1) Perspectives of GDP

Future GDP during the period of 2010 – 2025 was already estimated in Chapter 12. According to this estimation, annual GDP growth rate is assumed to be 5.7 % during the period of 2010-2015, and 6 % during the period of 2016-2025.

**Table 21.1-1 Estimation of GDP and Growth Rate**

	2010	2015	2020	2025
GDP (Million BDT)	6,490,160	8,603,554	11,513,496	15,407,655
Growth Rate (%)	-	5.7%	6.0%	6.0%

*Source: JICA Study Team*

## (2) Government Public Expenditure and Development Expenditure

Table 21.1-2 shows the past trend of government public and development expenditure. According to this table, share of public expenditure was almost constant and ranging from 12.5% to 14% while share of development expenditure to public one was ranging from 26% to 39%. When the Bangladesh economy becomes stronger, then the share of public expenditure is expected to increase compared with those in the past several years. It is, therefore, assumed that the share of public expenditure to GDP will be 15 % and development expenditure to public one will be 40 % during the period of 2010-2025, respectively.

**Table 21.1-2 Past Trend of Government Public and Development Expenditure**

Unit: Million BDT

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
GDP	2,732,010	3,005,801	3,329,731	3,707,070	4,157,279	4,724,769	5,419,188
Public Expenditure	360,904	420,224	442,495	514,996	546,264	592,831	706,983
Development Expenditure	140,902	154,343	168,173	187,260	194,720	179,280	185,060
% Share of Public Expenditure to GDP	13.2%	14.0%	13.3%	13.9%	13.1%	12.5%	13.0%
% Share of Development to Public Expenditure	39.0%	36.7%	38.0%	36.4%	35.6%	30.2%	26.2%

Source: Statistics Yearbook 2008

In the development expenditure mentioned above, both domestic resource and foreign assistance expenditure is included. In the foreign assistance, there are two (2) major categories, project assistance, and non-project assistance. Table 21.1-3 shows past trend of development expenditure by type of resource. According to this table, the development expenditure is largely depending upon foreign assistance. Without the foreign assistance, the projects and programs will not be implemented, especially large scale transport infrastructure projects.

**Table 21.1-3 Past Trend of Development Expenditure by Type of Resources**

Unit: Million BDT

	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Development Expenditure	140,902	154,343	168,173	187,260	194,720	179,280	185,060
Domestic Resources	63,930	73,580	95,900	152,110	182,030	174,390	167,100
Foreign Assistance	87,940	82,410	110,840	115,410	115,320	111,980	174,120
Project Assistance	71,330	72,140	74,190	66,200	74,750	85,290	94,990
Non-Project Assistance	11,240	8,760	33,180	45,570	36,170	22,730	72,800
Others	5,370	1,510	3,470	3,640	4,400	3,960	6,330
Total Resources	151,870	155,990	206,740	267,520	297,350	286,370	341,220
Balance	-10,968	-1,647	-38,567	-80,260	-102,630	-107,090	-156,160

Source: Statistic Yearbook 2008

## (3) Transport Expenditure

Table 21.1-4 shows the past trend of transport development expenditure to development expenditure. According to this table, share of transport development to public expenditure was ranging from 16.4% to 20.0%. Based on this analysis, percentage share of transport sector in the total development expenditure is assumed to be 20 % during the period of 2010-2025.

**Table 21.1-4 Past Trend of Transport Expenditure to Development Expenditure**

Unit: Million BDT

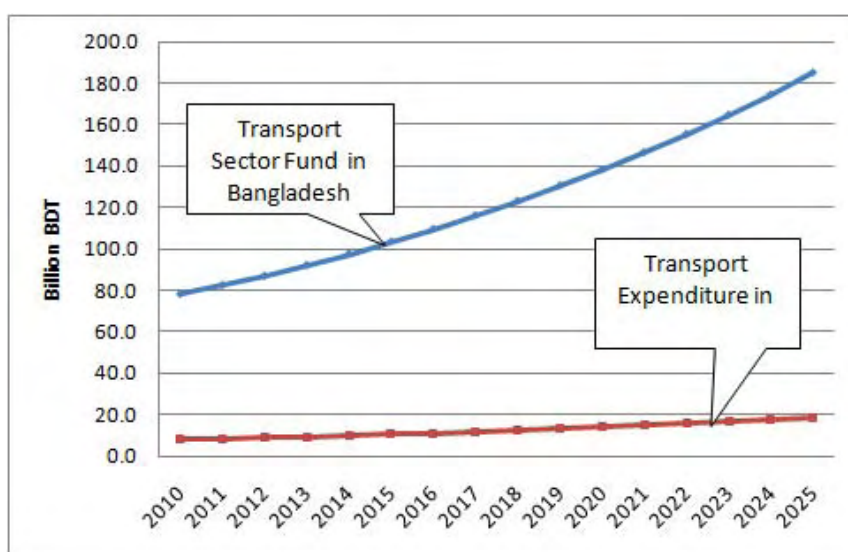
	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Transport Development	28	29.1	30.3	30.8	32	29.5	30.4
Development Expenditure	140.9	154.3	168.2	187.3	194.7	179.3	185.1
% Share to Development Expenditure	19.9%	18.9%	18.0%	16.4%	16.4%	16.5%	16.4%

Source; Statistical Yearbook

## (4) Transport Development Allocated to DMA

There are no data available regarding to the transport development funds allocated to DMA. This study is therefore assumed that transport development funds are allocated in proportion with number of population and standard deviation value of GDP per capita of Dhaka<sup>1</sup>. As the results of calculation, transport allocation rate to DMA is about 10 % to total transport development.

Based on the above mentioned assumptions, the future transport development funds in DMA are estimated as shown in Figure 21.1-2 and Table 21.1-5.



**Figure 21.1-2 Expected Budget for Transport Development**

**Table 21.1-5 Future Transport Development Fund in DMA**

*Million BDT*

	Short Term '2010-15	Medium Term 2016-20	Long Term 2021-25
Real GDP	44,938,234	51,408,976	68,796,806
Share of Public Expenditure (%)	15.0%	15.0%	15.0%
Public Expenditure	6,740,735	7,711,346	10,319,521
Share of Development Expenditure (%)	40.0%	40.0%	40.0%
Development Expenditure	2,696,294	3,084,539	4,127,808
Share of Transport Sector (%)	20.0%	20.0%	20.0%
Transport Sector Development	539,259	616,908	825,562
Allocation to DMA (%)	10.0%	10.0%	10.0%
Transport Development Expenditure in DMA	53,926	61,691	82,556

Source: JICA Study Team

<sup>1</sup> 'Bangladesh Strategy for Sustained Growth' June 2007, World Bank

## 21.2 Implementation Schedule

### (1) Phasing Concepts

To establish a realistic and effective implementation program, the phasing concept is introduced. Major criteria are described as follows;

- a) On-going and committed projects shall be completed in the short term plan
- b) Projects for maximum utilization of existing facilities
- c) Projects for alleviating chronic traffic problems
- d) Strengthening of an integrated public transport system featuring MRT & BRT
- e) Low cost solutions with ease of implementation and quick impacts.
- f) Institutional and organizational programs required as a prerequisite the implementation of the MRT project
- g) Projects for promotion to satellite community developments
- h) Projects for provision of mobility of Dhaka People

### (2) Implementation Program

In the previous chapters, the Study Team proposed the phasing implementation projects and programs. Based on this phasing plan, the implementation program is presented here.

Within the condition of the implementation framework established here, the overall implementation schedule of the projects under the DHUTS is proposed as shown in Table 21.2-1. Based on the overall implementation schedule, urban transport network development phasing plan in the short term (2010-2015), medium term (2016-2020) and long term (2021-2025) are illustrated in Figure 21.2-1, Figure 21.2-2, and Figure 21.2-3 respectively.

Table 21.2-1 Implementation Programs

	Proposed Project/Program	Implementation Organization	Unit	QTY	Cost (Million USD)	Short Term (2010-'15)	Medium Term (2016-'20)	Long Term (2021-'25)	Beyond 2025
1	Public Transport Project				7,313.0				
1-1	MRT Projects	BR/DTCB	km	21	6,572.0				
1-1-1	Line 4	DTCB	km	23	100.0				
1-1-2	Line 5	DTCB	km	22	1,725.0				
1-1-3	Line 6	DTCB	km	26	1,641.0				
1-1-4	Line 7	DTCB	km	34	1,950.0				
1-1-5	Line 8	DTCB	km	21	1,156.0				
1-2	BRT Projects	DTCB	km	14	591.0				
1-2-1	Line 1	DTCB	km	17	221.0				
1-2-2	Line 2	DTCB	km	14	188.0				
1-2-3	Line 3	DTCB	km	17	182.0				
1-3	Bus Transport Improvement	BRTA/Private	km	100.0	100.0				
1-4	Para Transport Improvement	BRTA/Private	km	50.0	50.0				
2	Roads and Highways	RHD/PSP	km	683.6	1,595.9				
2-1	Urban Expressway	RHD/PSP	km	54.0	935.0				
2-2	Roads and Highways	DCC	km	6.3	647.2				
2-3	Missing Links	RHD/DCC/RAJUK	km	123.8	2.5				
2-4	Grid Roads	RHD/RAJUK	km	304.6	216.1				
2-5	Circumferential Roads	RHD/RAJUK	km	194.9	295.3				
2-6	Radial Roads	RHD/RAJUK	km	5	133.3				
2-6	Grade Separation	RHD/DCC/RAJUK	No.	5	13.7				
3	Traffic Management				732.1				
3-1	Short Term Actions		No.	10	517.1				
3-1-1	Intersection Improvement	DCC/Private	No.	10	50.0				
3-1-2	Parking System	DCC	No.	100	300.0				
3-1-3	Traffic Signal System	DCC	km	204.3	100.0				
3-1-4	Traffic Safety Facility	DCC	yr.	5	51.1				
3-1-5	Traffic Safety Campaign	DTCB/BRTA/DCC	yr.	5	16.0				
3-2	Medium & Long Term Improvement	DCC	System	2	150.0				
3-2-1	ITS Ssystem	DTCB/DCC	System	2	150.0				
3-3	Traffic Demand Management	DTCB/DCC	System	16	65.0				
3-3-1	Short Term TDM	DTCB/DCC	Yr	16	5.0				
3-2-2	Medium Term TDM	DTCB/DCC	Yr	16	60.0				
4	Environmental & Management				32.0				
4-1	Monitoring of the Projects	MOE/DTCB	Yr	2	16.0				
4-2	Environmental Monitoring	MOE/DTCB	Yr	3	16.0				
5	Institutional & Organization				15.0				
5-1	Establishment of DTCB(DMTA)	DTCB	Yr	2	2.0				
5-2	Establishment of DMTC	MOC/DTCB	Yr	3	3.0				
5-3	Capacity Development of DMTC	DTCB	Yr	5	10.0				
	Total Cost				4,857.0	1,579.5	1,527.9	1,749.7	4831.0
	Cost per Year				303.6	263.3	305.6	349.9	

Source: JICA Study Team

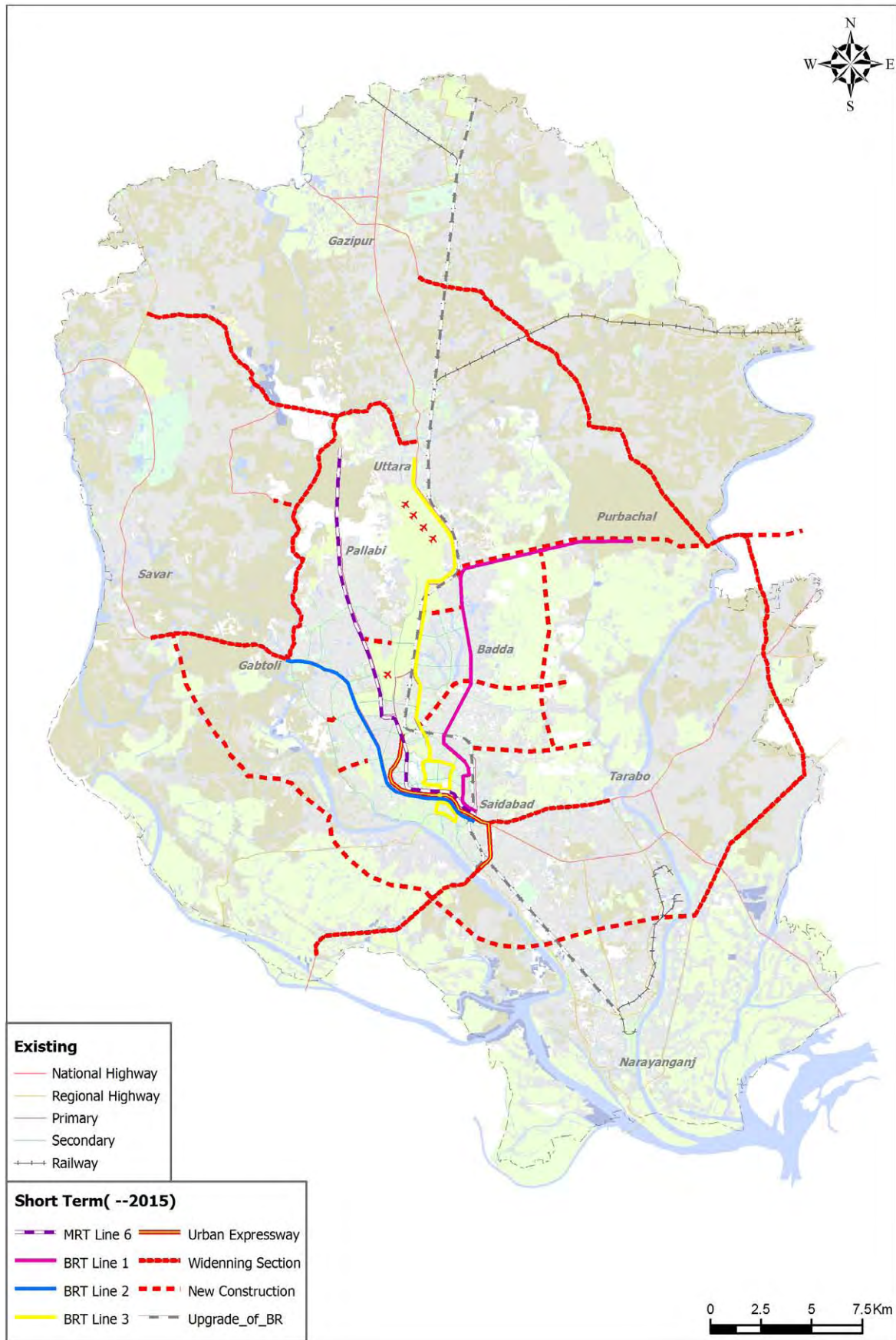


Figure 21.2-1 Future Transportation Network by year 2015



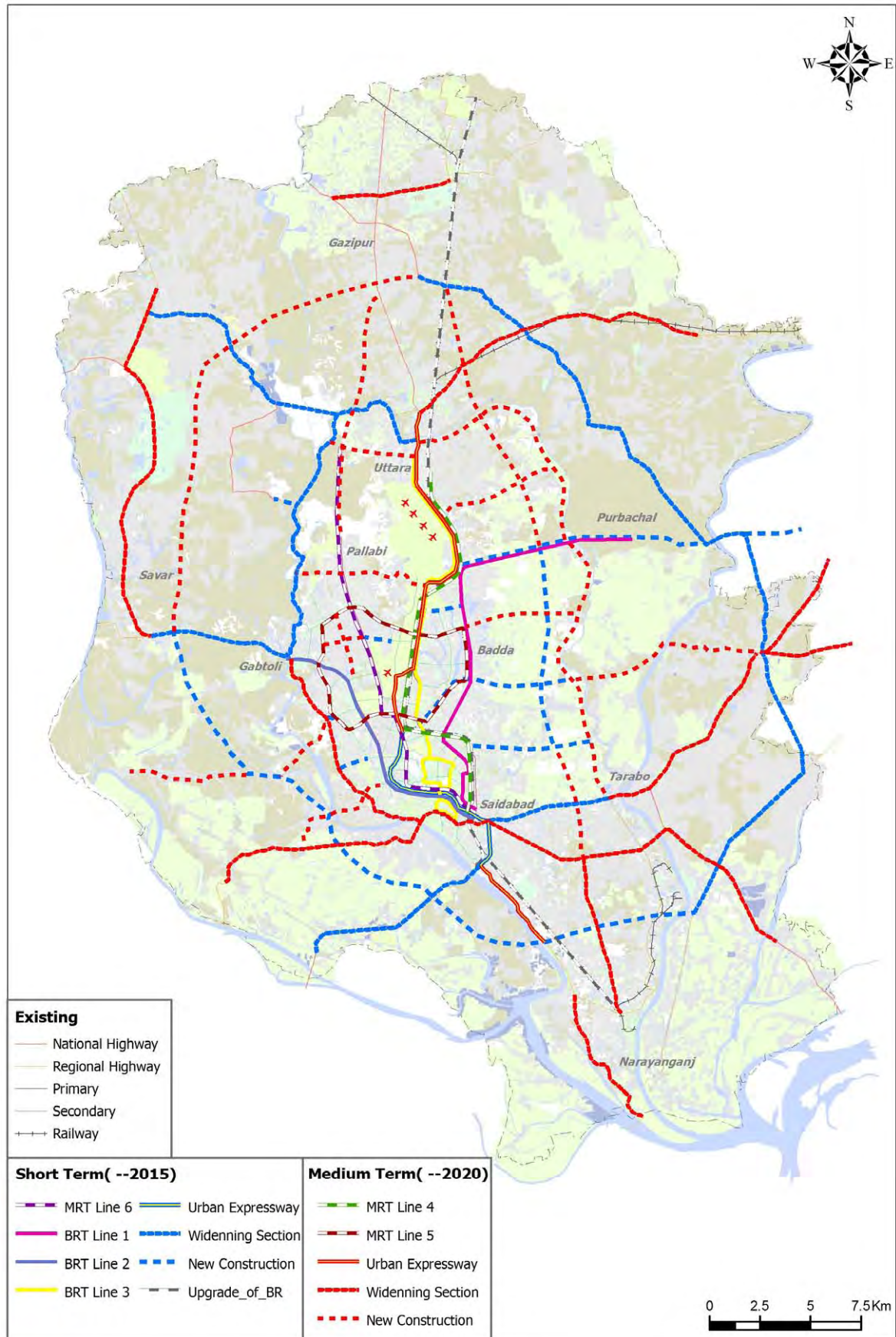


Figure 21.2-2 Future Transportation Network by Year 2020

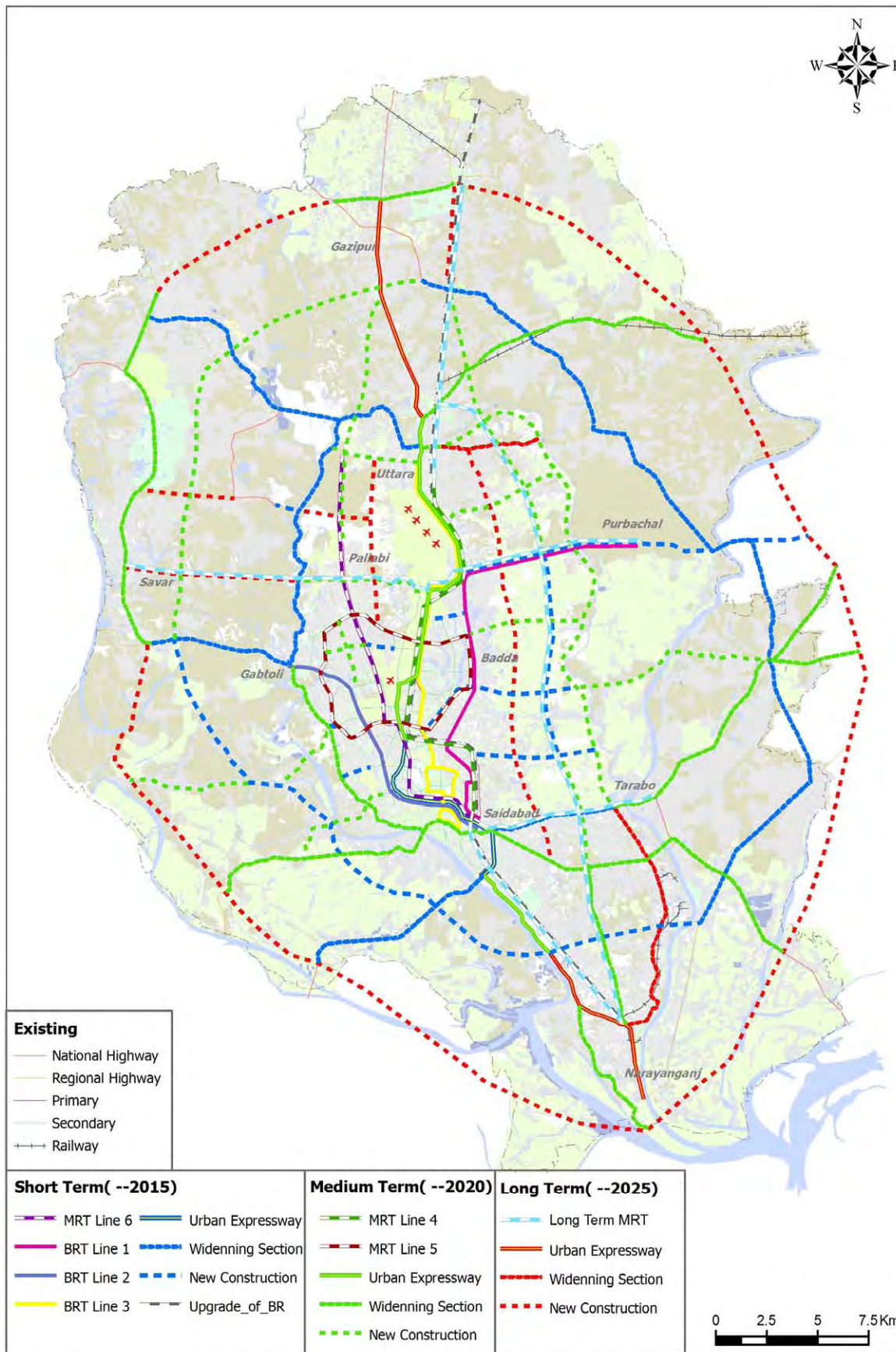


Figure 21.2-3 Future Transportation Network by Year 2025



## (3) Investment Allocation Plan

Based on the proposed implementation schedule, the required investment costs are estimated, as shown in Table 21.2-2. According to this table, the following findings can be made;

- a) The total investment costs are required for US\$ 4.8 billion by 2025. Among those costs, US\$ 1.6 billion is required for the project implementation in the short term, US\$ 1.5 billion is required in the medium term, and US\$ 1.7 billion is the long term.
- b) Against the required costs, local fund may be available for US\$ 1.7 million by 2025. The remaining balance of about US\$ 3.1 billion shall be procured from private sector and/or foreign assistance.
- c) It is assumed that the development of infrastructure in MRT system and BRT system are financed by foreign funding agencies. In addition, major arterial roads proposed by DHUTS, such as the east fringe road, middle ring road and outer ring road, are also expected to be financed by foreign funding agencies.

**Table 21.2-2 Investment Requirements and Available Funds**

*Unit: USD Million*

Item	Total	Short Term (2010-2015)	Medium Term (2016-2020)	Long Term (2021-205)
<b>Required Cost</b>				
1 Public Transport Development	2,482.0	980.0	760.7	741.3
2 Roads and Highways	1,596.0	417.1	475.5	703.4
3 Traffic Management	732.1	161.4	275.7	295.0
4 Environmental & Management	32.0	12.0	10.0	10.0
5 Institutional Improvement	15.0	9.0	6.0	-
<b>Total</b>	<b>4,857.1</b>	<b>1,579.5</b>	<b>1,527.9</b>	<b>1,749.7</b>
<b>Available Fund</b>				
1 Available Local Fund	0.0	0.0	0.0	0.0
2 Private Participation	1,193.0	388.0	375.3	429.8
3 Foreign Assistance	3,664.1	1,191.5	1,152.6	1,320.0
<b>Total</b>	<b>4,857.1</b>	<b>1,579.5</b>	<b>1,527.9</b>	<b>1,749.7</b>

*Source: JICA Study Team*

## (4) Selection of High Priority Projects

High priority projects are selected for the feasibility study to be conducted in the Phase 2 Study, in accordance with criteria and requirements mentioned below;

## 1) Criteria and Requirement for Selection of High priority Projects

The following criteria and requirement are chosen in the study;

## a) Project Urgency

High priority projects shall be in urgently implementation. These projects shall be included in the short term plan and be intended to directly solve the existing traffic problems. The scale and degree of such traffic problems are likely to be great with large effects and impact.

b) Project Maturity

One of important requirements of the high priority project shall be readiness for implementation. Projects included in the STP and Case Projects must be given high priority, while those involving the acquisition of large-scale right of way (ROW) and relocation of residents are given low priority because of difficulty in project preparation.

c) Project Impacts

Projects are preferred to have a large-scale effort and impact so that the actualization of the DHUTS plan will be accelerated.

d) Compatibility with Transport Policy

The high priority project shall be followed the government transport policy and strategies.

2) Recommendation of the High Priority Projects

Using above mentioned criteria, the candidate projects and programs are evaluated as shown in Table 21.2-4. Among the candidate projects, the following projects are selected as the high priority projects. The location of the project is shown in Figure 21.2-4.

1. Public Transport Projects

- MRT Line 6 Project
- BRT Line 3 Project

2. Road Projects

- Eastern fringe road project
- Southern section of middle ring road
- Flyover projects

3. Traffic Management

- Comprehensive traffic management project

4. Organizational development for DTCB(DMTA) and MRT Line 6 Operating company (DMTC)

**Table 21.2-3 (1) Proposed Major Transport Projects and Issues**

Sector	Name of Project	Outline of the Project	Issues
Public Transport System	MRT Line 6 Project	<ul style="list-style-type: none"> <li>This project is construction project of Mass Rapid Transit Railway System (MRT) line No 6 where starts from North of Dhaka to Saidabad. Total length of 22 km</li> <li>This project aims at a) solving chronic urban transport congestion, b) providing peoples mobility, c) providing high capacity and trunk public transport system</li> <li>This project is the highest priority among the proposed projects</li> </ul>	<ul style="list-style-type: none"> <li>How to procure finance to construct the project</li> <li>Organizational and institutional issues</li> <li>Capacity development of the DMTA &amp; DMTC</li> </ul>
	BRT Line 3 Project	<ul style="list-style-type: none"> <li>This project is introduction project of Bus Rapid Transit (BRT) System Line No. 3 from UTTRA to Old Dhaka via Ramna. Total Length is about 17 km</li> <li>This project aims at a) solving chronic urban transport congestion, b) providing people's mobility, c) providing high capacity and trunk public transport system.</li> <li>This project is also one of the highest projects among the transport projects.</li> <li>This project will be financed by World Bank.</li> </ul>	<ul style="list-style-type: none"> <li>Success of bus franchise system is presumption of the BRT Project</li> <li>How to treat traffic congestion along the corridor and at the intersections in old Dhaka and CBD area</li> </ul>
	Bus Improvement Project	<ul style="list-style-type: none"> <li>This project is to improve existing bus transport project.</li> <li>This project aims at a) re-structuring of the existing bus industries, b) improving operation system, c) building an integrated network, and d) providing proper information system</li> </ul>	<ul style="list-style-type: none"> <li>Cooperation with bus companies</li> </ul>
Road Network	Eastern Fringe Road Project	<ul style="list-style-type: none"> <li>This project is to construct the eastern fringe road in the eastern fringe area of Dhaka from Tongi to Narayangaji. Total length is about 23.1 km.</li> <li>The project aims at a) promotion of urban development along the eastern fringe area of Dhaka, b) providing bypass of Airport Road, and DIT road, and c) providing accessibilities to people of eastern fringe area.</li> <li>This project is one of the priority projects among the proposed projects</li> </ul>	<ul style="list-style-type: none"> <li>How to procure financial resource to construct the project</li> <li>Coordination with urban development</li> </ul>
	Middle Ring Road Project	<ul style="list-style-type: none"> <li>This project is to construct the middle ring road in RAJUK Area.</li> <li>This project aims at a) providing traffic disperse routes from inter-district traffic, especially Padma multi-purpose bridge, and b) promotion of urban development in RAJUK Area.</li> </ul>	<ul style="list-style-type: none"> <li>How to procure financial resources</li> <li>Feasibility study shall be made</li> </ul>
	Outer Ring Road Project	<ul style="list-style-type: none"> <li>This project is to construct the outer ring road in RAJUK Area.</li> <li>This project aims at a) providing traffic disperse routes from inter-district traffic, especially Padma multi-purpose bridge, and b) promotion of urban development in RAJUK Area.</li> </ul>	<ul style="list-style-type: none"> <li>How to procure financial resources</li> <li>Feasibility study shall be made</li> </ul>
	Urban Expressway Project	<ul style="list-style-type: none"> <li>This project is to construct the urban expressway in DMA Area</li> <li>This project aims at a) providing backbone of road network in DMA, and b) providing higher level of services for road traffic.</li> <li>This expressway is constructed as grade separated structure with on-and off-lump.</li> </ul>	<ul style="list-style-type: none"> <li>Project implementation method, PPP</li> <li>Detailed Planning Report (DPR) shall be made.</li> </ul>
	Grade Separation Project at Mogh Bazar Intersection	<ul style="list-style-type: none"> <li>This project is to grade separated intersections at major bottleneck intersections in DCC area.</li> <li>This project aims at a) providing smooth traffic at bottleneck intersections, and b) providing higher level of services for road traffic.</li> <li>The grade separation will be constructed as flyover structure or underground structure.</li> </ul>	<ul style="list-style-type: none"> <li>Traffic disturbance during construction period</li> </ul>
Traffic Management	Comprehensive Traffic Management	<ul style="list-style-type: none"> <li>This project aims at a) achieving smooth traffic flow, b) ensuring traffic safety for pedestrians.</li> <li>This project includes a) intersection improvement, b) u-turning point improvement, c) traffic signal improvement, d) road marking and signs and e) improvement of coordination between traffic related agencies</li> </ul>	<ul style="list-style-type: none"> <li>Coordination with DTCB, DCC and , DMP</li> </ul>
	Area Traffic Signal Control Project	<ul style="list-style-type: none"> <li>This project aims at achieving efficient and smooth traffic flow in the traffic congested areas by synchronization of traffic signals in the CBD area of DCC.</li> <li>This project includes a) improvement of local traffic signals, b) establishment of traffic control center, c) traffic surveillance system, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Feasibility study shall be made</li> <li>Coordination with DTCB, DCC and DMP</li> </ul>
	IIS System Project	<ul style="list-style-type: none"> <li>This project aims at providing traffic information to Dhaka peoples in order to achievement more smooth traffic flow and traffic safety.</li> <li>This project including a) dissemination system of traffic information, b) parking information, c) route guidance and navigation system, d) bus approach and information system</li> </ul>	<ul style="list-style-type: none"> <li>Feasibility study shall be made</li> <li>Coordination with DTCB, DCC and DMP</li> </ul>
Organizational & Institutional Development	Restructuring DTCB to DMTA Organization	<ul style="list-style-type: none"> <li>This project aims at establishment of appropriate organizational structure for supervising the MRT, BRT and other transport system</li> <li>This project includes formulation of organization structure, role of each organization, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Coordination with DTCB, MOC</li> <li>MRT construction and operation acts</li> </ul>
	Setting up DMTC Organization	<ul style="list-style-type: none"> <li>This project aims at establishment of appropriate organizational structure for implementation and operation of the MRT system</li> <li>This project includes formulation of organization structure, role of each organization, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Stage implementation program</li> <li>MRT construction and operation organization</li> </ul>

**Table 21.2-3 (2) Proposed Major Transport Projects and Issues**

Sector	Name of Project	Outline of the Project	Issues
Urban Development	Comprehensive Urban Development Study for Eastern Fringe Area	<ul style="list-style-type: none"> <li>This project aims at formulation of urban development plan for Eastern Fringe Area.</li> <li>Un-control urban development in the Eastern Fringe Area is now on-going. Without appropriate land use plan, it is expected to be un-controlled urban development.</li> </ul>	<ul style="list-style-type: none"> <li>Flood protection</li> <li>Location of retention pond</li> <li>Land fill regulation and environmental issue</li> </ul>
	UTTRA Phase 3 Development Plan	<ul style="list-style-type: none"> <li>MRT Line 6 will be extended at UTTRA Phase 3 area. However, urban planner has no experiences on transit oriented development (TOD).</li> <li>The objectives of the study are to a) formulate station plaza urban development plan, b) formulate feeder transport system plan, and c) to draw up transport related plan</li> </ul>	<ul style="list-style-type: none"> <li>Coordination with RAJUK and JICA Study</li> </ul>
	Saidabad Area Redevelopment Plan	<ul style="list-style-type: none"> <li>MRT Line 6 will be terminated at Saidabad area. However, a large scale bus terminal is located at the area. When MRT Line 6 is constructed, more urban and transport activities will concentrate in this area.</li> <li>The objective of the study is to formulate redevelopment plan of Saidabad Area, which include bus terminal plan, station plaza urban development plan, b) formulate feeder transport system plan, and c) to draw up transport related plan</li> </ul>	<ul style="list-style-type: none"> <li>Urban redevelopment methods</li> </ul>
	East-West corridor Development	<ul style="list-style-type: none"> <li>JICA Study Team proposed east –west Corridor development together with implementation of MRT East West Line which starts from Purbachal to Savar.</li> <li>This project aims at formulation of east – west corridor development plan together with MRT plan.</li> </ul>	<ul style="list-style-type: none"> <li>Application of Transfer Development Right (TDR) concept</li> <li>Institutional Aspect</li> </ul>

Table 21.2-4 Comparative Evaluation of High Priority Projects

Name of Project	Project Urgency	Project Maturity	Project Impact	Compatibility with Transport Policies	Overall Evaluation
MRT Line 6 Project	Very urgent because of chronic traffic congestion	Principally a few land acquisition is necessary	Very large impact and significant effects because of diverted car traffic to MRT	Compatible with Government transport policies	Very urgent and no special problems for implementation except financing
	○○	○	○○	○○	○○
BRT Line 3 Project	Very urgent because of chronic traffic congestion	Principally a few land acquisition is necessary	Bus franchise is necessary to implement the project	Compatible with Government transport policies	Very urgent but need to bus companies and no special problems for implementation except financing
	○○	○○	X	○○	○○
Bus Improvement Project	Urgent because of poor services of bus system	Demand of restructuring shall be made after MRT/BRT Projects	Bus companies may receive impacts	Compatible with Government transport policies	Necessary to improve after implementation of MRT/BRT System
	○	X	X	○	△
Eastern Fringe Road	Urgent because sprawl development is on-going	RAJUK has made a plan of Eastern Fringe Road	Very large impact on urban development	Compatible with government transport policies	Necessity for new road development
	○	○○	○○	○	○○
Middle Ring Road	Urgent because Padma bridge construction	RAJUK has made a plan	Much impact not only passenger traffic but also freight traffic	Compatible with government transport policies	Necessity for completion of middle ring road network
	○	○○	○	○	○
Outer Ring Road	Urgent because Padma bridge construction	RAJUK has no such plan	Much impact not only passenger traffic but also freight traffic	Compatible with government transport policies	Necessity for completion of outer ring road network in long term basis
	○	X	○	○	△
Urban Expressway	Very urgent because of chronic traffic congestion	Private companies have a plan	Very large impact and significant effects because of diverted to expressway	Not compatible with government transport policies	Necessity for completion of Urban Expressway. Implemented by PPP fund
	○○	○	○○	X	○
Missing links	Very urgent because of easing chronic traffic congestion	Demand to construct missing links	Very large impact and significant effects because of completion of network	Compatible with government transport policies	Necessity for completion of Missing Links. Implemented by local fund
	○○	○	○○	○	○
Flyover Project	Very urgent because of easing chronic traffic congestion	No major ROW acquisition	Very large impact and significant effects because of removal bottlenecks	Compatible with government transport policies	Very urgent and no special problems for implementation
	○○	○	○○	○○	○○
Comprehensive Traffic Management	Very urgent because of chronic traffic congestion	Principally no land acquisition is necessary	Very large impact and significant effects because of increasing capacity	Compatible with Government transport policies	Very urgent and no special problems for implementation
	○○	○	○○	○○	○○
ITS System Project	Urgent because of easing chronic traffic congestion	High technologies are not urgently necessary	Large impact and significant effects because of increasing capacity	Compatible with Government transport policies	Necessary after implement CTM scheme
	○	X	○	○	X
Organizational Development for MRT	Very urgent because of establishing MRT implementation organization	Demand of restructuring DTCTB to DMTA and DMTC	Very large impact and significant effects because of increasing capacity	Compatible with Government transport policies	Necessary to develop implementation organization for MRT/BRT System
	○○	○○	○○	○○	○○

Notes: ○○ very positive, ○ positive, X negative XX very negative○○



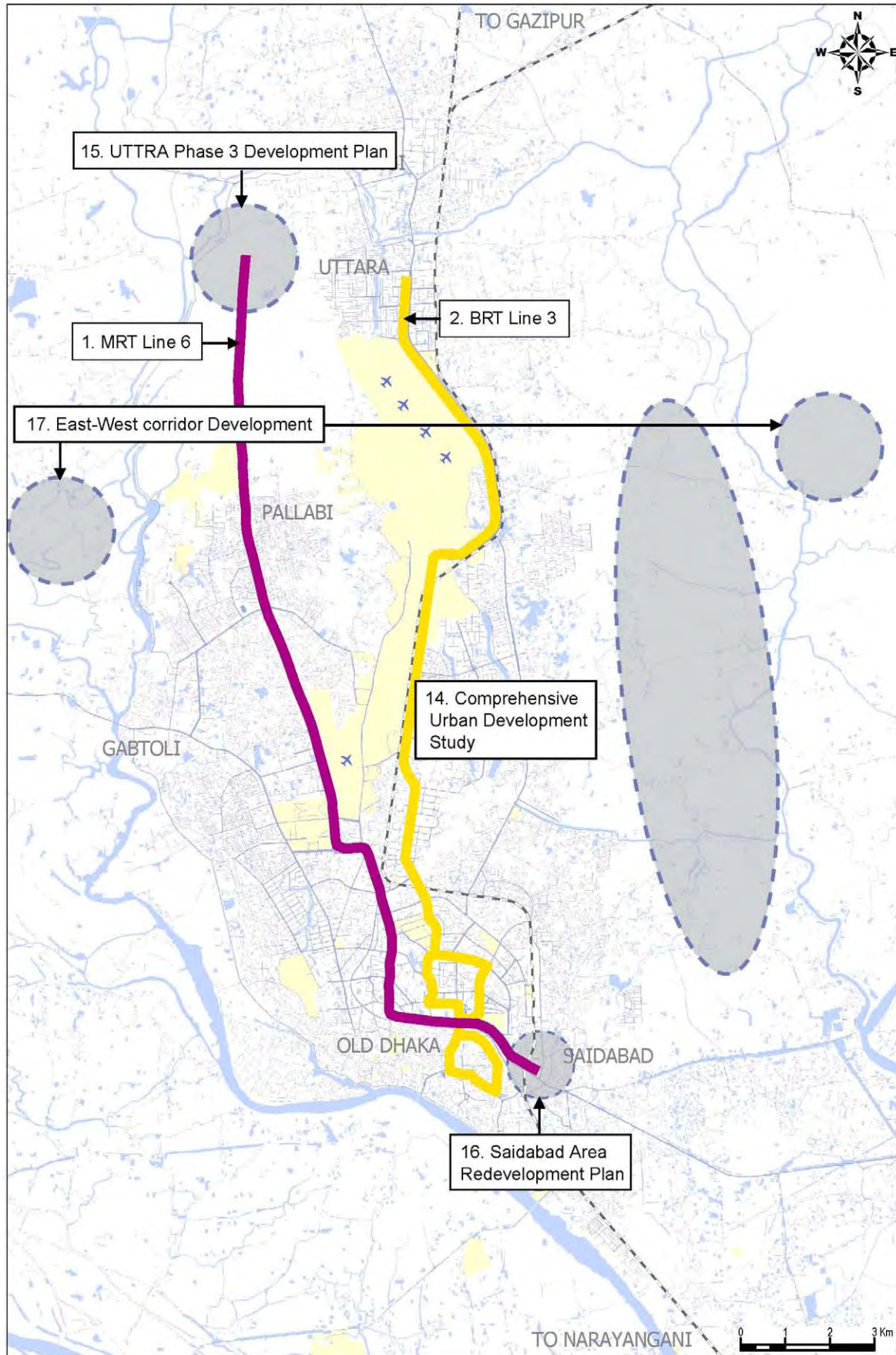


Figure 21.2-4 (1) Project Location Map

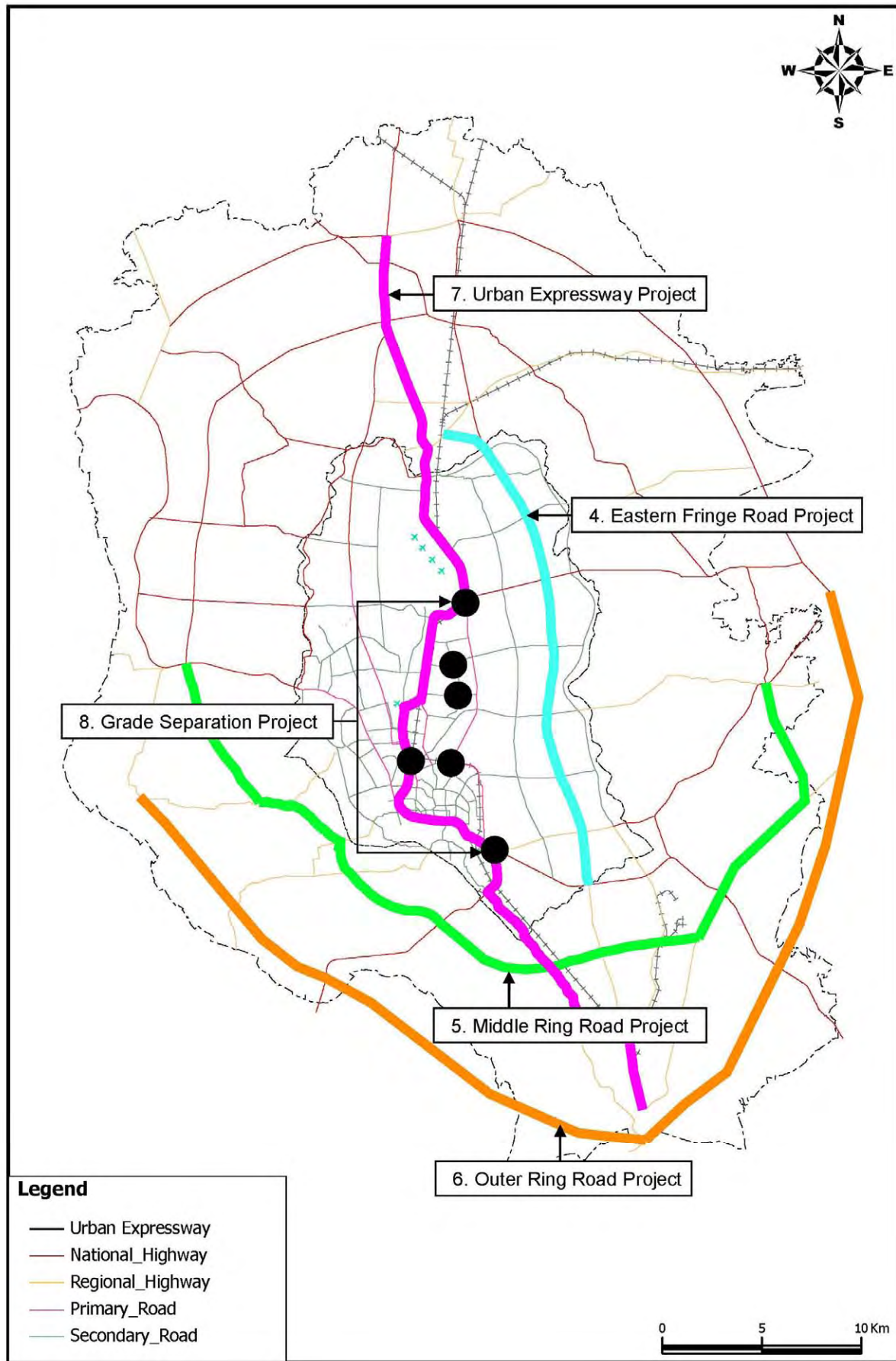


Figure 21.2-4 (2) Project Location Map

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## CHAPTER 22: BUILDING OF DATABASE SYSTEM

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### 22.1 General

GIS provides a means of integrating information/ data to understand issues and problems faces in Dhaka Metropolitan area today such as uncontrolled urbanization and traffic congestion. GIS shall help to organize data regarding these problems, and to understand their spatial relationships quantitatively and visually. These understandings shall lead to more sensitive and intelligent decision-making. However, there is no existing land use data/ information in RAJUK Administrative Area. It is therefore carried out GIS Study in this study.

The objective of the GIS Study is to prepare base map of DHUTS Study and the existing land use situation in RAJUK Area including DMA in order to discuss the future land use situation with transport system. The exiting land use condition was already presented in Chapter 2 and the future land use plan was formulated on the basis of the collected GIS data/ information.

The GIS data/ information will be transferred to DTCCB and BUET after completion of Phase 2 Study of DHUTS. The JICA Study Team is expected to renew the GIS/ Information to be transferred.

This chapter presents Database sector of DHUTS, including usage of GIS techniques in the DHUTS, result of data collection, concept of DHUTS database, and next step of GIS sector in Dhaka Metropolitan area for transport/ urban/ regional planning work.

### 22.2 Introduction of GIS

#### 22.2.1 Concept of GIS Techniques

There are a lot of definitions of GIS in these days;

- a) GIS is a computing system to support effective utilization of data, such as geographical operation which includes “search”, “spatial analysis” and “visualization of analysis results”, for various purposes with managing geographical data/information, statistical data, attribute data and other related data in unified coordination system.
- b) GIS is a kind of problem solving tool and allows users to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.
- c) GIS helps users answer questions and solve problems by looking at data in a way that is quickly understood and easily shared.”



Basic features of GIS are follows;

- a) Digitized Geospatial data
- b) Data Overlay
- c) Linkage to Tabular data (attribute data)
- d) Data share
- e) Easy to update data

Above basic features allow users to develop GIS data, overlay wide range of data layers and label or symbolize data using attributes from linked data tables. Multiple users can work with the same dataset independent of each other to browse and analyze data, or to create maps of nearly any size or level of quality. In addition, updates posted to a centralized GIS database can be immediately available to all users.

JICA Study Team utilizes this GIS technique as not only for mapping/ visualization tools, but also planning tools to identify existing conditions/ problems, and evaluate future plan for formulation of optimal Master Plan.

### 22.2.2 GIS basic data and GIS data

#### (1) GIS basic data

GIS basic data is fundamentals of GIS database, which normally includes administrative boundary, waterbody, transportation networks, coastal line and so forth. Typical contents of GIS basic data are as follows:

- a) Road
- b) Railway
- c) Water body such as lake, pond, river and sea
- d) Coastal line
- e) Vegetation
- f) Contour lines and spot heights
- g) Administrative boundary
- h) Name of administrative unit, etc.

GIS basic data is able to be defined as GIS structured digital topographic data or GIS formatted digital topographic data which would be commonly used for any kind of GIS data and commonly used for various purposes in various sectors.

It is significantly important to share these GIS basic data among all related agencies/ ministries to avoid duplication of work.

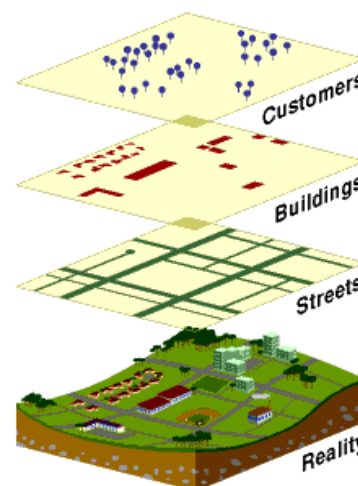


Figure 22.2-1

Image of GIS data and Real World

(2) GIS data

GIS data is not equal to GIS basic data, because GIS data is added additional data or information from other data sources to make data suitable for particular purpose by user. In other words, GIS data is value added GIS basic data to fit to user purpose. For example, road network data of GIS basic data might only have “coordination” and “length” as an attributes, however GIS data of road network often includes road length, road name, road type, speed limit and number of lanes according to user needs.

The difference of “GIS basic data” and “GIS data” is depicted in the figure bellow.

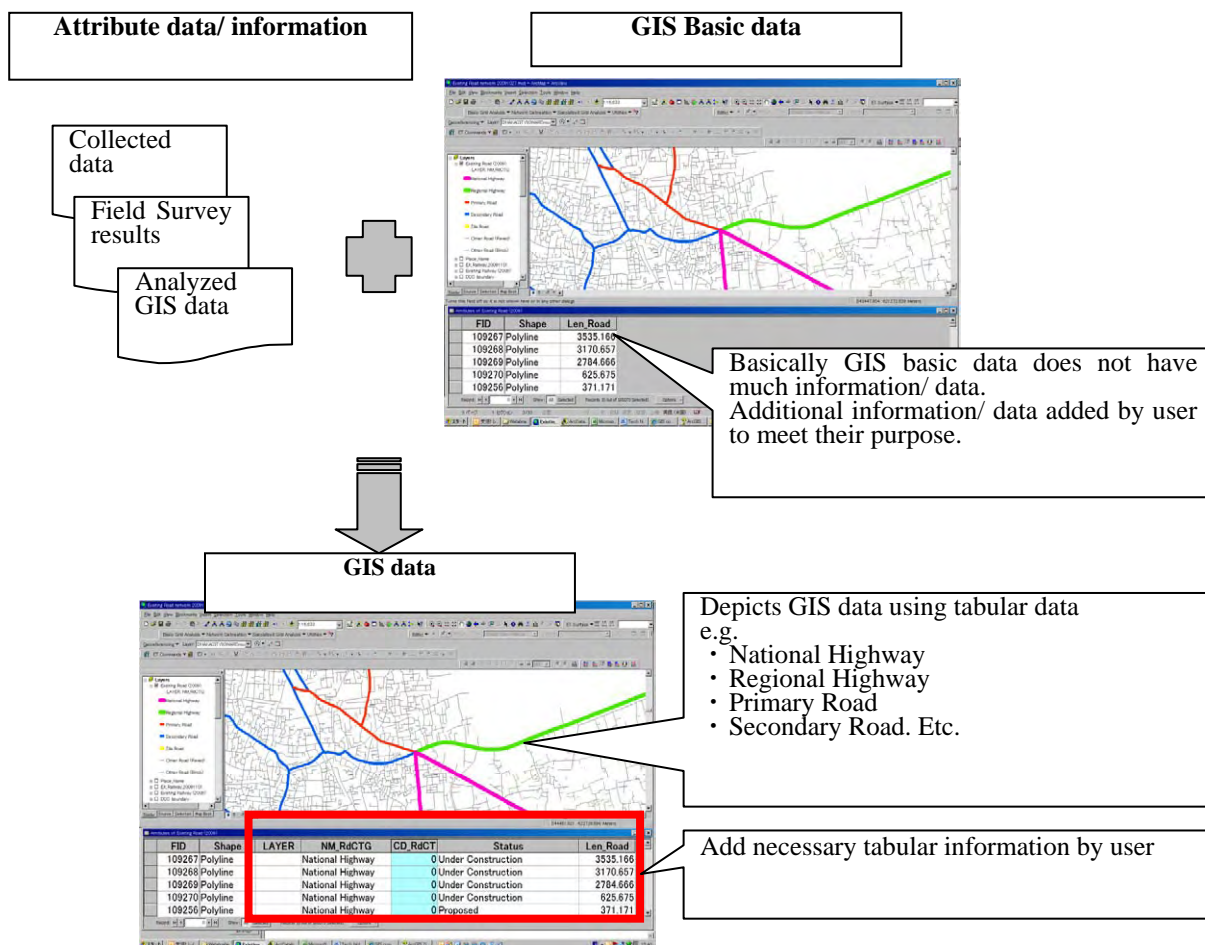


Figure 22.2-2 Example of Difference between GIS Basic Data and GIS Data

(3) Attribute data

There are many types of attribute data for GIS data. Some of them are from relevant agencies/ organizations, some of them through field survey and some of them might collect from internet with various formats, such as Microsoft Excel, statistical books, and print out maps. In case, data format is Microsoft Excel or Access, those data are relatively easy to integrate with GIS data. However, in case the collected data is in hard copy only, it is required to input/digitize to digital format to integrate with GIS data.

Thus, preparing GIS data is quite time consuming work. To reduce total time of preparation of GIS data, identification and collection of suitable data for the purpose is inevitable and important to meet ultimate purpose of development of GIS data. Otherwise, final products might be difficult to handle, such as huge data size because of lots of unnecessary attribute data.

### **22.3 Application of GIS in DHUTS**

A variety of data/information has been collected in DHUTS from relevant ministries, agencies and other data source. It is also collected from traffic surveys, including large scale person trip survey, conducted by DHUTS. These collected data were also compiled/ integrated in numerical or GIS format, for further analysis and future urban or transportation planning purpose.

In DHUTS, GIS shall be utilized not only as a database or mapping tool, but also as one of the planning tools. The primary objective of this GIS data development effort is for urban planning and transportation planning in DHUTS, at the same time it is expected to be used for further planning activities by the people concerned in the field of transportation planning, urban and regional planning.

#### **22.3.1 Objectives of GIS usage in DHUTS**

The objectives of GIS in DHUTS is to prepare base data for evaluation of present condition and planned future condition in Dhaka Metropolitan Area (DMA) to support formulation of master plan.

Followings are typical usage of GIS in DHUTS;

a) For tabulation

There are various kinds of data collected through DHUTS. Population data was collected by Thana-basis, the most of transport survey result was collected by traffic analysis zone (TAZ) basis, and landuse data was prepared in the DHUTS study area as a whole. Those collected and prepared data were analyzed through overlay analysis. In addition, some of those results were used for tabular information of other GIS data.

For example, service coverage population was calculated by GIS overlay operation between “future population by TAZ” and “proposed metro station”, and utilized for suitable metro station location.

b) For map preparation

A strong point of GIS technology is visualization of result of data analysis. In DHUTS study, GIS was used for preparing maps in transportation master plan by using analytical and map production function of GIS system.

c) For database development

Through DHUTS, many kinds of GIS data were prepared. Those data were integrated with DHUTS database. This database shall handover to Bangladesh side for future planning activities. The concept of DHUTS database is explained in the section 22.4.1.

d) For supporting tool of master plan

From another aspect of utilization of GIS in DHUTS, GIS was utilized as supporting tools for formulation of transportation master plan in each master plan phase. In the phase of “understanding existing condition”, GIS technology was utilized as analyzing and evaluation tools with collected and newly developed GIS data. In the next phase of “master planning”, it is utilized as simulation/ evaluation tools for the plan. Thus, GIS technology was utilized in various purposes in this Study.

In addition, this GIS technology also expects to utilize after this master plan study as monitoring tools of implementation of project and maintenance plan of infrastructures.

## 22.4 DHUTS Database and Data Collection

### 22.4.1 Concept of DHUTS Database

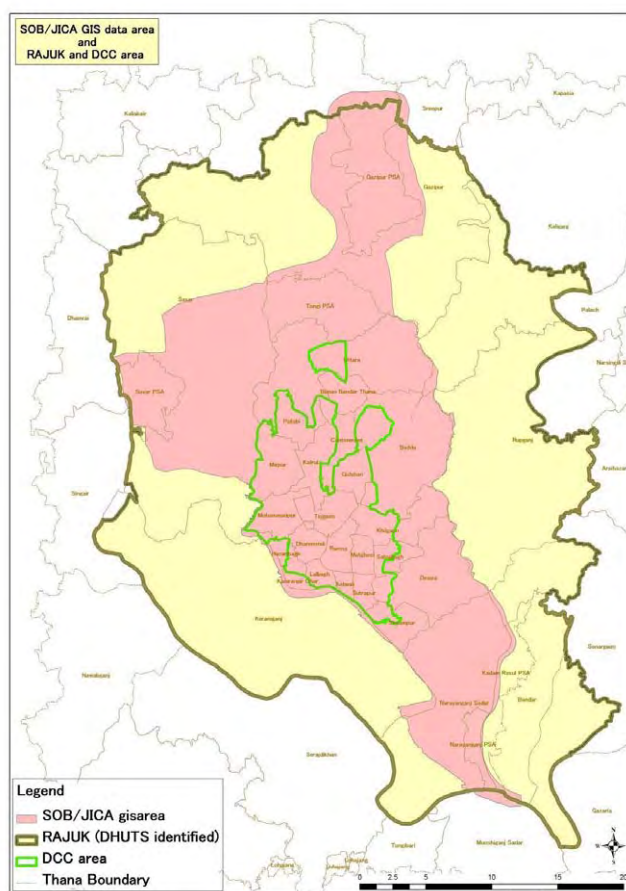
All of collected/ purchased data are compiled and integrated in user friendly manner and finalized as DHUTS database at the end of this Study. This DHUTS database expects to support future planning work in Dhaka Metropolitan area.

### 22.4.2 Summary of Collected/Purchased GIS data

Throughout of DHUTS study, the following GIS data were collected from relevant agencies and previous JICA project.

(1) SOB/JICA GIS data (GIS basic data)

This data was prepared in the Study on Urban Information Management for Greater Dhaka City (JICA, 2004), and this data is currently used as base data for Dhaka metropolitan area through SOB. This data was developed from aerial photo taken in



**Figure 22.4-1 SOB/JICA GIS Data Available Area and DHUTS Study Area (=RAJUK Area)**

year 2003 and compiled into 1:5,000 scale GIS basic data. Unfortunately data available area was much smaller than DHUTS study area as shown in Figure 22.4-1.

(2) Solid Waste Management (Clean Dhaka Master Plan) GIS data

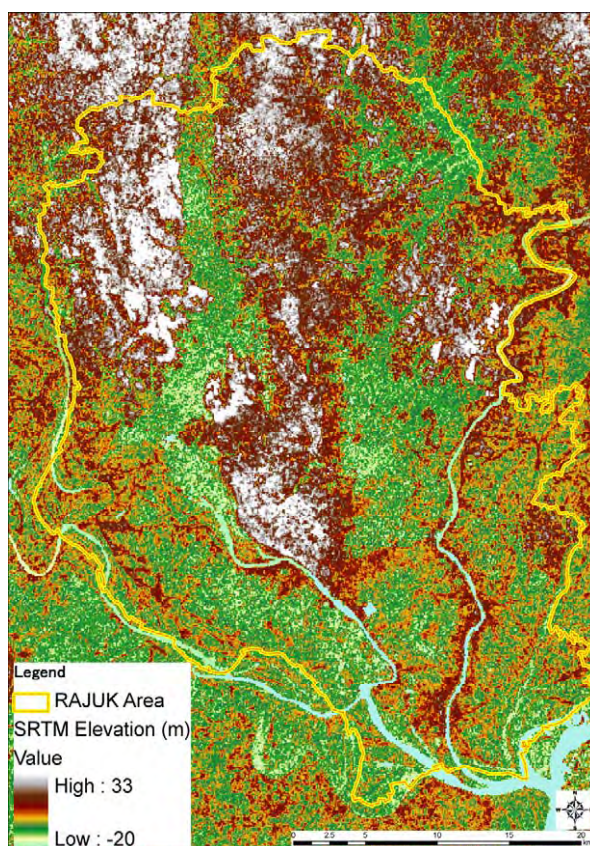
This data was prepared for “the Study on the solid waste management in Dhaka City (JICA, 2005)” and this study utilized the above “SOB/JICA data” as GIS basic data. Through additional field survey in the solid waste management study, various GIS data were prepared such as landuse, building height and poverty indicators. The data extent is exactly same as SOB/JICA GIS data, so that unfortunately does not cover entire study area of DHUTS.

(3) GIS data for Dhaka Division

This purchased data was prepared by private company in Bangladesh. Original data source is SOB, LGED and field survey by the company. Since this data covers all Dhaka division, the Study team decided to utilize this data as base data for outside of SOB/JICA data area.

(4) SRTM Digital Elevation Model

This data is well known for understanding elevation for almost the entire world except Polar Regions. This data provides land elevation information by almost 90m grid (3 arc second data) all over the world. This data also support us to understand land elevation outside of SOB/JICA data area.



**Figure 22.4-2 SRTM DEM Data**



**Table 22.4-1 Summary of Collected/ Purchased GIS Data by JICA Study Team**

	Data Name	Data extent and Scale	Data Year	Data Source	Note
1	SOB/ JICA Data (GIS basic data)	DMA area where identified in the “Study on Urban Information management for Greater Dhaka City” (581sqkm) Scale 1:5,000	2004	SOB and “The Study on Urban Information Management for Greater Dhaka City” (JICA, 2004)	All of output from this study is submitted to SOB as a GIS base data for Greater Dhaka area
2	JICA Solid Waste Management Project data	DMA area where identified in the “Study on Urban Information management for Greater Dhaka City” (581sqkm) Scale 1:10,000	2004	The study on the solid waste management in Dhaka City” (JICA, 2005)	This dataset includes various data to prepare thematic map, such as land use, land condition and social-economic data for solid waste management plan. Data is compiled into 122 map sheets.
3	GIS data for Dhaka Division	Dhaka Division	2008 (not confirmed)	Private GIS company “Geo Consults”. This company collects data from SOB and LGED. The company integrated/ updated GIS data using collected data. <sup>1</sup>	Purchased data by JICA Study Team
4	SRTM <sup>2</sup> Digital Elevation Model data	Dhaka and surrounding area		USGS <sup>3</sup>	Free download data from: <a href="http://srtm.csi.cgiar.org">http://srtm.csi.cgiar.org</a>

## (5) Newly develop/ update GIS data by JICA Study Team

The GIS data of SOB/JICA of year 2004 was prepared based on year 2003 aerial photo and field survey, and this data is highly reliable compared to other data. So, the Study team decided to utilize this data as a GIS basic data for this project, and other collected data was utilized as a supporting data.

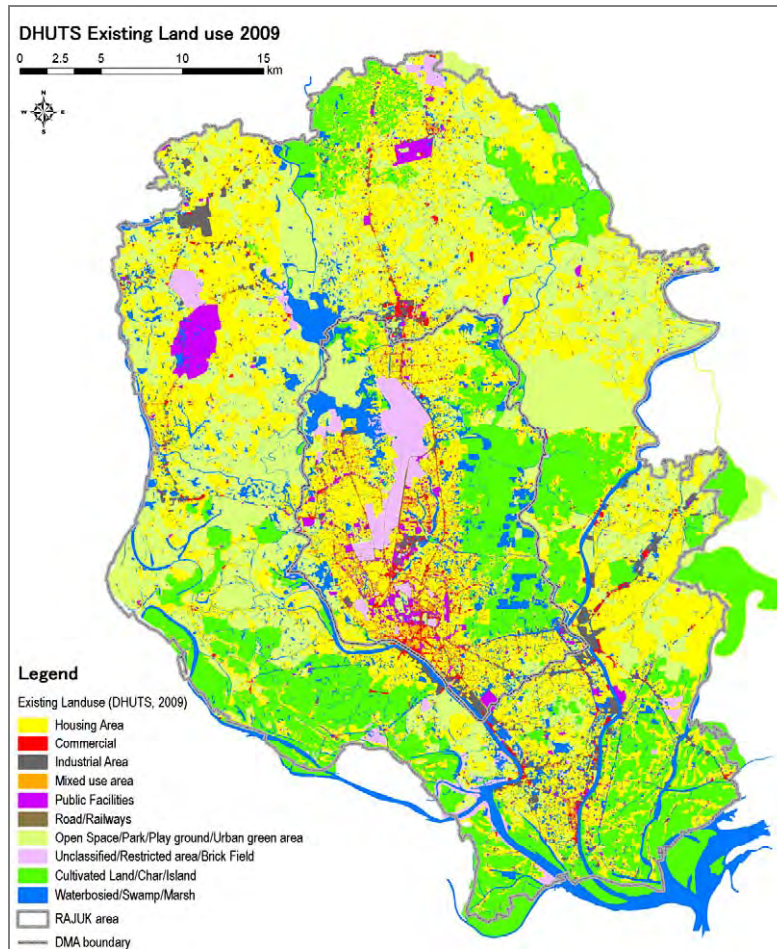
However, SOB/ JICA data does not cover entire area of study area, so that the Study team shall need to newly develop data for outside of SOB/JICA data area.

The Study team aimed to develop/ update GIS data as basis of efficient/ realistic transportation master plan. Especially understanding relationships between transportation and landuse is significant, so that study team highly focuses on updating/ developing current landuse data together with other data for further spatial analysis.

<sup>1</sup> Interview from Geo Consults, 10 May 2009

<sup>2</sup> SRTM: Shuttle Radar Topographic Mission, produced originally by NASA

<sup>3</sup> U.S. Geological Survey



**Figure 22.4-3 Existing Landuse 2009 Prepared by DHUTS**

(6) GIS data collected from relevant agencies

Survey of Bangladesh (SOB) is the national mapping agency and is now an inevitable data provider for various sectors, such as disaster management, natural resources managements, infrastructure development and urban/



**Figure 22.4-4 GIS Based RHD Road Network Map**

rural development planning. In addition, SOB provides data not only for public sector, but also for private sector under their regulations.

On the other hand, there are several other agencies which develop GIS data for their own purpose. For example, Local Government Engineering Department (LGED) develops settlement distribution, road network and various GIS data to support local government, and Road and Highway Department (RHD) develops road network data to implement/monitor their work and publish road network map on their website.

### 22.4.3 Composition of DHUTS Database System

DHUTS database system has compiled not only surveyed data but also statistical data and relevant data from related government ministries and agencies collected throughout DHUTS study. The database expects to utilize for urban transportation planning and urban planning. The overall structure of DHUTS database is indicated at Figure 22.4-5. The database is composed by GIS files containing graphic and attribute data, and tabular files in Excel spreadsheet format. Table 22.4-2 indicates a list of major data stored in DHUTS database. Refer to DHUTS Database Structure and GIS Metadata Dictionary in Appendix 16 for the complete composition and contents of data.

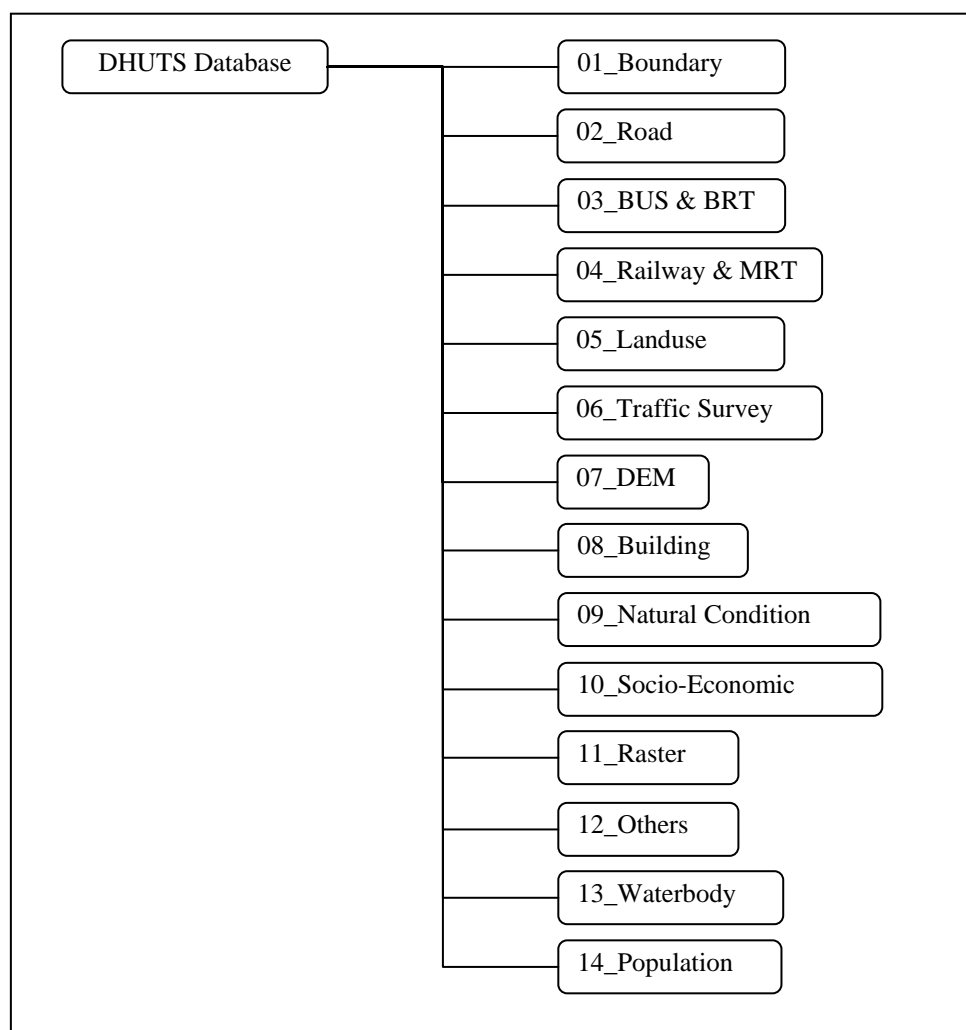


Figure 22.4-5 Structure of DHUTS Database



**Table 22.4-2 List of Major Data Stored in DHUTS Database**

Category	Feature	Data Source	Coverage Area
Boundary	Dhaka Division	Geo Consults	Dhaka Division
	RAJUK area	RAJUK DAP Database	RAJUK
	DMA	JICA Study Team (based on GeoConsults data)	DMA
	Thana and PSA	RAJUK DAP Database	RAJUK
	DCC area	DCC SWM Project	DCC
	DCC ward	JICA Study Team (based on DCC ward map)	DCC
Road	Existing Road Network in 2009	JICA Study Team (Road inventory survey result is linked to road network)	RAJUK
	Existing Truck Terminal	JICA Study Team	RAJUK
	DHUTS Proposed Road Network	JICA Study Team	RAJUK
Bus & BRT	Existing Bus Route & Bus Facility	JICA Study Team	DMA
	DHUTS Proposed BRT Route & BRT Facility	JICA Study Team	DMA
Railway & MRT	Existing Railway & Railway Facility	JICA Study Team	RAJUK
	DHUTS Proposed MRT Route & MRT Station	JICA Study Team	RAJUK
Waterbody	Waterbody	JICA Study Team	RAJUK
Landuse	Existing landuse in 2009	JICA Study Team	RAJUK
	Planned landuse	RAJUK	RAJUK
Traffic Survey	Intersection Location	JICA Study Team	DMA
	Cordon Location	JICA Study Team	DMA
	Screen Line	JICA Study Team	DMA
	Desire Line	JICA Study Team	DMA
	Traffic Analysis Zone A, B and C	JICA Study Team	RAJUK
DEM	SRTM DEM	CIAT	RAJUK
Building	Building	JICA SWM Project	SOB/JICA study area
Natural Condition	Natural Condition	JICA SWM Project	SOB/JICA study area
Socio-Economic Condition	Socio-Economic Condition	JICA SWM Project	SOB/JICA study area
Raster	DMDP Dhaka Urban Area Plan	DMDP	DMDP
	DMDP Structure Plan	DMDP	DMDP
Population	Population Projection by C zone	JICA Study Team	RAJUK

#### 22.4.4 Specifications of GIS Data

The specification of GIS data in DHUTS database is indicated in Table 22.4-3. JICA study team adopted ESRI shapefile (.shp), developed by ESRI<sup>4</sup>, for GIS data format, because the most of government agencies in Bangladesh is using ESRI's GIS software such as ArcGIS.

<sup>4</sup> Environmental Systems Research Institute, Inc

**Table 22.4-3 Specification of GIS Data**

Category	Specification of GIS data
Vector File Format	ESRI shapefile (.shp)
Raster File Format	JPEG file (.jpg) with world file, and ERDAS Imagine Image file (.img)
Metadata Format	ESRI ArcCatalog Format
GIS Map File Format	ESRI ArcMap GIS Project File (.mxd)
Projection System	Bangladesh Transverse Mercator (BTM)
Mapping Scale for Newly Developed Data	1:5,000

Source: JICA Study Team

In DHUTS database, Bangladesh Transverse Mercator (hereinafter referred to as BTM) is selected for the projection system of GIS data. The main reason for selecting BTM projection is that RAJUK is using BTM projection for GIS data in DAP database including proposed landuse and proposed road network. The comparison and analysis will be consistent with existing landuse and existing road network, which were built in DHUTS, by adopting the same projection system. The parameters of BTM projection system is indicated in Table 22.4-4.

**Table 22.4-4 Parameter of BTM Projection System**

Parameter	Value
Projection System	BTM
Spheroid	Everest 1830
Scale Factor	0.9996
Central Meridian	90 degree east
False Easting	500,000 meter
False Northing	-2,000,000 meter
Latitude of Origin	0 degree (Equator)

Source: RAJUK

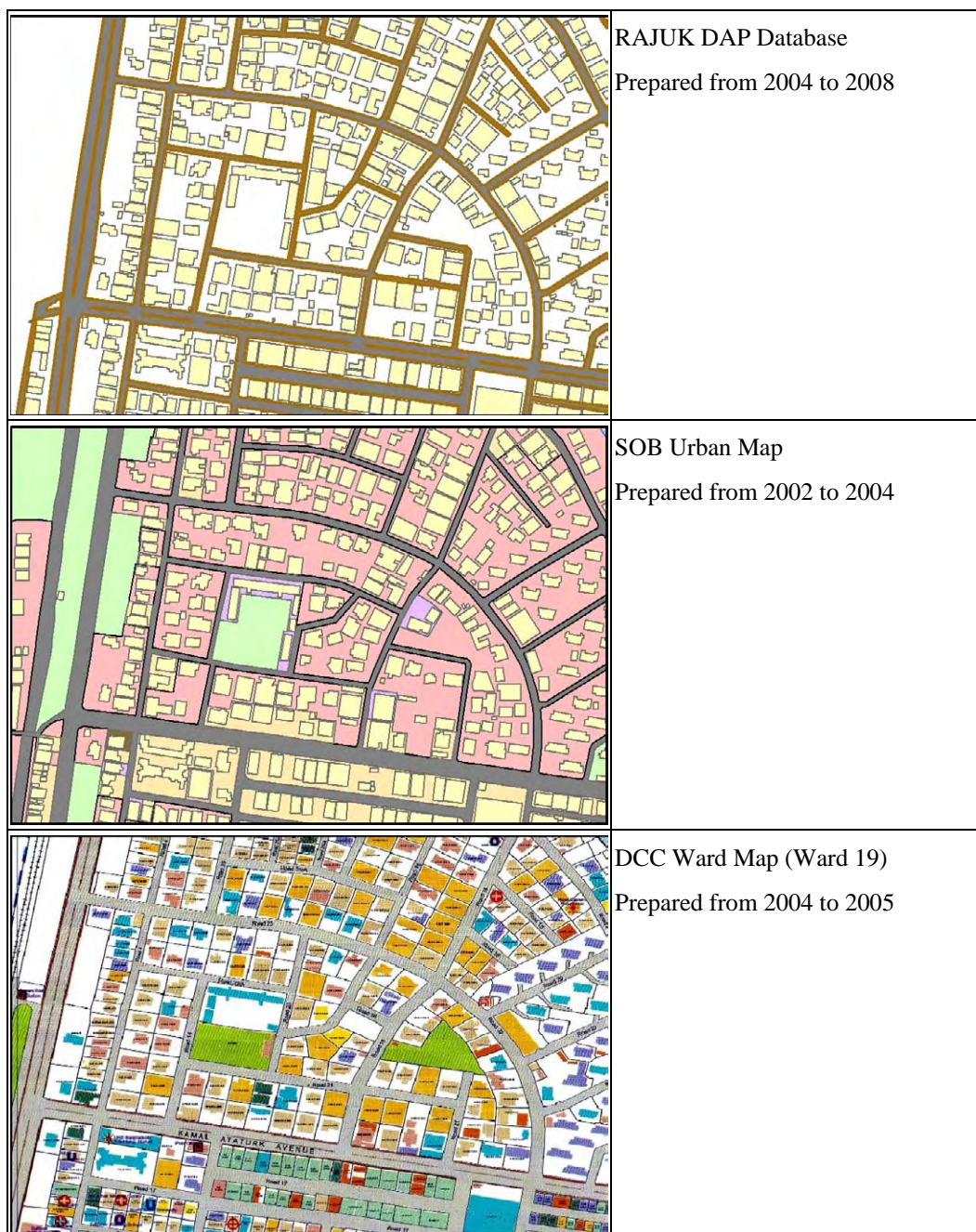
## 22.5 Problems of GIS Data in Transport and Urban Planning in Dhaka Metropolitan Area

### 22.5.1 Duplication of Investment for Constructing GIS Database in Different Agencies

In Bangladesh, the government agencies such as DCC, LGED, RAJUK, RHD and SOB have established their own GIS database, and the contents of GIS database are frequently duplicated. Generally, there is less coordination for sharing GIS database between different government agencies in Bangladesh. JICA study team noticed that only LGED and RHD are sharing their GIS database each other.

Figure 22.5-1 indicates the comparison of GIS base maps of central Dhaka in RAJUK DAP Database, SOB urban map and DCC ward map at Gulshan along Kamal Ataturk Avenue. These

GIS base maps were prepared in 2000's by different survey methods. RAJUK DAP database was prepared based on existing cadastral data, SOB urban map was prepared by aerial survey conducted in "The Study on Urban Information Management for Greater Dhaka City in the People's Republic of Bangladesh", and DCC ward maps were prepared by plane table and tape survey. Since the survey methods, mapping scales and projection system adopted for these GIS base map are different, these GIS base map do not overlap completely.



**Figure 22.5-1 Comparison of RAJUK DAP DB, SOB Urban Map and DCC Ward Map**

Table 22.5-1 indicates the duplication of GIS data within RAJUK area. The most of these GIS database have not updated from original version due to a lack of funds in each agency. In the most of government agencies, the budget for periodical update of GIS database is not allocated,

even though every agency has plan or willingness to update their database.

**Table 22.5-1 Duplication of GIS Data within RAJUK Area**

Category of GIS data	Agency	Title of database or map	Coverage area	Year of production
Base map or Existing Landuse	DCC	DCC ward map	ALL 90 DCC wards completed	From 1998 to 2009
	LGED	Municipality map	Gazipur, Narayanganji, Tongi and Savar municipality area	Completed in 2009
	RAJUK	DAP database	4 out of 16 groups & locations in RAJUK area completed	From 2004 to 2008
	SOB	Urban map	Greater Dhaka area	From 2002 to 2004
Road Network	RAJUK	DAP database	2 out of 16 groups & locations in RAJUK area completed	From 2004 to 2008
	RHD	RHD road network	Outside of DCC area	Initial road survey conducted from 2002 to 2004
	SOB	Urban map	Same as Base map	
Structure	DCC	DCC ward map	Same as Base map	
	RAJUK	DAP database	15 out of 16 groups & locations in RAJUK area completed	From 2004 to 2008
	SOB	Urban map	Same as Base map	

Source: JICA Study Team

## 22.5.2 Difference of Projection System of GIS data Adopted by Different Agencies

In Bangladesh, more than 75% of the government agencies are using BTM projection system for their map and GIS database, and the rest of the agencies are using LCC<sup>5</sup> as well as UTM<sup>6</sup> projection system (CEGIS, 2009). Table 22.5-2 indicates a list of projection system adopted by different government agencies closely related to DHUTS study.

**Table 22.5-2 List of Projection Systems Adopted by Different Agencies**

Agency	Title of GIS database or map	Adopted Projection System
DCC	Ward Map	BTM
DCC	SWM Map	BUTM <sup>7</sup>
LGED	Municipality Map	LCC
RAJUK	DAP Database	BTM
RHD	RHD Road Network	LCC
SOB	Urban Map	BUTM

Source: JICA Study Team

In case, each agency is using different projection system, there will be a problem when they conduct statistical analysis of landuse area or road length by using statistical data from different agencies, because land area and road length become different by the difference of projection system. Table 22.5-3 indicates the variation of area of Bangladesh and road length in different

<sup>5</sup> Lambert Conformal Conic

<sup>6</sup> Universal Transverse Mercator

<sup>7</sup> Bangladesh Universal Transverse Mercator

projection system.

If base maps or GIS data is acquired from other agencies, the variation of area and road length can be minimized by performing projection system conversion by using GIS software, however; if only statistical data is acquired, the analyst have to take into account the projection system of base map or GIS data for the statistical data. Otherwise, the statistical analysis will not be consistent.

**Table 22.5-3 Variation of Area and Road Length in Different Projection System**

Projection System	Area of Bangladesh (km <sup>2</sup> )	Road Length (km) of Teknaf - Tentulia
Lambert Conformal Conic (LCC)	139,798.00	954.78
Bangladesh Transverse Mercator (BTM)	139,813.28	955.22
Bangladesh Universal Transverse Mercator (BUTM Everest)	139,813.28	955.84
Universal Transverse Mercator (UTM Zone 46)	140,073.21	955.58
Bangladesh Universal Transverse Mercator (BUTM WGS84)	139,845.65	955.95

Source: CEGIS

### 22.5.3 Administrative Unit and Other Boundaries

As already mentioned in the report “the Study on the Solid Waste Management in Dhaka City (JICA, 2005)”, there are still problem regarding administrative boundaries in Dhaka Metropolitan Area (DMA) as follows;

- a) Administrative boundaries are not shared among relevant agencies
- b) Due to above reason, integrate with statistical data is significantly difficult and most of the case cannot integrate properly

To manage public services properly in the jurisdiction, to share unique administrative boundary among related agencies/ organizations is inevitable. DCC is preparing 90 ward maps by conducting field survey to map geographic feature at present. However without any coordination among related agencies, this data might indicate another boundary. To avoid this kind of problem, clear demarcation and coordination among related agencies/ organizations are inevitable.

### 22.5.4 Unmatched data among Agencies

Related to previous sections, other GIS data also has an integration problem because of a lack of coordination.

For example, Road network data is prepared by RHD and LGED. RHD is responsible for national road and regional road; on the other hand LGED is responsible for lower category road other than National road and regional road. LGED is responsible for only lower level road though, without national road and regional road it is impossible to understand road network in



their jurisdiction, so that LGED also prepare national road and regional road data by themselves. In the result of this lack of coordination, unmatched data problem occurs between RHD and LGED regarding national road and regional road at present.

### **22.5.5 Integration with statistical data**

There were many difficulties in integrating (table join) statistical data and GIS data such as census population data in charge of BBS and administrative unit data in charge of SOB. Without attribute data, GIS technologies can only be limitedly utilized for spatial analysis.

## **22.6 Recommendation**

Development of technology depends on recognition of its importance and acceptance by community. In the case of GIS or DMA urban transportation database, it is important to develop two-way communication – from bottom to top and from top to bottom. This two-way communication would help to recognize the importance of the content of database system that is to be provided at lower level of administration, since higher level of administration could provide feedback information derived from the consolidated information. This could be achieved through exchanging information periodically.

Continuous update of DHUTS database could help urban planning and transportation planning practices because updated information is of great importance for developing a realistic transportation system development plan.

### **22.6.1 Coordination with Bangladesh Bureau of Statistics (BBS)**

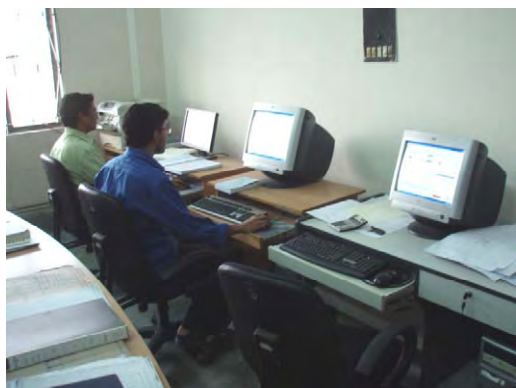
Coordination with Bangladesh Bureau of Statistics is significantly important to utilize GIS technology.

GIS data is consisted by map object, such as polygon, line and point, and attribute data. Basic attribute data for transport/ urban/ regional planning such as population, household data and other statistical data are prepared by BBS. However there are problem to integrate GIS data and those statistical data, because of a lack of coordination.

It is recommended that to establish unique administrative code system between BBS and SOB as a national standard. Integration of statistical data and GIS data is important for various sectors not only for transport planning sector, but also all public service sectors to plan, implement and monitor their activities efficiently.

### **22.6.2 Maintenance and Update of DHUTS Database after the Completion of Study**

Building of DHUTS database will be succeeded to and completed in the Feasibility Study, which is expected to be started after the completion of DHUTS study, and DHUTS database will be installed at Department of Civil Engineering in BUET.



Left Photo: DHUTS database will be installed to one of the computers in the office of counterpart consultancy team of former STP project located at Department of Civil Engineering in BUET.

The study team considers that the periodical updating of DHUTS database after the completion of this study would be indispensable for revising transport development plan by reflecting transport analysis based on the updated existing transport, landuse and socio-economic data.

The study team proposes to establish a database management unit in DTCB and conduct the periodical updating of DHUTS database, and BUET would supervise DTCB and upper ministry to establish methodology and procedure for updating DHUTS database, and allocating necessary budget for periodical updating of database.

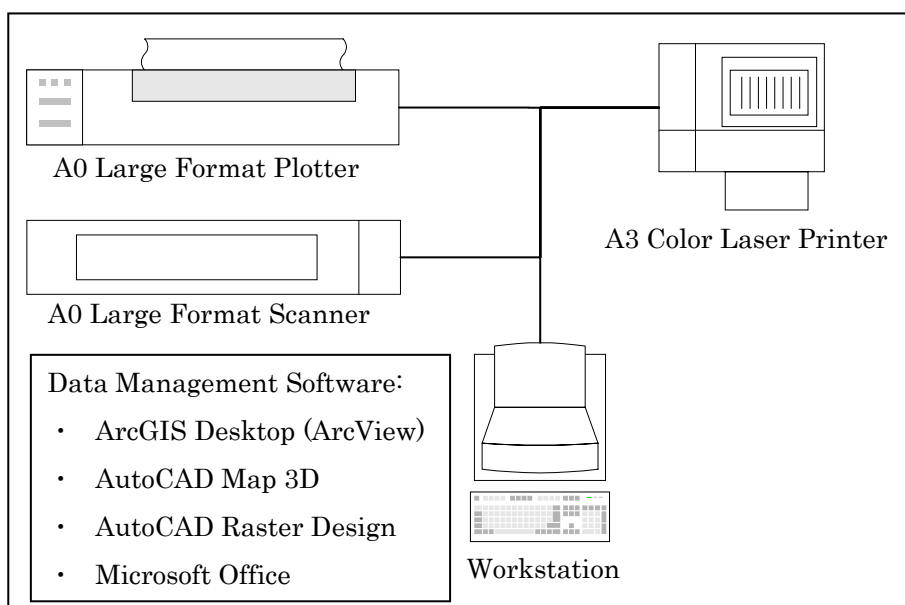
It is also proposed that DHUTS database should be shared by free of charge between transport planning and management related agencies in DMA such as DCC, LGED, RAJUK and RHD for effective and efficient implementation of their activities, and reducing over investment on the establishment of duplicated GIS data for Bangladesh government as a whole. In return for that, these agencies should provide updated existing and proposed road network, road facility and land use information periodically to DTCB for updating DHUTS database.

### **22.6.3 Required Inputs for Setting up Database Management Unit in DTCB and Possibility of Technical Assistances from JICA**

As mentioned in Section 22.6.2, the study team proposes to establish a database management unit in DTCB for the management and periodical updating of DHUTS database. For setting up Database Management Unit in DTCB, the hiring of database manager and procurement of hardware and software as listed in Table 22.6-1 are required. The database manager should have advanced skill of managing and editing of GIS database. The study team considers that there is a possibility that the technical transfer for the management and periodical updating of database to the database manager, and procurement of hardware and software could be made by the technical assistances from JICA.

**Table 22.6-1 Required Inputs and Estimated Costs for Setting up Database Management Unit in DTCB**

Input	Description	Unit Cost	Unit	Total
<i>Labor Costs</i>				
Database Manager	Technical manager of DHUTS database	\$48,000/year	1	\$48,000/year
<i>Procurement Costs of Hardware (costs in US \$)</i>				
Workstation	For database management	\$3,000	1	\$3,000
A3 Color Laser Printer	For printing out of maps and tables	\$2,000	1	\$2,000
A0 Large Format Plotter	For printing out of large format maps	\$10,000	1	\$10,000
A0 Large Format Scanner	For scanning of large format maps	\$10,000	1	\$10,000
Total Procurement Costs of Hardware				\$25,000
<i>Procurement Costs of Software (costs in US \$)</i>				
ArcGIS Desktop (ArcView)	For reference and editing of GIS data	\$4,500	1	\$4,500
AutoCAD Map 3D	For building and editing of vector data	\$7,700	1	\$7,700
AutoCAD Raster Design	For geometric correction of raster images such as scanned map image and satellite image	\$3,100	1	\$3,100
Microsoft Office Professional	For managing tabular data and reporting	\$500	1	\$500
Total Procurement Costs of Software				\$15,800
<b>Total Procurement Costs of Hardware and Software</b>				<b>\$40,800</b>



**Figure 22.6-1 Proposed Hardware and Software Configuration in Database Management Unit**