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 DTCB 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 indentified 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 DTCB (to be renamed to DMTA)—** establishment of a new organization outside the DTCB or a new organization within the DTCB.

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 DTCB’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 DTCB 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 DTCB. This change will lead DTCB 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 DTMA 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 DTCB)
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). DTMC is an independent organization in charge of MRT project implementation and operation.

**Major functional organizations for MRT**

1. Governmental Organization for Public Transport Policies, Plans and Project Formation
2. Governmental Regulatory Organization
3. MRT Operating Company
4. Private sector concessionaire/contractors

![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)
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 reasonability, 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.
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. DTMC, 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 DTMC.

(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 temporarily 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.

<table>
<thead>
<tr>
<th>Option A</th>
<th>DMTA (DTCB)</th>
<th>Operating Company (DMTC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delhi Metro</td>
<td>Infrastructure construction (Structure, Track)</td>
<td>Procurement of rolling stock</td>
</tr>
<tr>
<td>Bangkok MRT</td>
<td>Development of E&amp;M</td>
<td>Development of E&amp;M*</td>
</tr>
<tr>
<td>Manila LRT</td>
<td>Procurement of rolling stock</td>
<td>MRT operation</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>MRT operation and maintenance of infrastructure</td>
<td>Maintenance of E&amp;M</td>
</tr>
<tr>
<td>Infrastructure construction (Structure, Track)</td>
<td>Operating Company (DMTC)</td>
<td></td>
</tr>
<tr>
<td>Option B</td>
<td>Construction</td>
<td>(not execute the project)</td>
</tr>
<tr>
<td>Singapore MRT</td>
<td>Infrastructure construction (Structure, Track)</td>
<td>Procurement of rolling stock</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Development of E&amp;M</td>
<td>Development of E&amp;M*</td>
</tr>
<tr>
<td>Option C</td>
<td>Construction</td>
<td>MRT operation</td>
</tr>
<tr>
<td>Bangkok</td>
<td>Infrastructure construction (Structure, Track)</td>
<td>Maintenance of E&amp;M</td>
</tr>
<tr>
<td>SRT Airport Rail Link Jakarta MRT</td>
<td>Development of E&amp;M</td>
<td>Operating Company (DMTC)</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Procurement of rolling stock</td>
<td>(Assets to be transferred or leased to Operating Company.)</td>
</tr>
<tr>
<td>Infrastructure construction</td>
<td>Operating Company (DMTC)</td>
<td></td>
</tr>
<tr>
<td>(not execute the project)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*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 DTCB to DMTA. One of the major changes was that the chairperson of the DTCB 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, BRRTC 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 DTCB Act to the draft DMTA Act, 2009 are as follows:

a) The Board of the DTCB 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 DTCB 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.
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. Therefore, in this section, 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.
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).
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>
<thead>
<tr>
<th>Phase</th>
<th>Planning</th>
<th>Preparation of Construction</th>
<th>Construction/Commissioning</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Year</td>
<td>2011-2012</td>
<td>2013</td>
<td>2014-2018</td>
<td>2018</td>
</tr>
<tr>
<td>Source of Funds for Operation</td>
<td>National Budget</td>
<td>National Budget /Loan</td>
<td>National Budget /Loan</td>
<td>Operating Revenue /Subsidy</td>
</tr>
</tbody>
</table>
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.
(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>
<thead>
<tr>
<th>Year</th>
<th>GDP (Million BDT)</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-2015</td>
<td>GDP (Million BDT)</td>
<td>6,490,160</td>
<td>8,603,554</td>
<td>11,513,496</td>
<td>15,407,655</td>
</tr>
</tbody>
</table>

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.
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

<table>
<thead>
<tr>
<th></th>
<th>2001/02</th>
<th>2002/03</th>
<th>2003/04</th>
<th>2004/05</th>
<th>2005/06</th>
<th>2006/07</th>
<th>2007/08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Expenditure</td>
<td>140,902</td>
<td>154,348</td>
<td>168,175</td>
<td>177,250</td>
<td>194,720</td>
<td>179,380</td>
<td>185,069</td>
</tr>
<tr>
<td>Domestic Resources</td>
<td>82,990</td>
<td>73,590</td>
<td>96,900</td>
<td>152,110</td>
<td>160,200</td>
<td>174,300</td>
<td>167,100</td>
</tr>
<tr>
<td>Foreign Assistance</td>
<td>67,912</td>
<td>60,998</td>
<td>77,260</td>
<td>115,100</td>
<td>124,500</td>
<td>115,080</td>
<td>117,969</td>
</tr>
<tr>
<td>Project Assistance</td>
<td>71,200</td>
<td>72,140</td>
<td>74,150</td>
<td>66,000</td>
<td>74,750</td>
<td>85,300</td>
<td>94,500</td>
</tr>
<tr>
<td>Non-Project Assistance</td>
<td>11,540</td>
<td>8,750</td>
<td>23,150</td>
<td>25,570</td>
<td>36,170</td>
<td>52,700</td>
<td>72,300</td>
</tr>
<tr>
<td>Others</td>
<td>5,870</td>
<td>1,510</td>
<td>8,470</td>
<td>8,940</td>
<td>4,400</td>
<td>3,950</td>
<td>6,380</td>
</tr>
<tr>
<td>Total Resources</td>
<td>151,370</td>
<td>155,600</td>
<td>206,740</td>
<td>269,500</td>
<td>289,500</td>
<td>268,570</td>
<td>257,420</td>
</tr>
<tr>
<td>Balance</td>
<td>-15,085</td>
<td>-1,941</td>
<td>-38,500</td>
<td>-90,200</td>
<td>-102,600</td>
<td>-107,000</td>
<td>-158,140</td>
</tr>
</tbody>
</table>

Source: Statistic Yearbook 2008

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

<table>
<thead>
<tr>
<th></th>
<th>2001/02</th>
<th>2002/03</th>
<th>2003/04</th>
<th>2004/05</th>
<th>2005/06</th>
<th>2006/07</th>
<th>2007/08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Development</td>
<td>28</td>
<td>29.1</td>
<td>30.3</td>
<td>30.3</td>
<td>32</td>
<td>29.5</td>
<td>30.4</td>
</tr>
<tr>
<td>Development Expenditure</td>
<td>140.9</td>
<td>154.9</td>
<td>169.2</td>
<td>187.3</td>
<td>194.7</td>
<td>179.3</td>
<td>165.1</td>
</tr>
<tr>
<td>% Share to Development Expenditure</td>
<td>18.5%</td>
<td>18.9%</td>
<td>18.0%</td>
<td>16.4%</td>
<td>16.4%</td>
<td>16.5%</td>
<td>16.4%</td>
</tr>
</tbody>
</table>

Source: Statistical Yearbook
(4) Transport Development Allocated to DMA

There are no data available regarding 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\(^1\). 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](image)

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

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

*Source: JICA Study Team*

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\(^1\) ‘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 perquisite 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

<table>
<thead>
<tr>
<th>Proposed Project/Program</th>
<th>Implementation Organization</th>
<th>Unit</th>
<th>QTY</th>
<th>Cost (Million USD)</th>
<th>Short Term (2010-'15)</th>
<th>Medium Term (2016-20)</th>
<th>Long Term (2021-'25)</th>
<th>Beyond 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Public Transport Project</td>
<td>MRT Projects</td>
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<td>1-2 BRT Projects</td>
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<td>1-3 Bus Transport Improvement</td>
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<td>1-4 Para Transport Improvement</td>
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<td>2 Roads and Highways</td>
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<td>2-1 Urban Expressway</td>
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<td>2-2 Roads and Highways</td>
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<td>2-3 Missing Links</td>
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<td>2-4 Circumferential Roads</td>
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<td>2-5 Radial Roads</td>
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<td>2-6 Grade Separation</td>
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<td>3 Traffic Management</td>
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<td>3-1 Short Term Actions</td>
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<td>3-1-1 Intersection Improvement</td>
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<td>3-1-2 Parking System</td>
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<td>3-1-3 Traffic Signal System</td>
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<td>3-1-4 Traffic Safety Facility</td>
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<td>3-1-5 Traffic Safety Campaign</td>
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<td>3-2 Medium &amp; Long Term Improvement</td>
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<td>3-2-1 ITS System</td>
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<td>3-3 Traffic Demand Mangement</td>
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<tr>
<td>3-3-1 Short Term TDM</td>
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<tr>
<td>3-2-2 Medium Term TDM</td>
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<tr>
<td>4 Environmental &amp; Management</td>
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<tr>
<td>4-1 Monitoring of the Projects</td>
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<td>4-2 Environmental Monitoring</td>
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<tr>
<td>5 Institutional &amp; Organization</td>
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<tr>
<td>5-1 Establishment of DTCB(DMTA)</td>
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<tr>
<td>5-2 Establishment of DMT</td>
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<tr>
<td>5-3 Capacity Development of DMT</td>
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</tr>
</tbody>
</table>

| Total Cost | 4,857.0 | 1,579.5 | 1,527.9 | 1,749.7 | 4,831.0 |
| Cost per Year | 303.0 | 263.3 | 305.6 | 348.9 |

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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Required Cost</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Public Transport Development</td>
<td>2,482.0</td>
<td>980.0</td>
<td>760.7</td>
<td>741.3</td>
</tr>
<tr>
<td>2 Roads and Highways</td>
<td>1,596.0</td>
<td>417.1</td>
<td>475.5</td>
<td>703.4</td>
</tr>
<tr>
<td>3 Traffic Management</td>
<td>732.1</td>
<td>161.4</td>
<td>275.7</td>
<td>295.0</td>
</tr>
<tr>
<td>4 Environmental &amp; Management</td>
<td>32.0</td>
<td>12.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>5 Institutional Improvement</td>
<td>15.0</td>
<td>9.0</td>
<td>6.0</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4,857.1</td>
<td>1,579.5</td>
<td>1,527.9</td>
<td>1,749.7</td>
</tr>
<tr>
<td><strong>Available Fund</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Available Local Fund</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2 Private Participation</td>
<td>1,193.0</td>
<td>388.0</td>
<td>375.3</td>
<td>429.8</td>
</tr>
<tr>
<td>3 Foreign Assistance</td>
<td>3,664.1</td>
<td>1,191.5</td>
<td>1,152.6</td>
<td>1,320.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4,857.1</td>
<td>1,579.5</td>
<td>1,527.9</td>
<td>1,749.7</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Sector</th>
<th>Name of Project</th>
<th>Outline of the Project</th>
<th>Issues</th>
</tr>
</thead>
</table>
| Public Transport System    | MRT Line 6 Project              | • 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.  
• This project aims at a) solving chronic urban transport congestion, b) providing peoples mobility, c) providing high capacity and sunk public transport system  
• This project is the highest priority among the proposed projects  
• This project is also one of the highest projects among the transport projects.  
• This project will be financed by World Bank.                                                                 | • How to procure finance to construct the project  
• Organizational and institutional issues  
• Capacity development of the DMTA & DMTC  
• Success of bus franchise system is presumption of the BRT Project  
• How to treat traffic congestion along the corridor and at the intersections in old Dhaka and CBD area                                                                 |
|                            | BRT Line 3 Project              | • 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.  
• This project aims at a) solving chronic urban transport congestion, b) providing peoples mobility, c) providing high capacity and sunk public transport system  
• This project is also one of the highest projects among the transport projects.  
• This project will be financed by World Bank.                                                                 |                                                                                                               |
|                            | Bus Improvement Project         | • This project is to improve existing bus transport project.  
• 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  
• This project is one of the priority projects among the proposed projects.                                                                                      | • Cooperation with bus companies                                                                                |
| Road Network               | Eastern Fringe Road Project     | • This project is to construct the eastern fringe road in the eastern fringe area of Dhaka from Inner to Naryangonj. total length is about 23.3 km.  
• 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.  
• This project is one of the priority projects among the proposed projects.                                                                                   | • How to procure financial resource to construct the project  
• Coordination with urban development                                                                                  |
|                            | Middle Ring Road Project        | • This project is to construct the middle ring road in RAJUK Area.  
• This project aims at a) providing traffic dispense routes from inter-district traffic, especially Padma multi-purpose bridge, and b) promotion of urban development in RAJUK Area.  
• This project is one of the priority projects among the proposed projects.                                                                                   | • How to procure financial resources  
• Feasibility study shall be made.                                                                                                                                         |
|                            | Outer Ring Road Project         | • This project is to construct the outer ring road in RAJUK Area.  
• This project aims at providing traffic dispense routes from inter-district traffic, especially Padma multi-purpose bridge, and b) promotion of urban development in RAJUK Area.  
• This project is one of the priority projects among the proposed projects.                                                                                   | • How to procure financial resources  
• Feasibility study shall be made.                                                                                                                                         |
|                            | Urban Expressway Project         | • This project is to construct the urban expressway in DMA Area.  
• This project aims at a) providing backbone of road network in DMA, and b) providing higher level of services for road traffic.  
• This expressway is constructed as grade separated structure with on-and off-lamp.  
• This project is one of the priority projects among the proposed projects.                                                                                   | • Project implementation method, PPP  
• Detailed Planning Report (DPR) shall be made.                                                                                                                             |
|                            | Grade Separation Project at Mogh Bazar Intersection | • This project is to grade separated intersections at major bottleneck intersections in DCC area.  
• This project aims at a) providing smooth traffic at bottleneck intersections, and b) providing higher level of services for road traffic.  
• The grade separation will be constructed as flyover structure or underground structure.  
• This project is one of the priority projects among the proposed projects.                                                                                   | • Traffic disturbance during construction period  
• Coordination with DTCB, DCC and DMP                                                                                                                                             |
| Traffic Management         | Comprehensive Traffic Management | • 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.  
• This project aims at 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  
• This project is one of the priority projects among the proposed projects.                                                                                       | • Feasibility study shall be made  
• Coordination with DTCB, DCC and DMP                                                                                                                                             |
|                            | Area Traffic Signal Control Project | • This project aims at providing traffic information to Dhaka peoples in order to achieve more smooth traffic flow and traffic safety.  
• This project including a) dissemination system of traffic information, b) parking information, c) route guidance and navigation system, d) bus approach and information system  
• This project is one of the priority projects among the proposed projects.                                                                                       | • Feasibility study shall be made  
• Coordination with DTCB, DCC and DMP                                                                                                                                             |
|                            | ITS System Project              |                                                                                                   |                                                                                                               |
| Organization & Institutional Development | Reconstituting DTCB to DMTA Organization | • This project aims at establishment of appropriate organizational structure for supervising the MRT, BRT and other transport system  
• This project includes formulation of organization structure, role of each organization, etc.                                                                 | • Coordination with UTCB, MOIC.  
• MRT construction and operation acts                                                                                                                                          |
|                            | Setting up DMTA Organization   | • This project aims at establishment of appropriate organizational structure for implementation and operation of the MRT system  
• This project includes formulation of organization structure, role of each organization, etc.                                                                 | • Stage implementation program  
• MRT construction and operation organization                                                                                                                                          |
### Table 21.2-3 (2) Proposed Major Transport Projects and Issues

<table>
<thead>
<tr>
<th>Sector</th>
<th>Name of Project</th>
<th>Outline of the Project</th>
<th>Issues</th>
</tr>
</thead>
</table>
| Urban Development        | Comprehensive Urban Development Study for Eastern Fringe Area                   | • This project aims at formulation of urban development plan for Eastern Fringe Area.  
• Un-controlled 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. | • Flood protection  
• Laxation of construction control  
• Land fill regulation and environmental issue                                                                                                                          |
|                          | UTTRA Phase 3 Development Plan                                                  | • MRT Line 6 will be extended at UTTRA Phase 3 area. However, urban planner has no experiences on transit oriented development (TOD).  
• The objective of the study are to a) formulate station plan urban development plan, b) formulate feeder transport system plan, and c) to draw up transport related plan | • Coordination with RAJUK and JICA Study                                                                   |
|                          | Saitabadd Area Redevelopment Plan                                               | • MRT Line 6 will be terminated at Saitabadd 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.  
• The objective of the study is to formulate redevelopment plan of Saitabadd Area, which include bus terminal plan, station plan urban development plan, b) formulate feeder transport system plan, and c) to draw up transport related plan | • Urban redevelopment methods                                                                             |
|                          | East-West corridor Development                                                   | • JICA Study Team proposed east–west Corridor development together with implementation of MRT East West Line which starts from Purbachal to Savar.  
• This project aims at formulation of east–west corridor development plan together with MRT plan.        | • Application of Transfer Development Right (TDR) concept  
• Institutional Aspect                                                                                                                      |
### Table 21.2-4 Comparative Evaluation of High Priority Projects

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

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
CHAPTER 22: BUILDING OF DATABASE SYSTEM

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 DTCB 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.
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 “coordinating” and “length” as 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 below.

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

<table>
<thead>
<tr>
<th>Data Name</th>
<th>Data extent and Scale</th>
<th>Data Year</th>
<th>Data Source</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 SOB/ JICA Data (GIS basic data)</td>
<td>DMA area where identified in the “Study on Urban Information management for Greater Dhaka City” (581sqkm) Scale 1:5,000</td>
<td>2004</td>
<td>SOB and “The Study on Urban Information Management for Greater Dhaka City” (JICA, 2004)</td>
<td>All of output from this study is submitted to SOB as a GIS base data for Greater Dhaka area</td>
</tr>
<tr>
<td>2 JICA Solid Waste Management Project data</td>
<td>DMA area where identified in the “Study on Urban Information management for Greater Dhaka City” (581sqkm) Scale 1:10,000</td>
<td>2004</td>
<td>The study on the solid waste management in Dhaka City” (JICA, 2005)</td>
<td>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.</td>
</tr>
<tr>
<td>3 GIS data for Dhaka Division</td>
<td>Dhaka Division</td>
<td>2008 (not confirmed)</td>
<td>Private GIS company “Geo Consults”. This company collects data from SOB and LGED. The company integrated/ updated GIS data using collected data.</td>
<td>Purchased data by JICA Study Team</td>
</tr>
<tr>
<td>4 SRTM Digital Elevation Model data</td>
<td>Dhaka and surrounding area</td>
<td>USGS³</td>
<td>Free download data from: <a href="http://srtm.csi.cgiar.org">http://srtm.csi.cgiar.org</a></td>
<td></td>
</tr>
</tbody>
</table>

(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.

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1 Interview from Geo Consults, 10 May 2009
2 SRTM: Shuttle Radar Topographic Mission, produced originally by NASA
3 U.S. Geological Survey
Figure 22.4-3  Existing Landuse 2009 Prepared by DHUTS

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 management, infrastructure development and urban/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](image-url)
### Table 22.4-2  List of Major Data Stored in DHUTS Database

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

#### 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 ESRI⁴, for GIS data format, because the most of government agencies in Bangladesh is using ESRI’s GIS software such as ArcGIS.

⁴ Environmental Systems Research Institute, Inc
Table 22.4-3 Specification of GIS Data

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projection System</td>
<td>BTM</td>
</tr>
<tr>
<td>Spheroid</td>
<td>Everest 1830</td>
</tr>
<tr>
<td>Scale Factor</td>
<td>0.9996</td>
</tr>
<tr>
<td>Central Meridian</td>
<td>90 degree east</td>
</tr>
<tr>
<td>False Easting</td>
<td>500,000 meter</td>
</tr>
<tr>
<td>False Northing</td>
<td>-2,000,000 meter</td>
</tr>
<tr>
<td>Latitude of Origin</td>
<td>0 degree (Equator)</td>
</tr>
</tbody>
</table>

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.

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

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

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\(^5\) as well as UTM\(^6\) 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

<table>
<thead>
<tr>
<th>Agency</th>
<th>Title of GIS database or map</th>
<th>Adopted Projection System</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCC</td>
<td>Ward Map</td>
<td>BTM</td>
</tr>
<tr>
<td>DCC</td>
<td>SWM Map</td>
<td>BUTM(^7)</td>
</tr>
<tr>
<td>LGED</td>
<td>Municipality Map</td>
<td>LCC</td>
</tr>
<tr>
<td>RAJUK</td>
<td>DAP Database</td>
<td>BTM</td>
</tr>
<tr>
<td>RHD</td>
<td>RHD Road Network</td>
<td>LCC</td>
</tr>
<tr>
<td>SOB</td>
<td>Urban Map</td>
<td>BUTM</td>
</tr>
</tbody>
</table>

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

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\(^5\) Lambert Conformal Conic  
\(^6\) Universal Transverse Mercator  
\(^7\) 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>
<thead>
<tr>
<th>Projection System</th>
<th>Area of Bangladesh (km²)</th>
<th>Road Length (km) of Teknaf - Tentulia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lambert Conformal Conic (LCC)</td>
<td>139,798.00</td>
<td>954.78</td>
</tr>
<tr>
<td>Bangladesh Transverse Mercator (BTM)</td>
<td>139,813.28</td>
<td>955.22</td>
</tr>
<tr>
<td>Bangladesh Universal Transverse Mercator (BUTM Everest)</td>
<td>139,813.28</td>
<td>955.84</td>
</tr>
<tr>
<td>Universal Transverse Mercator (UTM Zone 46)</td>
<td>140,073.21</td>
<td>955.58</td>
</tr>
<tr>
<td>Bangladesh Universal Transverse Mercator (BUTM WGS84)</td>
<td>139,845.65</td>
<td>955.95</td>
</tr>
</tbody>
</table>

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.
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

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

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