

**PREPARATORY SURVEY REPORT
ON
DHAKA URBAN TRANSPORT NETWORK
DEVELOPMENT PROJECT
PHASE 2**

**SUMMARY
(SIMPLE BINDING)**

OCTOBER 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

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(As of December, 2010)



Study Area and Location of Proposed MRT Line 6

DHAKA URBAN TRANSPORT NETWORK DEVELOPMENT PROJECT

PHASE 2

Preparatory Survey Report

SUMMARY

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Study Area and Location of Proposed MRT Line 6

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LIST OF ABBREVIATIONS

AAGR	Annual Average Growth Rate
AFC	Automatic Fare Collection
ATC	Automatic Train Control
ATO	Automatic Train Operation
ATS	Automatic Train Stop
BBA	Bangladesh Bridge Authority
BDT	Bangladesh Taka
BRT	Bus Rapid Transit
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CASE Project	Clean Air and Sustainable Environment Project
CBR	Cost Benefit Ratio
CCTV	Closed Circuit Television
CNG	Compressed Natural Gas
COD	Chemical Oxygen Demand
CTC	Centralized Traffic Control
CWR	Continuously Welded Rail
DC	Direct Current
DCC	Dhaka City Corporation
DESCO	Dhaka Electricity Supply Company
DMA	Dhaka Metropolitan Area
DMTC	Dhaka Mass Transit Company
DOE	Department of Environment
DPDC	Dhaka Power Distribution Company Limited
DSA	Debt Sustainability Analysis
DTCB	Dhaka Transport Coordination Board
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
FIRR	Financial Internal Return
FS	Feasibility Study
GDP	Gross Domestic Product
GOB	Government of Bangladesh
JICA	Japan International Cooperation Agency
JICA STRADA	JICA System for Traffic Demand Analysis
JPY	Japanese Yen
LCX	Leaky Coaxial Cable
MOC	Ministry of Communications
MOD	Ministry of Defense
MRT	Mass Rapid Transit Railway
NHA	National Housing Authority
NO _x	Nitrogen Oxide
NPV	Net Present Value
O&M	Operation and Maintenance
OD	Origin and Destination
ODA	Official Development Assistance
P&R	Park and Ride
PAPs	Project Affected Persons
PC	Prestressed Concrete
PM ₁₀	Particulate Matter 10

PM2.5	Particulate Matter 2.5
PSC	Project Steering Committee
RAJUK	Rajdhani Unnayan Katnipakkha (Dhaka Metropolitan Development Authority)
RAP	Resettlement Action Plan
ROW	Right of Way
SCADA	Supervisory Control and Data Acquisition
SO ₂	Sulfur Dioxide
SO _x	Sulfur Oxide
SP	State Preference
STP	Strategic Transport Plan
UIC	Union Internationale des chemins de fer (International Union of Railways)
UPS	Uninterrupted Power Supply
USD/US\$	United States Dollar
VCR	Volume Capacity Ratio
VOC	Vehicle Operating Cost
VVVF	Variable Voltage Variable Frequency
WACC	Weighted Average Cost of Capital
WTP	Willingness to Pay

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EXECUTIVE SUMMARY

BACKGROUND

BACKGROUND OF THE STUDY

- Dhaka City is the capital of People's Republic of Bangladesh. The Dhaka Metropolitan Area (DMA) has a population of 9.15 million (estimated) (6.1% of the whole nation in 2009). Currently the urban transportation in DMA heavily relies on road traffic, where the travel modes such as automobile, bus, and rickshaw are mixed. This brings about serious traffic congestion in addition to aggravation of health condition due to air pollution. It is expected that, in the years to come, DMA will experience growth of the economy and the number of automobiles, as well as growth of the urban population. All these make the improvement of the urban public transport system pressing issues for the DMA.
- With due consideration of this situation, the Government of Bangladesh (GOB), through Dhaka Transport Coordination Board (DTCB) as the implementing agency, formulated the "Strategic Transportation Plan" (STP) in cooperation with the World Bank in 2005. The STP prepared an "Urban Transportation Policy" for the 20 year period from 2004 to 2024 and identified priority issues such as the establishment of an organization to manage project implementation and maintenance /operation, improvement of the mass transit system such as introduction of Bus Rapid Transit (BRT) and Mass Rapid Transit (MRT) and improvement of road network.
- Under such circumstance, Japan International Cooperation Agency (JICA) conducted formulation study for Dhaka Urban Transport Project in March 2008.

Following this study, JICA conducted preparatory survey on Dhaka Urban Transport Network Development Study (Phase 1 Study) from March, 2009 to March 2010. The Phase 1 Study recommended a series of urban transport network development projects and programs.

- MRT Line 6 project was selected in the Phase 1 Study as the high priority project and it was agreed between GOB and JICA that this project will be further studied in the Phase 2 to confirm its feasibility.

OBJECTIVES OF THE STUDY

- The objectives of the Phase 2 Study are to conduct the feasibility study on MRT Line 6 project by confirming technical, economical and financial viability of the project as well as confirming environmental and social aspect.

STUDY AREA

- The study area covers the whole length of MRT Line 6 initially from "Uttara Phase 3 New Urban Development" area to Saidabad but later altered to Bangladesh Bank, and its surrounding area.

TRAFFIC DEMAND FORECAST

- After careful review of traffic demand forecast made in the Phase 1 Study, the traffic demand forecast on MRT Line 6 is carried out more precisely taking into account the stage construction plan mentioned in Section 2.2 of Summary Volume. The result of traffic demand forecast is shown in **Figure E-1**.

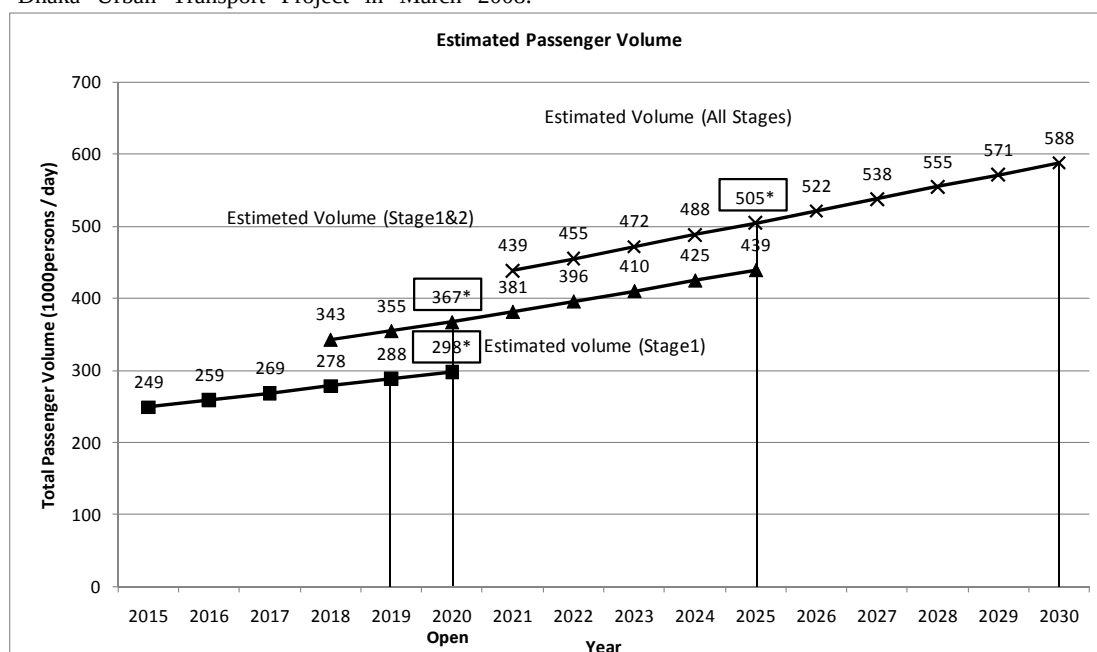


Figure E-1 Traffic Demand Forecast by Year and By Stage Plan

PROJECT PLAN

STAGE CONSTRUCTION PLAN

- To construct 20.1 km length of MRT Line 6 may not be practical because the planned line requires a huge land during construction period and immense cost. Hence, the following stage construction plan is recommended.
- **Stage 1:** From Pallabi to Sonargaon including Pallabi Depot. Length will be 11.0 km plus 1.3 km access track to the depot and 9 stations.

- **Stage 2:** Extension to Bangladesh Bank from Sonargaon. Length will be 4.4 km and 4 stations.

- **Stage 3:** Uttara Phase 3 Development area to Pallabi. Length will be 4.7 km and 3 stations.

ROUTE ALIGNMENT & DEPOT LOCATION

- The proposed alignment of MRT Line 6 and depot location are shown in **Figure E-2**.



Figure E-2 Proposed Route and Depot Location of MRT Line 6

Closed due to confidentiality

STATION FACILITIES

- Station plan and facility plan are made for the following typical three stations.
 1. Standard Intermediate Station: Mirpur 10 Station.
 2. Terminal Stations: Pallabi Station, Sonargaon Station and Bangladesh Bank Station.

Lateral type platform is proposed for intermediate stations and Island type platform is proposed for terminal

stations. The station building has two floors, first floor will be concourse and second floor will be platform.

- Station Plan and Facilities Plan was made in consideration of passenger's convenience and barrier free design for handicapped people. Proposed Station Plan is shown in **Figure E-5**.

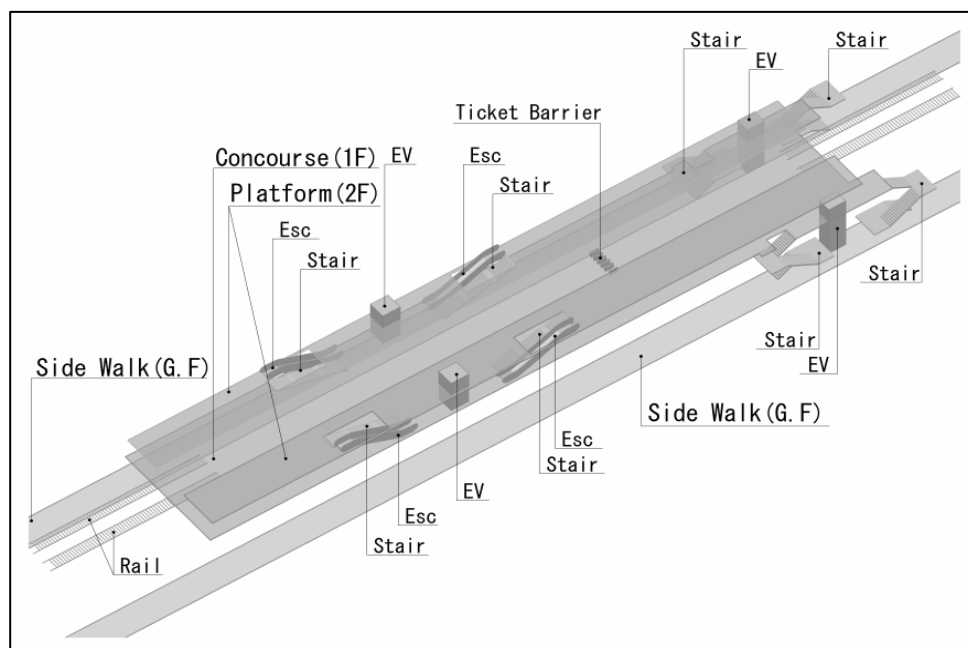


Figure E-5 Station Plan

Closed due to confidentiality

ENVIRONMENTAL IMPACT ASSESSMENT**RAP Implementation policy**

- Considering the gap between JICA Guidelines and related ordinances in Bangladesh, preliminary RAP is prepared in accordance with the following policy.
 - Eligibility for compensation: All PAPs must be acknowledged for eligibility for compensation.
 - Support for non-titled people: Identify the eligibility for the non-titled people when census survey recorded them as PAPs and compensate them for all type of losses and consider support.
 - Establishment of support system for vulnerable social groups: Take them into account and consider compensation for them.
 - Land acquisition against PAPs: Confirm the necessity of alternative sites when census survey is carried out and when the sites are needed to secure the sites.
 - Offering measure to the recovery of livelihood to PAPs: Formulate the countermeasures to restore

PAPs' livelihood.

- Formulation of Resettlement Action Plan and promotion of citizen's participation in the project implementation stage: Formulate the local stakeholder meetings with citizen's participation and accept the opinion from them on RAP.
- Compensation for house loss at full replacement cost: Make compensation with full replacement cost without considering the depreciation or re-use of debris.
- Grievance committee: Formulate a simplified, convenient and reliable committee including the third parties.
- Implementation of monitoring: Formulate the monitoring panel which is valid both legally and administratively.

Extent of Impact

Number of project affected families and people by station and project stage is shown in **Table E-3** and **E-4**.

Table E-3 Number of Project Affected Families and People by Station

Variables	Number of PAHs/PAPs							Total
	Pallabi	IMT	Mirpur 10	Kazipara	Farmgate	National Stadium	Bangladesh Bank	
Male Head Family	75	28	2	8	5	67	34	219
Female Head Family	0	0	0	0	0	0	0	0
Sub-Total	75	28	2	8	5	67	34	219
Male Residents	183	77	7	31	15	165	77	555
Female Residents	177	67	7	27	11	136	60	485
Sub-Total	360	144	14	58	26	301	137	1,040

Table E-4 Number of Project Affected Families and People by Project Stage

Category	Stage-1	Stage-2	Stage-3	Total
Number of PAHs	118	101	0	219
Number of PAPs	602	438	0	1,040

PROJECT IMPLEMENTATION PLAN**PROJECT COST ESTIMATE**

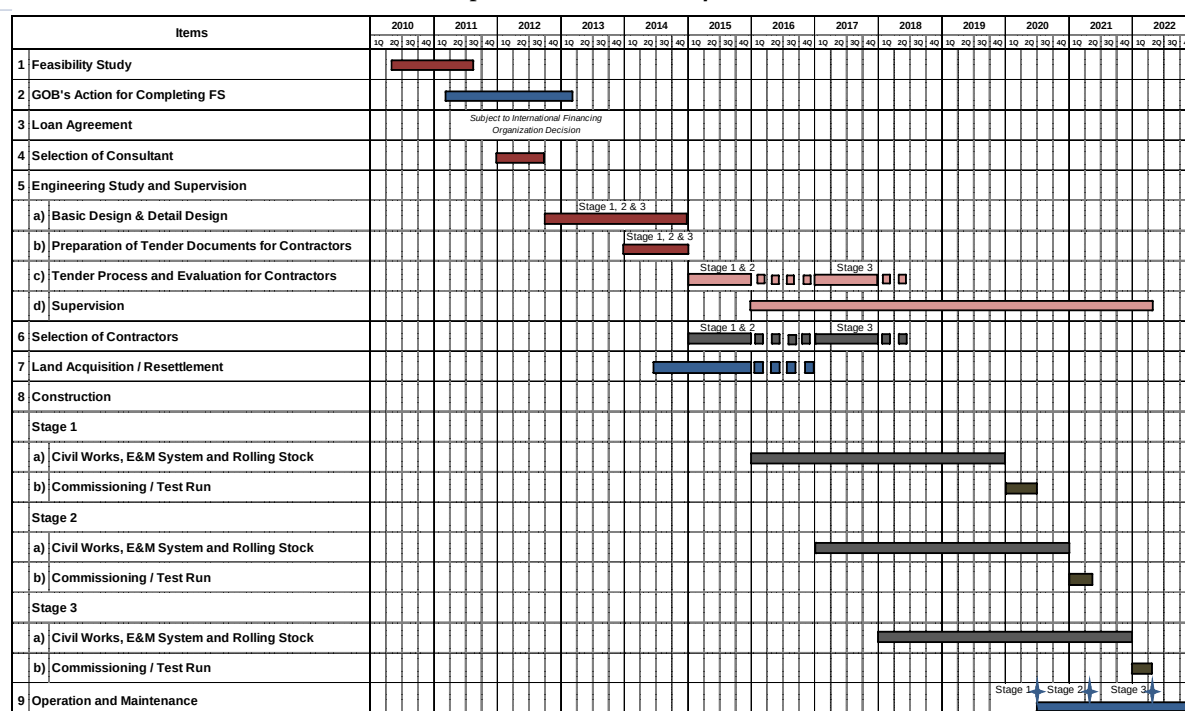
- Taking into consideration of characteristics and features of all works involved in MRT Line 6, four contract groups, namely 1) Civil and Station works in Main Line, 2) Civil and Building Works in Depot, 3) E&M Systems and, 4) Rolling stocks and equipment for Rolling Stocks in Depot, are proposed.

- The project cost estimated for each stage by contract group is shown in **Table E-5**.
- The costs for management consulting to DMTC have not been included in the consulting services (item 5), as those will be computed under the other study.
- Number of train sets (one set consists of six rolling stocks) to procure is 12 for Stage 1, additional 6 for Stage 2 and another 6 for Stage 3. At the time of operation in whole route, train sets will be 24 numbers.

Table E-5 Summary of Project Cost

Closed due to confidentiality

Table E-6 Implementation Schedule for MRT Line 6



ECONOMIC AND FINANCIAL ANALYSIS

ECONOMIC ANALYSIS

- Based on the results of the user benefit and cost estimate,

MRT Line 6 project was evaluated in terms of EIRR, CBR and NPV within assumed project implementation period of 35 years. Evaluation of the economic viability was done through comparative analysis between EIRR

and evaluation indicator that is so-called as social discount rate and its value is 12.0%. Comparing to such discount rate, it can be said that the project is viable and economically feasible.

Table E-7 Result of the Economic Analysis

Evaluation Item	Stage 1	Stages 1&2	All Stages
EIRR	25.4	25.2	25.6
CBR ¹⁾	7.2	7.3	8.8
NPV [million BDT] ¹⁾	240,122	307,381	438,699

Note: 1) Discount rate adopted is 12.0%

FINANCIAL ANALYSIS

- Each Financial performance by Stage 1, Stage 1&2 and All Stages was shown in the following table as a summary. In examining FIRR as well as NPV, FIRR is

very low and all of NPV are negative. Taking account of such analytical results, it is very hard to say that the project is financially viable on the basis of the self-financial business scheme. Therefore any kind of public financial support is indispensable.

Table E-8 Result of Financial Analysis

Evaluation Item	Stage 1	Stages 1&2	All Stages
NPV [million BDT]	-35,102	-46,439	-54,357
FIRR [%]	0.92	0.56	0.12

Note: Discount rate adopted is 8.0%

OPERATION AND EFFECT INDICATORS

To quantitatively monitor the project's operational conditions and effects, the indicators shown in **Table E-9** are established considering objectives and functional characteristics of the MRT Line 6 Project.

Table E-9 Operation and Effect Indicators of MRT Line 6 Project

Indicators				Unit	Base year (2009)	Stage 1 Opening Year (2020)	Stage 1&2 Opening Year (2021)	Stage 1&2 1Year After Opening (2022)	All Stage Opening Year 2022	Monitoring Year	
										All Stages (2025)	All Stages (2030)
Operation Indicators	Passenger Kilometer	W/ MRT Line 6		Paxkm/ Day (000)	-	1,547	2,324	2,412	3,778	4,193	4,882
	Train Kilometer	W/ MRT Line 6		Train km/ Day	-	2,957	4,567	4,567	6,450	6,528	6,751
	Fare Revenue	W/ MRT Line 6		BDT(000)/ Year	-	3,672	4,688	4,860	5,587	6,223	7,246
Effect Indicators	Average Traffic Volume	W/O MRT Line 6	Road Traffic	PCU/ km	4,440	5,096	5,425	5,753	5,753	6,739	7,458
		W/ MRT Line 6	Road Traffic	PCU/ km	-	4,041	4,094	4,225	4,181	4,569	5,291
	Average Travel Time	W/O MRT Line 6	Bus Transport	Minute (Pallabi-Sonargaon)	51.0	71.1	--	--	--	--	--
				Minute (Pallabi-Saidabad)	81.6	113.9	131.8	153.7	--	--	--
				Minute (Uttara North - Saidabad)	110.4	--	--	--	207.9	445.5	1,247.6
		W/ MRT Line 6	Bus Transport	Minute	-	109.8	108.5	112.5	146.8	164.2	226.8
				Minute	-	59.3	36.1	36.4	46.2	47.4	51.6
				Breakdown		Stage 1 (18 min.) Bus (41.3 min.)	Stage 1&2 (26.2 min.) Bus (9.9 min.)	Stage 1&2 (26.2 min.) Bus (10.2 min.)	Stage 1&2 (26.2 min.) Bus (9.9 min.)	Stage 1&2 (26.2 min.) Bus (11 min.)	Stage 1&2 (26.2 min.) Bus (15.2 min.)
	Average Travel Speed	W/O MRT Line 6	Bus Transport	km/h	11.3	8.1	7.0	6.0	6.0	2.8	1.0
		W/ MRT Line 6	Bus Transport	km/h	-	8.4	8.5	8.2	8.5	7.6	5.5
			MRT Line 6	km/h	-	32.0	32.0	32.0	32.0	32.0	32.0
	Average Traffic Congestion Degree (V/C ratio)	W/O MRT Line 6	Road Traffic	-	0.81	0.93	0.99	1.05	1.05	1.23	1.30
		W/ MRT Line 6	Road Traffic	-	-	0.72	0.73	0.75	0.75	0.79	0.92

*1: Sonargaon - Saidabad shall be bus transport

*2: Bangladesh Bank - Saidabad shall be bus transport

Note 1) Effect Indicators of Stage 1 and Stage 1 & 2 are calculated on the basis of road links along MRT Line 6 between Pallabi and Saidabad via Bangladesh Bank. Total length is 15.374 km.

While effect indicators of All Stage are calculated on the basis of road links between Uttara North and Saidabad via Bangladesh Bank. Total length is 20.794km

2) Number of passengers is shown in Figure 4.3-13 in Chapter 4.

3) Tariff for MRT Line 6 is adopted to be 10 BDT per ride and 2.5 BDT / km.

4) Average travel time of bus transport (w/o MRT Line 6) = Total Length / Travel speed of bus transport (w/o MRT Line 6)

5) Average travel time of bus transport (w/ MRT Line 6) = Total length / Travel speed of bus transport (w/ MRT Line 6)

6) Average travel time of MRT Line 6 = MRT length / Travel speed of MRT Line 6 + Length of bus transport / Travel speed of bus transport (w/ MRT Line 6)

7) Length of MRT and bus transport adopted for calculation of above travel times is shown below

Stage	Assessment Section	Total Assessment Length	MRT Section	Length of MRT	Bus Route Section	Length of Bus Route
Stage 1	Pallabi - Saidabad	15.374 km	Pallabi - Sonargaon	9.596 km	Sonargaon - Saidabad	5.778 km
Stage 1&2	Pallabi - Saidabad	15.374 km	Pallabi - Bangladesh Bank	13.979 km	Bangladesh Bank - Saidabad	1.395 km
All Stage	Uttara North - Saidabad	20.794 km	Uttara North - Bangladesh Bank	19.399 km	Bangladesh Bank - Saidabad	1.395 km

REMAINING ISSUES AND RECOMMENDATIONS

REMAINING ISSUES

- DTCB shall coordinate with the following agencies
- Bangladesh Bridge Authority (BBA) to review the plans and alignment of on-going Dhaka Elevated Expressway

Project at Farmgate and Sonargaon that conflicts with the proposed MRT Line 6 Project.

- Ministry of Defense (MOD) to obtain the concurrence of the proposed route A1 which is close to Tejgaon Airport before the project appraisal.
- Rajdhani Unnayan Katripakkha (Dhaka Metropolitan

Development Authority) (RAJUK), MOD, Dhaka Cantonment Board, National Housing Authority (NHA), Bangladesh Water Development Board (BWDB) and other related authorities to discuss in detail the depot layout and settle land acquisition before the project appraisal.

- Relevant authorities and settle land acquisition for proposed five (5) substations before the design stage.
- DTCB shall obtain an official confirmation of the supply of required power for MRT Line 6 from Ministry of Energy before the project appraisal.
- Department of Environment (DOE) to renew the Environment Clearance Certificate (ECC) before the expiry date.
- Effective organizational structure for project implementation and operation/maintenance of MRT Line 6 is essential to operate MRT Line 6 efficiently and smoothly. It is urgently establish the organizational structure.
- Organization structure for the project implementation shall be established before the project appraisal.

- Organization structure for operation & maintenance shall be established to keep sufficient time for training the staff before the completion of Stage 1 section.

RECOMMENDATIONS

- The Phase 2 Study proved that the Project is feasible in terms of technical, socio-environmental, and economic view-points. It is therefore that the Project shall be implemented at earliest possible time in view of dissolving chronically traffic congestion and providing people's mobility and accessibility in Dhaka.

As first urban rail project in Bangladesh, and considering the nature of railway project as a huge investment of urban infrastructure, the MRT Line 6 Project must be funded by the Government. In order to make financially viable the Project, the Government shall be taken into consideration of introducing the ODA loan such as Yen Loan.

- Park and Ride (P&R) system along Stage 3 Section between Pallabi Station and Uttatara North Station should be considered in design stage to improve traffic congestion in the urban area along MRT Line 6.
- Provision of Bus Rapid Transit (BRT) system between Uttara Phase 3 Development area and Pallabi Station shall be studied until construction of Stage 3 Section will be completed. Shuttle bus service between Bangladesh Bank Station and Saidabad Bus Terminal shall be provided.
- Institutional framework for land acquisition and resettlement shall be formulated and training of staff shall be carried out as early as possible for smooth project implementation.
- Project cost shall be reviewed based on new findings and efforts to reduce project cost by adopting new technology shall be continued even after this Study.

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Dhaka City is the capital of People’s Republic of Bangladesh. The Dhaka Metropolitan Area (DMA) has a population of 9.15 million (6.1% of the whole nation in 2009). Currently the urban transportation in DMA relies heavily on road traffic using travel modes such as automobile, bus, and rickshaw in coexistence. This brings about serious traffic congestion in addition to the aggravation of health conditions in the people in the Dhaka City due to air pollution. It is further expected that, in the years to come, DMA will experience growth of the economy, and increase in the number of automobiles, and the urban population. All of these make the improvement of the urban public transport system pressing issues for the DMA.

With due consideration of this situation, the Government of Bangladesh (GOB), through Dhaka Transport Coordination Board (DTCB) as the implementing agency, formulated the “Strategic Transportation Plan”(STP) in cooperation with the World Bank in 2005. The STP prepared an “Urban Transportation Policy” for the 20 year period from 2004 to 2024 and identified priority issues such as the establishment of an organization to manage project implementation and maintenance/operation, improvement of the mass transit system such as introduction of Bus Rapid Transit (BRT) and Mass Rapid Transit (MRT) and improvement of road network.

Under these circumstances, Japan International Cooperation Agency (JICA) conducted a formulation study for the Dhaka Urban Transport Project in March 2008. Following this formulation study, JICA conducted a preparatory survey on the Dhaka Urban Transport Network Development Project (Phase 1 Study) from March, 2009 to March 2010. The Phase 1 Study recommended a set of urban transport network development projects and programs.

The MRT Line 6 Project was selected in the Phase 1 Study as the priority project and it was agreed between GOB and JICA that this project will be further studied in the Phase 2 to confirm the possibility of implementation.

1.2 OBJECTIVES OF THE STUDY

The objectives of the Phase 2 Study are to conduct the feasibility study on the MRT Line 6 Project by confirming technical, economic and financial viability of the Project as well as assessing the environmental and social impact and formulate project plan and implementation plan.

1.3 STUDY AREA

The study area covers the whole length of MRT Line 6 initially from “Uttara Phase 3 New Urban Development” area to Saidabad but later altered to Bangladesh Bank, and its surrounding area. (see Location Map on the front page) .

1.4 PROJECT DESCRIPTION

1.4.1 Priority of the Project

The Urban Transport Network Development Plan proposed the development of mass rapid transit network together with each component in the transport sectors with the following transport strategies;

- 1) Improvement of people’s mobility
- 2) Establishment of optimal transport infrastructure development
- 3) Provision of safe and secure transport system
- 4) Provision of accessible transport for all people
- 5) Establishment of sustainable institution and organization

In line with the above mentioned transport development strategies, 13 major transport projects including public transport projects, road network development projects, traffic management improvement projects, and organizational and institutional development projects were identified and their priorities were determined using the following criteria:

1) Project Urgency

Project included in the short term plan and contribute directly to solving existing traffic problems are considered as urgent project and shall be given high priority. Traffic projects with sufficient scale may bring about effective impact over wide area.

2) Project Maturity

One of the important requirements of the high priority project shall be the 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 the difficulty in project preparation.

3) Project Impacts

Projects, having a large-scale impact and accelerating actualization of the plans proposed by the Phase 1 Study are preferred.

4) Compatibility with Transport Policy

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

Using above mentioned criteria, the candidate projects and programs were evaluated. The high

priority projects selected in the Phase 1 Study are as follows:

- 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 project
 - Flyover projects
- 3) Traffic management project
- 4) Organizational development for DTCB and the MRT Line 6 operating company.

Among these, MRT Line 6 was selected as the highest priority project.

1.4.2 Justification of the Project

MRT Line 6 is located along the corridor from the north-western area to the southern area of DCC which is one of the major transport corridors in DMA. MRT Line 6 project can be justified as a high priority project for the following reasons:

- 1) In the Strategic Transport Plan (STP), DTCB, December 2006, approved by Ministry of Communication (MOC), and in the Phase 1 Study, MRT Line 6 was identified and determined as a high priority project.
- 2) Since the existing and future person trip demand along this corridor is bigger than that of the other corridors, there are many potential passengers for the proposed MRT Line 6.
- 3) This project is expected to ease severe traffic congestion along the MRT Line 6 corridor and provide economic benefits through saving in travel time and promoting urban development along the corridor.
- 4) This project is expected to provide mobility and accessibility to the future inhabitants in the area of Uttara Phase 3 Development by RAJUK, which is now on-going as a new urban development project.
- 5) This project is expected to improve environmental condition by reducing air pollution and minimize negative social impact such as relocation affected people by using existing road right of way.

2. FUTURE TRAFFIC DEMAND FORECAST

2.1 SOCIO-ECONOMIC FRAMEWORK

2.1.1 Future Economic Framework

Table 2.1-1 shows the result of the projection of the future GDP and per capita GDP. This projection is made using the World Bank's report on Debt Sustainability Analysis (DSA)¹ and the recent economic growth rate for adjusting Bank's report. The per capita GDP is estimated to be doubled from US\$ 600 in 2009 to US\$ 1,204 in 2025 with an average annual growth rate of 4.5%.

Table 2.1-1 Future GDP and Per Capita GDP in Bangladesh, 2009 – 2025

	2009	2015	2020	2025	AAGR (2009-'25)
Real GDP ¹⁾	87,375	122,908	164,479	220,109	5.9
Population ²⁾	149	162	172	183	1.3
GDP/Capita ³⁾	600	761	955	1,204	4.5

Sources: 1) GDP in 2009 is based on 2009 Article IV Consultation Report by IMF.

2) Projected by JICA Study Team in the Phase 1 Study

3) Population census 2001, Volume 1 Analytical Report

Note: 1) GDP: USD million as of 2009 prices

2) Population: Million

3) US\$ as of 2009 prices

AAGR: Annual Average Growth Rate

2.1.2 Projected Population in DMA

Table 2.1-2 shows population projection made for the DMA Area in the Phase 1 Study for the period from 2009 to 2025. It is estimated that the population of DMA will increase from 9.2 million in 2009 to 15.7 million in 2025.

¹ Debt Sustainability Analysis (DSA), September 2008, World Bank

Table 2.1-2 Population Estimation in the Phase 1 Study, 2009-2025

Population (Person)					
Area		2009	2015	2020	2025
DCC		7,301,976	8,620,901	9,687,619	10,726,434
Fringe Area of DCC		1,849,479	2,795,062	3,769,615	4,934,689
DMA		9,151,455	11,415,963	13,457,234	15,661,123
Population Density (Person/ha.)					
Area	Area (ha.)	2009	2015	2020	2025
DCC	12,668	576	681	765	847
Fringe Area of DCC	17,197	108	163	219	287
DMA	29,865	306	382	451	524
Annual Growth Rate (%)					
Area			2009-2015	2015-2020	2020-2025
DCC			2.8	2.4	2.1
Fringe Area of DCC			7.1	6.2	5.5
DMA			3.8	3.3	3.1
Population Increase (Person)					
Area			2009-2015	2015-2020	2020-2025
DCC			1,318,925	1,066,718	1,038,815
Fringe Area of DCC			945,583	974,553	1,165,074
DMA			2,264,508	2,041,271	2,203,889

Source: JICA Study Team (Phase 1)

2.2 TRAFFIC DEMAND FORECAST

2.2.1 Traffic Demand

The traffic demand forecasting model using a conventional four step methodology which has been commonly utilized and found to be effective in many cities around the world was applied in this study. As for the traffic assignment to road network, the method of user equilibrium assignment is used. In all steps, the JICA System for Traffic Demand Analysis (JICA STRADA) is employed as an analytical tool. This JICA STRADA is a package of traffic demand analysis system which assists of twenty three programs.

The following figure shows generated numbers of person trips in DMA, which increase from 35.9 million in 2009 to 65.5 million in 2025, or as large as 1.8 times during this period.

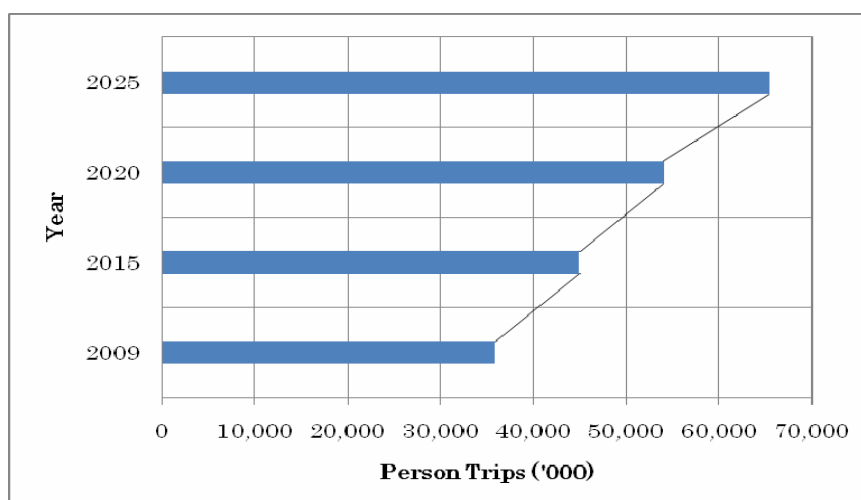
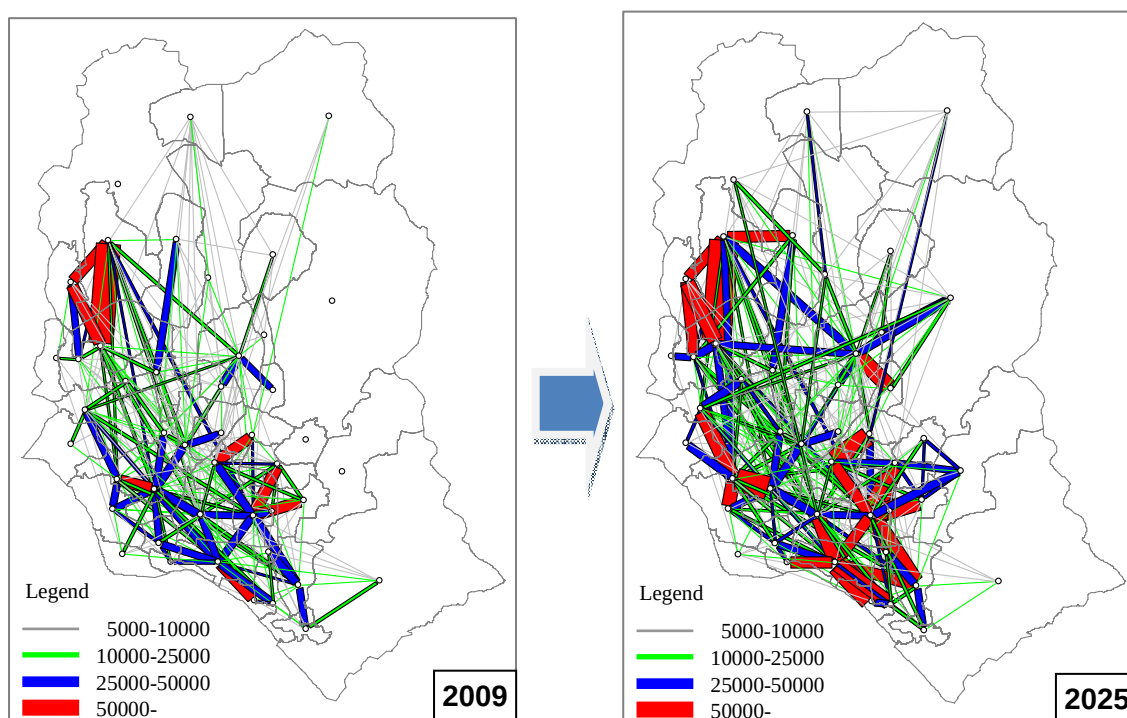


Figure 2.2-1 Generated Person Trips in DMA

Figure 2.2-2 shows comparative OD distribution pattern of the person trips between 2009 and 2025. As seen in this figure, movements of the person trips mainly concentrate from north-west area to central core area of DCC both in 2009 and 2025.



Source: JICA Study Team (the Phase 1 Study)

Note: trips which is less than 5,000 are not displayed

Figure 2.2-2 Desired Lines of Person Trips (All Purpose: 2009 - 2025)

2.2.2 Modal Split

Modal split of person trip in 2025 was estimated based on the modal split model using Willingness to Pay (WTP) data, which is obtained from a Special Preference (SP) survey

conducted by JICA Study Team together with BUET. The modal split was estimated on the basis of the following assumption:

1. The following transport network are developed
 - Public transport
 - MRT Line 6
 - BRT Line 1, 2 and 3
 - Upgrading of Bangladesh Railway
 - Road network proposed by phase 1 study
2. Fare level: 2.5 BDT per km taking into consideration WTP value
3. Schedule speed: MRT 32 km/h, BRT: 20 km/h

The result of modal split is shown in **Table 2.2-1**.

Table 2.2-1 Existing and Future Person Trips by Modes

Year	Case	Unit	Walk	Rickshaw	Car	Bus	MRT Line 6	BRT	CNG	Total
2009	Do Nothing	000 Trips	4,138	8,162	1,037	6,314	0	0	1,360	21,011
		%	19.7	38.8	4.9	30.1	0.0	0.0	6.5	100.0
2025	Do Nothing	000 Trips	9,887	20,376	7,089	20,594	0	0	6,624	64,570
		%	15.3	31.6	11.0	31.9	0.0	0.0	10.3	100.0
	W/ MRT Line6	000 Trips	9,889	20,441	7,664	18,120	505	1,925	6,027	64,570
		%	15.3	31.7	11.9	28.1	0.8	3.0	9.3	100.0

Source: JICA Study Team

2.2.3 Passenger Demand of MRT Line 6

Passenger traffic demand forecast on MRT Line 6 estimation is based on OD table and transport network data which include the MRT and BRT network, road network, etc. In the passenger traffic demand forecast, following three cases of the demand forecast were carried out:

Case 1: Stage 1: Section from Pallabi Station to Sonargaon Station will be constructed. The projection year is 2020.

Case 2: Stages 1&2: Section from Pallabi Station to Bangladesh Bank Station will be constructed. The projection year is 2020.

Case 3: All Stages: All stages from Uttara North Station to Bangladesh Bank Station will be constructed. The projection year is 2025.

As a result of the forecast, the passenger demands of the MRT Line 6 in three cases are shown in **Figure 2.2-3**.

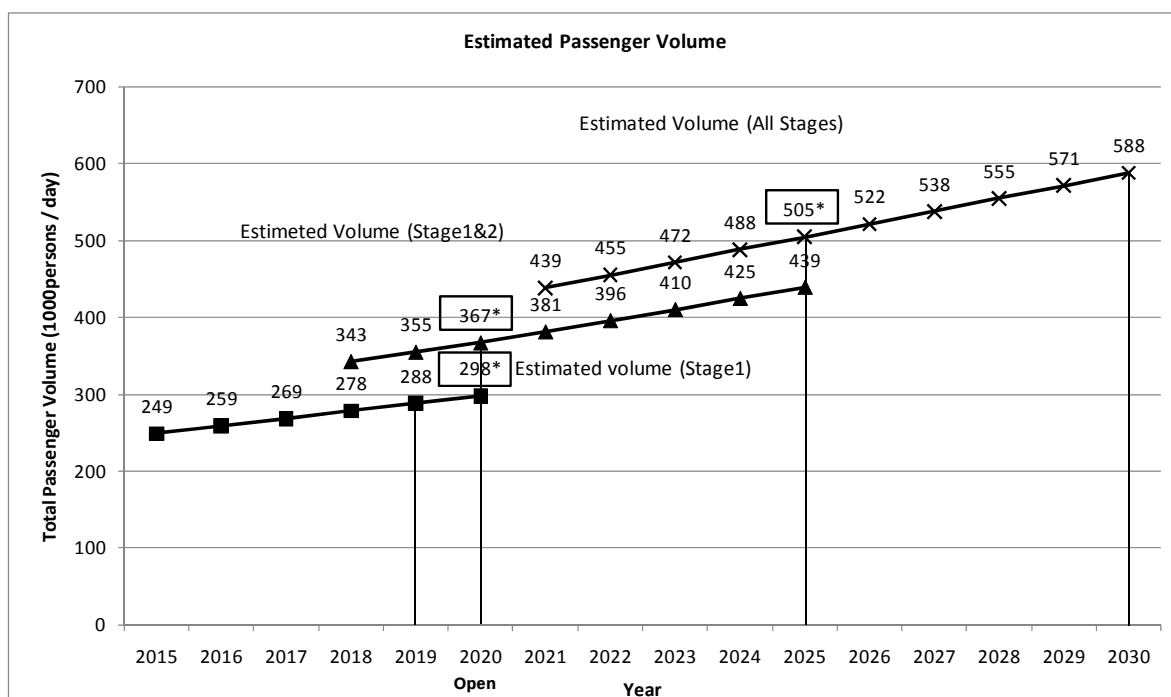


Figure 2.2-3 Passenger Demand Forecast on MRT Line 6 in Three Cases

3. PROJECT PLAN

3.1 STAGE CONSTRUCTION

MRT Line 6 is planned to be 20.1 km in length from the Uttara Phase 3 Development area to Bangladesh Bank. Land use along this line are diverse as there are residential development in the Uttara Phase 3 Development area, high density commercial area in the Farmgate area and Motijheel area, and educational area in the Dhaka University area.

Construction of 20.1 km length of MRT Line 6 at once may not be practical because a lot of land for casting yard has to be secured during construction period and is immensely costly. Furthermore, simultaneous construction of whole stage of MRT Line 6 may cause serious traffic congestion during the construction and procurement of the construction materials for civil structure such as cement, aggregate, sand, steel bars, etc. Taking into consideration of these, JICA Study Team recommended development in three stages as follows and it was approved by PSC.

Stage 1: From Pallabi to Sonargaon including Pallabi Depot.

Length: 11.0 km plus 1.3 access track from Pallabi Station to the depot

Station: 9 nos.

Depot: 1 no

Stage 2: Extension to Bangladesh Bank from Sonargaon.

Length: 4.4 km

Station: 4 nos

Stage 3: Uttara Phase 3 Development area to Pallabi.

Length: 4.7 km

Station: 3 nos.

3.2 ROUTE ALIGNMENT

In order to determine the most feasible route of the proposed MRT Line 6, JICA Study Team conducted alignment survey along proposed corridor and investigated several alternative routes, then the alignment of MRT Line 6 as shown in **Figure 3.2-1** was proposed and approved by PSC. However DTCB shall coordinate with MOD and other related authorities to obtain their agreement.



Figure 3.2-1 Proposed Route of MRT Line 6

3.3 DEPOT LOCATION

Depot layout with sufficient space and facilities meeting maximum capacity requirement of all three stages was designed. The preliminary layout plan of the depot was made based on the maintenance plan of rolling stocks and depot facilities, and approximately 22 ha of depot space was found to be secured. Uttara area around 1.3 km in the north from Pallabi Station where most of the area belongs to RAJUK was identified as proposed depot site. Current status of the proposed area is waste land and still under development. The outline of the proposed location has been discussed and approved by PSC. However, DTCB shall have further discussion with the related authorities for detailed layout and to settle land acquisition.

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3.6 STATION FACILITIES

Station plan and facilities plan are made for the following typical four stations.

1. Standard intermediate station : Mirpur 10 Station
2. Terminal stations : Pallabi Station, Sonargaon Station and Bangladesh Bank Station

A lateral type platform is proposed for intermediate stations and an Island type platform is proposed for terminal stations. In stage 1 and 2, stations shall be elevated type along existing road. The station should have two floors; first floor will be concourse and second floor will be the platform.

Location of station entrances is determined and basically two entrances are proposed at either end of a station. One entrance is located at one side of the road and the other is located at the opposite side of the road. However an additional entrances are proposed for Pallabi Station, Sonargaon Station, National Stadium Station, then two additional entrances are proposed for Bangladesh Bank Station with consideration of connection between the station and other transportation means.

Station Facilities Plan shall be made considering passenger's convenience and barrier free design for handicapped people. Escalator is proposed between concourse and platform level. Elevator is proposed from ground floor to concourse and from the concourse to the platform level. Connection arrangement of station is shown in **Figure 3.6-1**.

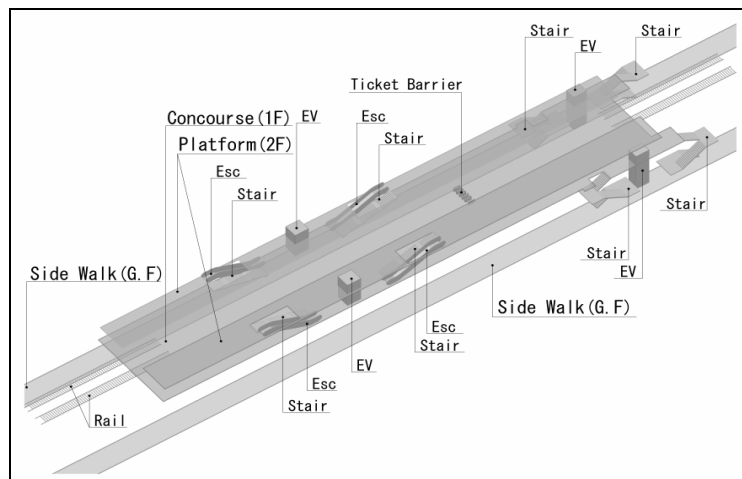


Figure 3.6-1 Connection Arrangement of Station

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4. ENVIROMENTAL IMPACT ASSESSMENT

4.1 GENERAL

In accordance with the JICA Guidelines, the proposed MRT Line 6 Project is classified as Category A which would likely have significant adverse impact on the environment because the project needs large scale involuntary resettlement.

Moreover, The proposed MRT Line 6 Project is classified as a Red Category in accordance with Item No. 60 “Engineering works capital above BDT 10 lacs” and Item No. 68 “Construction, reconstruction and expansion of bridge with a length above 200 m” in Schedule-1 of Environmental Conservation Rules, 1997 of Bangladesh.

The project proponent is obligated to obtain an Environmental Clearance Certificate (ECC) from the Department of Environment for those Red Category by preparing and submitting the EIA Report in accordance with Environmental Conservation Rules as well.

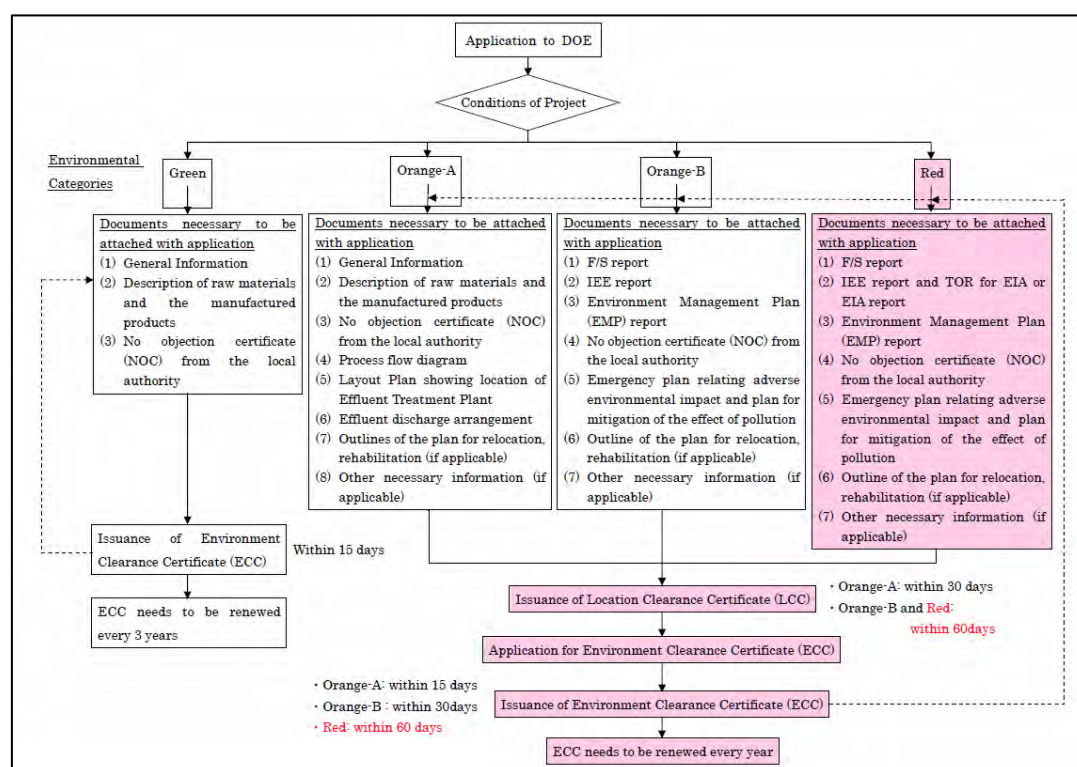


Figure 4.1-1 Procedure for Obtaining ECC

4.2 NATURAL AND SOCIAL IMPACT

4.2.1 Natural Impact

- 1) Geology: Clay and silt layer forms 10 m below ground with N value of 5 to 11 and stiff sand layer forms below under clay and silt layer. The bearing stratum is located 16 to 30 m below ground. The elevated structure and station will be supported by bored pile which will be driven by penetrating into the stiff sand layer; therefore it is assumed that adverse impact due to the ground subsidence might be almost negative.
- 2) Air Quality: The annual average level of NO_x and SO₂ are within Bangladesh ambient air quality standards, on the other hand, practical matters such as PM 10 and PM 2.5 level exceed the standards especially in the dry season. It is assumed that emission effect as of 2025 might be approximately 10% less than without the Project case.
- 3) Water Quality: Water quality surveyed at three bodies of water along the Project area was carried out. The surveyed pH value at different three points met the environmental standards; however the surveyed total coliform and COD indicate that contamination by domestic wastewater far exceed the standards at all locations. Amount of discharge from the Project will be little and serious adverse impact might be not expected.
- 4) Noise: Noise survey was carried out at five different locations and surveyed noise level far exceeded the standard noise level at all locations. It is assumed that the noise level by the Project is within 65 dB, the issue on noise might be not serious in urban area.
- 5) Fauna and Flora: The proposed project site from Uttara North to Pallabi is not built-up and will be developed as a new town in the near future. Rare and precious species in accordance with the Red Data Book in Bangladesh was surveyed around the project site. The rare and precious species were not identified by this survey.

4.2.2 Social Impact

Following items are considered to give adverse impacts due the Project

- 1) Involuntary resettlement: 219 households and 1, 040 persons might be affected due to the project alignment and construction of the new stations. Number of project affected families and people by project stage is shown in **Table 4.2-1**.

Table 4.2-1 Number of Project Affected Families and People by Project Stage

Category	Stage-1	Stage-2	Stage-3	Total
Number of PAHs	118	101	0	219
Number of PAPs	602	438	0	1,040

Number of involuntary settlement households will be reconfirmed and finalized in the design stage.

- 2) Land acquisition: Total 0.41 hectare of private land might be acquired.
- 3) Local economies such as employment and livelihood, etc: When resettlement or land

acquisition is required, legal frame work to mitigate adverse impact is being under taken in Bangladesh.

- 4) Poor, Misdistribution of benefits and damages: It is worried that the policy is not institutionalized for the poor becoming PAPs and compensation to informal settles is not yet defined, too.
- 5) Social consensus: The mutual agreement between the project proponent and PAPs might be premature and it is worried that the Project will commence with a lack of accountability or unreasonable compensation.
- 6) Others: Local conflicts of interest, gender and children's right.

On the other hand, following significant positive impacts are assumed.

- 1) Land use and utilization of local resources, social institutions such as social infrastructures, local decision-making institutions and existing social infrastructures and services.

4.3 PRELIMINARY RESETTLEMENT ACTION PLAN (RAP)

Considering the gap between JICA Guidelines and related ordinance in Bangladesh, preliminary RAP is prepared in accordance with the following policy.

- 1) Eligibility for compensation: All PAPs must be acknowledged for eligibility for compensation.
- 2) Support for non-titled people: Identify the eligibility for the non-titled people when census survey recorded them as PAPs and compensate them for all type of losses and consider support.
- 3) Establishment of support system for vulnerable social groups: Take them into account and consider compensation for them.
- 4) Land acquisition against PAPs: Confirm the necessity of alternative sites when the sites are needed to be secure.
- 5) Offering measures to the recovery of livelihood to PAPs: Formulate the countermeasures to restore PAPs' livelihood.
- 6) Formulation of Resettlement Action Plan and promotion of citizen's participation in the project implementation stage: Formulate the local stakeholder meetings with citizen's participation and accept the opinion arisen from them into RAP.
- 7) Compensation for house loss at full replacement cost: Make compensation with full replacement cost without considering the depreciation or re-use of debris.
- 8) Grievance committee: Formulate a simplified, convenient and reliable committee including third parties.
- 9) Implementation of monitoring: Formulate the monitoring panel which is valid both legally and administratively.

5. PROJECT IMPLEMENTATION PLAN

5.1 PROJECT COST ESTIMATE

Considering characteristics and features of all works involved in MRT Line 6, construction works are proposed and categorized as shown in **Table 5.1-1**.

Table 5.1-1 Proposed Contract Group for MRT Line 6

Contract Group	Construction Works
Civil and Station Works in Main Line	• Elevated guideway • Embankment for At-grade guideway • Station structure and finishes • Station facilities (lighting, air conditionings, water supply, sewerage system) • Elevators and escalators
Civil and Building Works in Depot	• Embankment and/or concrete deck • Building structures and finishes • Building facilities (lighting, air conditionings, water supply, sewerage system) • Elevators and escalator
E&M Systems	• Track works • Sub-stations equipment and those buildings • Catenary system • Signal and telecommunication system • AFC and other operational systems in stations
Rolling Stocks and Equipment for Rolling Stocks in Depot	• Rolling stocks • Equipment for rolling stocks in Depot

With the above grouping by the construction contract, project cost has been computed in each Stage and the summary is shown in **Table 5.1-2**.

Table 5.1-2 Summary of Project Cost

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6. ECONOMIC AND FINANCIAL ANALYSIS

6.1 ECONOMIC ANALYSIS

6.1.1 Methodology

Economic analysis is carried out through economic cash flow analysis based on ‘benefit-cost’ analysis. Evaluation indices are conventional “Cost Benefit Ratio (CBR)”, “Economic Internal Rate of Return (EIRR)” and Net Present Value (NPV).

Economic benefit, which consists of saving in travel time cost of road traffic and MRT/BRT passengers, and reduction of vehicle operating cost, is computed with and without MRT Line 6.

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6.1.3 Result of Economic Analysis

Based on the results of the user benefit and cost estimate shown in the above section, MRT Line 6 was evaluated in terms of EIRR, CBR and NPV for assumed project implementation period of 35 years. Evaluation of the economic viability was done through comparative analysis between EIRR and a social discount rate which is 12.0%. Comparing it with the social discount rate, it can be said that the project is economically viable and feasible.

Table 6.1-1 Result of the Economic Analysis

Evaluation Item	Stage 1	Stages 1&2	All Stages
EIRR	25.4	25.2	25.6
CBR ¹⁾	7.2	7.3	8.8
NPV[million BDT] ¹⁾	240,122	307,381	438,699

1) Discount rate adopted is 12.0%

6.2 FINANCIAL ANALYSIS

6.2.1 Basic Assumptions

Financial performance of Stage1, Stages 1&2 and All Stages were examined based on the financial cash flow for the project implementation of MRT Line 6. Basic presumptions adopted in the financial analysis are as follows:

(1) Project Cost

Construction cost and operation/maintenance cost presented in Section 5 were set up as inputs for financial evaluation. Some basic presumptions in conducting financial evaluation are as follows.

- **Escalation factor:** Price inflation was not taken into account for both construction cost and operation/maintenance cost.
- **Tax and import duty:** Those taxes were included.
- **Land acquisition cost:** Land acquisition cost was included.

(2) Revenue

Fare revenue was set up on the basis of the results of traffic demand forecast and fare rate, which is set as 2.5 BDT per km for passenger. In addition, other expected revenue was also taken into account e.g. revenue from retail sales activities, advertising and so on. Other types of revenue were taken as 10% of fare revenue. Escalation factor was not taken into account, since project cost did not include any price inflation.

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6.2.3 Result of Financial Analysis

Each Financial performance by Stage 1, Stages 1&2 and All Stages is shown in the following table as a summary. In examining FIRR as well as NPV, FIRR is very low and all of NPV are negative. Taking into account of the analytical results, it is very hard to say that the project is financially viable on the basis of the self-financial business scheme. Therefore any kind of public financial support is indispensable.

Table 6.2-4 Result of Financial Analysis

Evaluation Item	Stage 1	Stages 1&2	All Stages
NPV [million BDT]	-35,102	-46,439	-54,357
FIRR [%]	0.92	0.56	0.12

Note: Discount rate is assumed to be 8% taking into consideration 10 year treasury bond in Bangladesh

6.2.4 Sensitivity Analysis

Sensitivity analysis was conducted for 1) Revenue fluctuation ($\pm 10\%$), 2) Construction cost fluctuation ($\pm 10\%$) and 3) Delay of completion of construction period (1 year delay). Results of the sensitivity analysis are as follows.

Table 6.2-5 Summary of the Results of the Sensitivity Analysis (Stage 1)

Corresponding variable	Cases of analysis	FIRR [%]
Revenue	Base case	0.92
	10% increase in every year	1.69
	10% decrease in every year	0.09
Construction cost	Base case	0.92
	10% increase in every year	0.36
	10% decrease in every year	1.57
Time of the completion of the construction	Base case	0.92
	1 year delay	0.69

Table 6.2-6 Summary of the Results of the Sensitivity Analysis (Stages 1&2)

Corresponding variable	Cases of analysis	FIRR [%]
Revenue	Base case	0.56
	10% increase in every year	1.32
	10% decrease in every year	-0.28
Construction cost	Base case	0.56
	10% increase in every year	-0.01
	10% decrease in every year	1.20
Time of the completion of the construction	Base case	0.56
	1 year delay	0.37

Table 6.2-7 Summary of the Results of the Sensitivity Analysis (All Stages)

Corresponding variable	Cases of analysis	FIRR [%]
Revenue	Base case	0.12
	10% increase in every year	0.92
	10% decrease in every year	-0.76
Construction cost	Base case	0.12
	10% increase in every year	-0.45
	10% decrease in every year	0.77
Time of the completion of the construction	Base case	0.12
	1 year delay	-0.04

6.3 OPERATION AND EFFECT INDICATORS

To quantitatively monitor the project's operational condition and effects, the following indicators are established considering objectives and functional characteristics of the MRT Line 6 Project.

Table 6.3-1 Operation and Effect Indicators of MRT Line 6 Project

Indicators	Unit	Base year (2009)	Stage 1 Opening Year (2020)	Stage 1& 2 Opening Year (2021)	Stage 1&2 1 Year After Opening (2022)	All Stage Opening Year 2022	Monitoring Year	
							All Stages (2025)	All Stages (2030)
Operation Indicators								
Passenger Kilometer	Pax.km/ Day ('000)	-	1,547	2,324	2,412	3,778	4,193	4,882
Train Kilometer	Train km/ Day	-	2,957	4,567	4,567	6,450	6,528	6,751
Fare Revenue	BDT('000)/ Year	-	3,672	4,688	4,860	5,587	6,223	7,246
Average Traffic Volume	PCU/ km	4,440	5,096	5,425	5,753	5,753	6,739	7,458
	PCU/ km	-	4,041	4,094	4,225	4,181	4,569	5,291
	Minute (Pallabi-Sonargaon)	51.0	71.1	--	--	--	--	--
	Minute (Pallabi-Saidabad)	81.6	113.9	131.8	153.7	--	--	--
	Minute (Uttara North - Saidabad)	110.4	--	--	--	207.9	445.5	1,247.6
Average Travel Time	Minute	-	109.8	108.5	112.5	146.8	164.2	226.8
	Minute	-	59.3	36.1	36.4	46.2	47.4	51.6
Effect Indicators	MRT Line 6	Breakdown	Stage 1 (18 min.) Bus (41.3 min.)	Stage 1&2 (26.2 min.) Bus (9.9 min.)	Stage 1&2 (26.2 min.) Bus (10.2 min.)	Stage 1&2 (26.2 min.) Stage 3 (10.2 min.) Bus (9.9 min.)	Stage 1&2 (26.2 min.) Stage 3 (10.2 min.) Bus (11 min.)	Stage 1&2 (26.2 min.) Stage 3 (10.2 min.) Bus (15.2 min.)
			*1					*2
Average Travel Speed	km/h	11.3	8.1	7.0	6.0	6.0	2.8	1.0
	km/h	-	8.4	8.5	8.2	8.5	7.6	5.5
	km/h	-	32.0	32.0	32.0	32.0	32.0	32.0
			*1					*2
Average Traffic Congestion Degree (V/C ratio)	-	0.81	0.93	0.99	1.05	1.05	1.23	1.30
	-	-	0.72	0.73	0.75	0.75	0.79	0.92

*2: Bangladesh Bank - Saidabad shall be bus transport

*1: Sonargaon - Saidabad shall be bus transport

Note 1) Effect Indicators of Stage 1 and Stage 1 & 2 are calculated on the basis of road links along MRT Line 6 between Pallabi and Saidabad via Bangladesh Bank. Total length is 15.374 km.

While effect indicators of All Stage are calculated on the basis of road links between Uttara North and Saidabad via Bangladesh Bank. Total length is 20.794km

2) Number of passengers is shown in Figure 4.3-13 in Chapter-4.

3) Tariff for MRT Line 6 is adopted to be 10 BDT per ride and 2.5 BDT / km.

4) Average travel time of bus transport (w/o MRT Line 6) = Total Length / Travel speed of bus transport (w/o MRT Line 6)

5) Average travel time of bus transport (w/ MRT Line 6) = Total length / Travel speed of bus transport (w/ MRT Line 6)

6) Average travel time of MRT Line 6 = MRT length / Travel speed of MRT Line 6 + Length of bus transport / Travel speed of bus transport (w/ MRT Line 6)

7) Length of MRT and bus transport adopted for calculation of above travel times is shown below

Stage	Assessment Section	Total Assessment Length	MRT Section	Length of MRT	Bus Route Section	Length of Bus Route
Stage 1	Pallabi - Saidabad	15.374 km	Pallabi - Sonargaon	9.596 km	Sonargaon - Saidabad	5.778 km
Stage 1& 2	Pallabi - Saidabad	15.374 km	Pallabi - Bangladesh Bank	13.979 km	Bangladesh Bank - Saidabad	1.395 km
All Stage	Uttara North - Saidabad	20.794 km	Uttara North - Bangladesh Bank	19.399 km	Bangladesh Bank - Saidabad	1.395 km

Source: JICA Study Team

7. REMAINING ISSUES AND RECOMMENDATIONS

7.1 REMAINING ISSUES

- DTCB shall coordinate with the following agencies
 - Bangladesh Bridge Authority (BBA) to review the plans and alignment of on-going Dhaka Elevated Expressway Project at Farmgate and Sonargaon that conflicts with the proposed MRT Line 6 Project.
 - Ministry of Defense (MOD) to obtain the agreement for the proposed route A1 which is close to Tejgaon Airport before the project appraisal.
 - Rajdhani Unnayan Katripakkha (Dhaka Metropolitan Development Authority) (RAJUK), MOD, Dhaka Cantonment Board, National Housing Authority (NHA), Bangladesh Water Development Board (BWDB) and other related authorities have to discuss in detail the depot layout and settle the land acquisition issues before the project appraisal.
 - Relevant authorities and settle land acquisition for proposed five (5) substations before the design stage.
 - DTCB shall obtain an official confirmation of the supply of required power for MRT Line 6 from Ministry of Energy before the project appraisal.
 - Department of Environment (DOE) to renew the Environment Clearance Certificate (ECC) before the expiry date.
- Effective organizational structure for project implementation and operation/maintenance of MRT Line 6 is essential to operate MRT Line 6 efficiently and smoothly. The organizational structure should be urgently established.
 - Organizational structure for the project implementation shall be established before the project appraisal.
 - Organization structure for operation & maintenance shall be established to keep sufficient time for training the staff before the completion of Stage 1.

7.2 RECOMMENDATIONS

- The Phase 2 Study concluded that MRT Line 6 Project is feasible in terms of technical, socio-environmental, and economic view-points. Therefore the Project shall be implemented at the earliest possible time to solve chronic traffic congestion and providing people's mobility and accessibility in and around Dhaka.
- As the first urban rail project in Bangladesh, and considering the nature of a railway project being a huge investment in urban infrastructure, the MRT Line 6 Project must be funded by

the Government. In order to make it a financially viable project, the Government shall be taken into consideration while introducing the ODA loan such as Yen Loan.

- Park and Ride (P&R) system along Stage 3 Section between Pallabi Station and Uttatara North Station should be considered in design stage to improve traffic congestion in the urban area along MRT Line 6.
- Provision of Bus Rapid Transit (BRT) system between Uttara Phase 3 Development area and Pallabi Station shall be studied until construction of Stage 3 Section will be completed. Shuttle bus service between Bangladesh Bank Station and Saidabad Bus Terminal shall be provided.
- Institutional framework for land acquisition and resettlement shall be formulated and training of staff shall be carried out as early as possible for smooth project implementation.
- Project cost shall be reviewed based on new findings and efforts to reduce project cost by adopting new technology shall be continued even after this Study.