Initial Environmental Examination

Project No. 42169-024
July 2022

Bangladesh: Greater Dhaka Sustainable Urban Transport Project - Additional Financing

Prepared by Roads and Highway Department (RHD), Government of the People's Republic of Bangladesh for the Asian Development Bank.

CURRENCY EQUIVALENTS

(As of 14 July 2022)

Currency unit	–	Taka (Tk)
Tk.1.00	=	US$0.0106
US$1.00	=	Tk.93.617

ABBREVIATIONS

ADB	–	Asian Development Bank
BOD	–	Biological Oxygen Demand
BRT	–	Bus Rapid Transit
CCF	–	Chief Conservator of Forests
EIA	–	Environmental Impact assessment
EMP	–	Environmental Management Plan
EPCM	–	Engineering, Procurement, and Construction Management
ESC	–	Environmental and Social Circle
ESO	–	Environmental and Safety Officer
ESS	–	Environmental and Safety Specialist
GDSUTP	–	Greater Dhaka Sustainable Urban Transport Project
IEE	–	Initial Environmental Examination
IES	–	International Environmental and Safety Specialist
MMP	–	Materials Management Plan
MOC	–	Ministry of Communications
MOEFCC	–	Ministry of Environment, Forests and Climate Change
PM_{10}	–	Particulate Matter with diameter of 10 microns or smaller
$PM_{2.5}$	–	Particulate Matter with diameter 2.5 microns or smaller
PIU	–	Project Implementation Unit
PPE	–	Personal Protective Equipment
REA	–	Rapid Environmental Assessment
RHD	–	Roads and Highways Department
SPAR	–	Social and Poverty Assessment Report
SPS	–	ADB's Safeguard Policy Statement
ECA	–	Environmental Conservation Act (995)
ECR	–	Environmental Conservation Rules (1997)
TSP	–	Total Suspended Particulate
TSS	–	Total Suspended Solids
TTMP	–	Temporary Traffic Management Plan

WEIGHTS AND MEASURES

dB(A)	-	decibel (A-weighted)
masl	-	meters above sea level
km	-	kilometer
km^2	-	square kilometer
m	-	meter
m^3	-	cubic meter

NOTE

In this report, "$"refers to US dollars.

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

1. The project will contribute to the development of a sustainable urban transport system (UTS) within the Tongi and Gazipur Pourashavas Area (TGPA), which forms part of north Greater Dhaka, through the delivery of a 20-km bus rapid transit (BRT) corridor. This pilot project provides a holistic solution for integrated urban mobility, with a demonstration effect, as no modern mass-transit system exists in Bangladesh yet.

2. The project is the first in a series of planned BRT lines in Dhaka, and is approximately 20 km from the southern terminal, near the international airport, to the Gazipur Depot. The existing alignment is on the main National Highway 3 (NH3) to Joydebpur Chowrasta. The first 4-km of the alignment – from the airport to Tongi Bridge, is within Dhaka City Corporation. The rest of the alignment passes through Tongi Pourashava and Gazipur Pourashava. The BRT is located on NH3 as far as Joydebpur Chowrasta (Km 16.3) and then makes a right turn to run west to east as far as Gazipur.

3. This report prepared in 2012 was the initial environmental examination (IEE) for the project and complies with the provisions of Asian Development Bank's Safeguard Policy Statement (SPS, 2009). The IEE was carried out to ensure that the potential adverse environmental impacts were appropriately mitigated, and to present the environmental assessments for the project. The project corridor runs from Dhaka Mymensingh Road (16 km) to Joydebpur Chowrassta to Gazipur Road (4km) (Figure 1).

4. The objectives and scope of the IEE are to (i) assess the existing environmental conditions of the project area; (ii) identify potential environmental impacts from the proposed works; (iii) evaluate and determine the significance of the impacts; (iv) develop an environmental management plan (EMP) detailing mitigation measures, monitoring activities, reporting requirements, institutional responsibilities, and cost estimates to address adverse environmental impacts; and (v) carry out public consultations to document any issues/concerns and to ensure that such concerns are addressed in the project design. This IEE was submitted to ADB by the Roads and Railways Division under the Ministry of Communication, Government of Bangladesh, and the final IEE report was disclosed to the public through the ADB website and relevant project website.

5. The original plan of implementation of GDSUTP project scheduled to be commenced in 2013 and completed by 2017. The construction of BRT project has experienced many unexpected hindrances and hence the project happened to be delayed by 4-5 years from the first planned schedule. New completion time is June 2022 and to cope with the financial inflation and increase of construction materials, an Additional Financing (AF) has been approved by ADB mainly to meet cost overrun of the BRT project. As far as design is concerned, pavement design of the existing road is changed for both C-01 and C-02 from single layer overlay, that was assumed adequate during the design, to full reconstruction with new Polymer Modified Bitumen (PMB) wearing course and bitumen binder base course after widening, due to poor condition of the existing pavement and to serve high volume of heavy trucks. PMB also possesses less temperature sensitivity than plain bitumen PMB, hence durable against high variability under climate change condition. Other design changes included: large amount of drainage facilities to be added during the implementation, change of concrete type for C-01, increased maintenance works of existing roads, and change of girder type for C-01 under the AF. Adequate drainage facilities will reduce chance of inundation and flooding even during high monsoon.

6. Under operation phase, GDSUTP-AF has planned, as one of the options, to operate Battery Electric Buses (BEB). As BEB technology is changing fast, particularly regarding the capacity and autonomy of batteries, procurement of batteries could be under a leasing scheme, where manufacturer of batteries will remain as owner and replacement of batteries will be their responsibilities - battery will then be supplied as a service. This process of operating BRT will bring no risk of battery dumping after life time. Through this approach environmental impacts will be zero during operation phase of BRT.

7. Original IEE report of GDSUTP was prepared and approved in 2012 in accordance with the ADB SPS 2009. Since commencement of construction works about 7/8 years has elapsed and 80% and 67% physical progress have been accomplished for two major contracts, CO1 and CO2 respectively till May 2022. In addition, the BRT project obtained several design variations and implemented adaptive changes as required during the construction works. Time difference since preparation of the IEE report and caused design variations justify updating of the IEE and the EMP for GDSUTP-AF. Based on available data and information obtained from the Mid Term Review of the BRT project in March 2022, ADB Concept Note in June 2022 and AFD Concept Note on BRT Operation Preparation in May 2022, the project proponent updates IEE report and the EMP.

8. About 2022 Updates of the IEE Report. This original report has been updated only in relevant sections and subsections that deem important from the perspective of proper environmental management during the construction and operation phases of GDSUTP-AF. Project description (Section - IV) provides updates about design revisions that have been taken place and planned under GDSUTP-AF. COVID-19, which has been emerged as global pandemic and serious concern for health and safety issue, has been incorporated in the Anticipated Environmental Impacts and Mitigation Measures (Section-VI) of this report. In addition, BRT operational period issue of using battery-operated bus that may generate hazardous waste is also discussed in the operation phase subsection of Section-VI. Environmental Management Plan (EMP), the major working tool of the IEE given in Section-IX, is also updated particularly through revision of the issues and cocenrns on dust control, construction/spoil management, safety precautions, COVID-19 management, public inconvenience and accident prevention, and compensatory tree plantation. Operation phase of the EMP has also been updated to accommodate additional mitigation measures to tackle detrimental characteristics of hazardous material/waste of BRT operation and effluent management in the BRT Bus depot. Environemntal management cost, the BOQ item of implementation of EMP and Environmental Monitoring Plan, has been revised to meet additional expenditures of the EMP implementation during construction and operation phases.

9. **Project description**. The project will restructure the main urban transport corridor from Dhaka's international airport to Gazipur through: (i) a 20-km BRT route designed and built following international best practices and quality standards; (ii) two mixed-traffic lanes and one non-motorized traffic (NMT) lane per direction, and sidewalks; (iii) improvement of 62 access feeder roads in favor of NMT; (iv) an efficient high capacity drainage system installed all along the restructured corridor; and (v) a BRT terminal and depot in Gazipur.[1]

[1] The terminal at Gazipur is proposed in front of Gazipur railway station and will remain within the public ROW; the depot is proposed 2km west of the terminal on Chowrasta-Joydevbpur Road on 2.0 ha of public land belonging to the Bangladesh Telecommunication Company Limited (BTCL), under Ministry of Posts and Telecommunications (MoPT).

10. The project will also improve the urban quality of the corridor through construction of total of 24.10 km drains, and 33.60 km feeder road (62 different roads, of which 23.66 km bituminous road and 9.94 km CC road) have been constructed. Under the scope of GDSUTP-AF, ADB and AFD have agreed to restructure the project during the mid-term review mission dated on 20 March 2022: (a) ADB will support to complete the remaining civil works infrastructure, including streetlighting procurement and installation, and construction supervision service; and (b) AFD agreed to fund and implement the BRT operational part, including procurement of ITS, Buses, and logistics and system with additional financing. Based on the restructuring of the project, the output statement and output indicators in the design and monitoring framework (DMF) are revised. However, the outcome of the project remains unchanged hence this constitutes a minor scope change.

11. The project will also undertake institutional developments to efficiently manage BRT operations with the private sector and ensure efficient operations. This draft IEE focuses on the key physical activities of the above outputs.

12. Categorization. The project is classified as category B in accordance with ADB's SPS, as no significant impacts are envisioned.

13. **Implementation arrangements**. The executing agency for the project is the Roads Division (RD). A project management unit (PMU) will be established at RD and will be headed by a full-time project director. An environmental and social safeguard unit (ESSU) will be established in the PMU. The PMU/ESSU will consist of an environmental and safety officer (ESO) and a social safeguards officer (SSO) to oversee safeguards implementation and monitoring of the project. The ESO will submit an updated IEE and semiannual reports to ADB for review. There will be three implementing agencies:

(i) Roads and Highway Department (RHD) –will implement the main corridor restructuring, except the elevated section.

(ii) Bangladesh Bridges Authority (BBA) – will implement the 4.5 –km elevated section, integrating the new Tongi bridge and Abdullahpur intersection flyover.

(iii) Local Government Engineering Department (LGED) – will implement BRT depot facilities in Gazipur, and municipal infrastructures improvements (local roads and drains).

14. A project implementation unit (PIU) will be established in each of these implementing agencies, which will be headed by a full-time project manager. PIUs will each have an environmental officer and a resettlement officer who will receive support from the engineering, procurement, and construction management (EPCM) consultants, and will be assisted by a non-government organization to implement the resettlement plan. Safeguard specialists for environment and resettlement will be a part of the EPCM, including an international resettlement specialist (IRS) and a national resettlement specialist (NRS) to update the draft IEE during detailed design and ensure compliance with both ADB and Government of Bangladesh requirements. These specialists will also conduct safeguards capacity building activities within the PMU/ESSU and PIUs.

15. **Policy, legal, and administrative framework.** The project shall comply with the requirements of the ADB SPS and the government’s guidelines or initiatives on implementation of Environmental Conservation Rules Act1997 (under Environmental Conservation Act as amended ECR, 1997). The Ministry of Environment and Forests (MOEF) delegates powers to the

Director of Environmental Clearance in the Department of Environment (DOE) to approve environmental assessments, and MOEF will receive a copy of the environmental assessment before construction commences. However, certain activities commonly associated with infrastructure projects such as quarry operations, extraction of gravel, or discharge of wastewater may also require clearance from DOE and permission from relevant district level authorities from the *pourashavas*.[2] On behalf of the PMU, the ESSU (assisted by EPCM) will disclose the scale and scope of the project to the environmental authorities in due course. The ESSU (assisted by EPCM consultants) will also process the environmental clearance of the project under the Environmental Conservation Act (ECA, 1995, as amended). The statutory environmental assessment will be triggered by submission of the IEE to DOE and an application for environmental clearance. This will result in agreement of terms of reference for the statutory environmental assessment. The acceptance (in principle) of the environmental assessment by DOE will trigger a location clearance, after which clearance of the project corridor can start. Physical demolition and construction works will only take place after DOE has issued the environmental clearance certificate of the project under ECR 1997.

16. **Environmental management plan**. Mitigation measures, environmental monitoring, and capacity development are required to minimize the environmental impacts in the design, construction, and operational phases. The main issues relate to planning and design of BRT structures and roadside drainage; control of construction impacts such as traffic interruption; reprovisioning of utilities and telecommunications; spoil and waste disposal; and noise and dust during construction.

17. RT will allow faster, more efficient mass public transport and improved traffic flow on the adjacent traffic lanes, smoother asphalt pavement, and improved roadside gutters and drainage. Reduced air pollution from disturbed dust can also be expected.

18. **Information disclosure, consultation, and participation**. The stakeholder consultation process disseminates information to all key stakeholders, including the general public and authorities, through meetings and door-to-door surveys along the project corridor. Information was provided in advance on the scale and scope of the project works, expected impacts, and the proposed mitigation measures by means of consultations with government departments, utilities, educational institutions, local authorities, and the general public in meetings and by surveys. The process also gathered information on relevant concerns of the authorities and local community so as to address these in the project implementation stage.

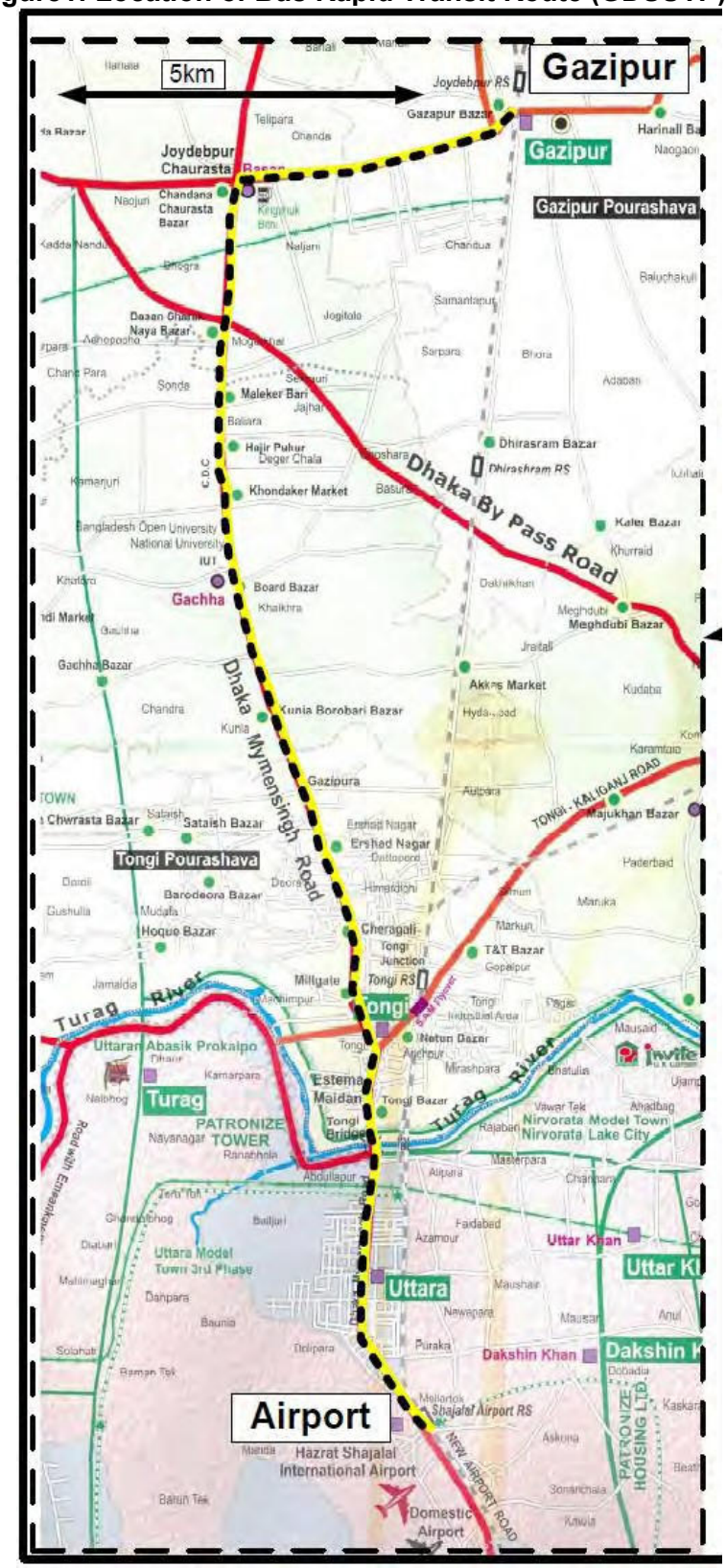
19. **Grievance redress mechanism (GRM)**. A GRM will be established to receive, evaluate and facilitate the resolution of affected people's concerns, complaints, and grievances. The GRM aims to provide a time bound and transparent mechanism to voice out and resolve social and environmental concerns linked to the project.

20. **Conclusion and recommendations**. The project construction is restricted to areas within the defined right of way (RoW), and the land required for terminals and depot. This IEE study was carried out when the project was at the feasibility (preliminary) stage of design during the TA 7415 BAN implementation. The impacts from construction and operation will be manageable, and no insurmountable impacts are predicted, provided that the EMP is included in the contract (RHD, BBA, and LGED shall ensure this), and its provisions are implemented and monitored to its full extent. In case of any change in the design details, such as the location and

[2] Local government in urban and rural areas is entrusted to bodies elected by the people called *pourashavas* or city corporations.

the scope of the proposed project, the environmental assessment and EMP shall be reviewed and revised accordingly. There is no need for further environmental impact assessment (EIA) as the provisions in the IEE and EMP will mitigate the impacts.

Figure1: Location of Bus Rapid Transit Route (GDSUTP)



II. INTRODUCTION AND BACKGROUND INFORMATION

A. Introduction

1. ADB approved the current project for a loan on 17 April 2012. The project was planned to be implemented over 5 years, and original loan closing date was 31 December 2017. Later due to lingering of project activities, till-date 4 extensions have been passed and final closing date is 31 December 2022. The project is co-financed by AFD and Global Environment Facility (GEF). GEF loan is fully administered by ADB, while partly for AFD loan.

2. The GDSUTP will contribute to the development of a sustainable urban transport system in Gazipur (an area in the northern part of Greater Dhaka administered by the Gazipur City Corporation (GCC))—through delivery of a 20-kilometer (km) bus rapid transit (BRT) corridor. The expected outcome of the project will be the improved public transport system of the Dhaka North City Corporation (DNCC) and GCC, benefiting approximately 1 million people. The project includes the following three outputs:

(i) Output 1: DNCC and GCC's main urban transport corridor is restructured,
(ii) Output 2: Project management is effective and BRT operations are sustainable, and
(iii) Output 3: Urban quality of the corridor is improved

3. The Roads, Transport and Highways Division (RTHD) of the Ministry of Road Transport and Bridges (MORTB) is the executing agency (EA) for the project and the implementing agencies (IAs) are: (i) Roads Highways Department (RHD), (ii) Bangladesh Bridge Authority (BBA), (iii) Local Government Engineering Departments (LGED), and (iv) Dhaka Bus Rapid Transit Company Limited (DBRTCL).

4. The project will develop a 20-km BRT corridor from the airport intersection to Gazipur (16 km at grade and 4.5 km elevated, including 6 flyovers and 25 BRT stations, and a bus depot). The project was designed as part of an integrated mass transit system of six metro rail and one bus transit subsystems under the Strategic Transport Plan (STP) of the government, approved in 2005, and included the BRT operations.

5. The project includes four civil works packages:

(i) Package-C01: Construction of 16 km at grade section,
(ii) Package-C02: Construction of 4.5 km elevated section,
(iii) Package-C03: Construction of feeder roads; and
(iv) Package-C04: Construction of Bus Depot at Gazipur.

6. The project also includes four consultancy contracts:

(i) project management, coordination and capacity building (PMCCB)—to support EA/IAs on procurement, capacity building and project management;
(ii) engineering, procurement and construction management (EPCM)—to support the EA/IAs on preparing the detailed design, bid documents and construction supervision;
(iii) operations design and business model (ODBM)—to support DBRTCL for preparing the BRT business model, fair system and BRT operational plan; and
(iv) resettlement NGO to support EA/IAs on land acquisition and resettlement plan implementation.

B. **Background Information**

7. Initial Environmental Examination. This IEE report was prepared in 2012 in accordance with the provisions of Asian Development Bank's Safeguard Policy Statement (SPS, 2009). The IEE has been carried out to ensure that the potential adverse environmental impacts are appropriately mitigated, and to present the environmental assessments for the project. The project corridor runs from Dhaka Mymensingh Road (16 km) to Joydebpur Chowrassta to Gazipur Road (4km). The potential impacts of this project were expected to be site-specific, low-scale adverse and mostly reversible. The Project therefore was classified as category B in accordance with the Safeguard Policy Statement (SPS), 2009 of the Asian Development Bank (ADB). The project obtained the Environmental Clearance Certificate (ECC) on 22 May 2016 which was later renewed up to 01 May 2022. The project proponent submitted application along with required documents to the DoE for further renewal of the ECC up to May 2023.

8. Project implementation progress. The construction of BRT project has experienced many unexpected hindrances and hence the project happened to be delayed by 4-5 years from the first planned schedule. New completion time is December 2022 and to cope with the financial inflation and increase of construction materials. As of 31 May 2022, the overall civil works progress of the project is 75.59%. Contracts of Packages C03 and C04 and NGO have been completed and closed; and Packages C01 and C02 are ongoing with physical progress of 80.4% and 66.2% respectively (as of 31 May 2022). All four consultancy services are awarded and ongoing. The procurement of mechanical & equipment (ITS, buses and traffic management) and fleet scrapping program have not started yet. IFB for procurement for remaining package for solar-powered streetlighting was published on 24 June 2022.

9. Project Restructuring. ADB and AFD have agreed to restructure the project during the mid-term review mission dated on 20 March 2022: (a) ADB will provide additional financing to complete the remaining civil works infrastructure, including streetlighting procurement and installation, and construction supervision service; and (b) AFD agreed to fund and implement the BRT operational part with additional financing. Including procurement of ITS, Buses, and logistics and system. Based on the restructuring of the project, the output statement and output indicators in the design and monitoring framework (DMF) are revised. However, the outcome of the project remains unchanged hence this constitutes a minor scope change. The restructuring of the project has been discussed and agreed by the Government and AFD.

10. Design Variations. Meanwhile, several design variations have been made that led to financial increase as well. Pavement design of the existing road is changed for both C-01 and C-02 from single layer overlay, that was assumed adequate during the design, to full reconstruction with new Polymer Modified Bitumen wearing course and bitumen binder base course after widening, due to poor condition of the existing pavement and high volume of heavy trucks. Other design changes included: large amount of drainage facilities to be added during the implementation, change of concrete type for C-01, increased maintenance works of existing roads, and change of girder type for C-01 under the AF.

11. Additional Financing for GDSUTP. The additional financing is required to finance the cost overrun to complete the remaining project activities and to ensure the invested BRT system operational. The overall project scope is aligned with the government’s priorities under the Eighth

Five Year Plan, FY2020–FY2025,[3] ADB's Country Partnership Strategy for Bangladesh, 2021–2025,[4] and the Revised Strategic Transport Plan for Dhaka (RSTP).[5]

12. DBRTCL of the has planned to operate Battery Electric Buses (BEB). As BEB technology is changing fast, particularly regarding the capacity and autonomy of batteries, procurement of batteries could be under a leasing scheme, where manufacturer of batteries will remain be owner and replacement of batteries will be their responsibilities - battery will then be supplied as a service. This process of operating BRT will bring no risk of battery dumping after life time. Through this approach environmental impacts will be zero during operation phase of BRT, however stringent policy should be followed to dispose of hazardous batteries in environmentally friendly way.

C. Updating IEE Report

13. About 2022 Updates of the IEE Report. Original IEE report of GDSUTP was prepared and approved in 2012 in accordance with the ADB SPS 2009. Since commencement of physical construction works about 7/8 years passed and about 80% and 67% physical progress accomplished for two major contracts, CO1 and CO2 respectively till May 2022. In addition, the BRT project obtained several variations and implemented adaptive changes in design which may have triggered basis for environmental re-categorization and updating of the IEE report and EMP. Based on available data and information obtained from the Mid Term Review of the BRT project in March 2022, ADB Concept Note in June 2022 and AFD Concept Note on BRT Operation Preparation in May 2022, the project proponent realizes justified to update below issues of the IEE report to commence BRT-AF activities:

Issues need update	**Section in the Report**
Environmental regulatory compliance for BRT-AF	Section II: Background of the report
Updating design variations and adaptive changes	Section IV: Description of Project
- General and Hazardous waste management - COVID-19 pandemic related health safety	Section VI: Anticipated Environmental Impacts and Mitigation Measures during Operation Period
- Re-emphasis implementing mitigation measures to offset pollution caused by dust, construction waste/spoil; to prevent accidents, conduct compensatory tree plantation; to control COVID-19 pandemic during construction phase. - Implement necessary mitigation measures to control indiscriminate waste dumping, hazardous waste/material management, and	Section IX: Environmental Management Plan

[3] Government of the People's Republic of Bangladesh. Bangladesh Planning Commission. 2020. *Eighth Five-Year Plan July 2020 – June 2025: Promoting prosperity and fostering inclusiveness.* Dhaka.

[4] ADB. 2021. *Country Partnership Strategy: Bangladesh - Sustain Growth, Build Resilience, and Foster Inclusion, 2021–2025.* Manila

[5] JICA. 2016. *Revision and Updating of the Strategic Transport Plan for Dhaka*, Tokyo

to control COVID-19 or other health-safety related issues. F	
Updating Environmental Management Cost which was estimated 10 years ago.	Section IX: Environmental Monitoring and EMP implementation cost in Table 13
Updating relevant information in Executive Summary, Introduction and Conclusions	Executive Summary Introduction and Background, and Conclusions and Recommendations

III. POLICY AND LEGAL FRAMEWORK

A. Environmental Regulatory Compliance

13. The implementation of the project will be governed by ADB SPS and the environmental laws, policies, and regulations of the Government of Bangladesh.

14. **Asian Development Bank**. The ADB SPS addresses environmental concerns, if any, of a proposed activity in the initial stages of project preparation. For this, the ADB SPS categorizes the proposed components into A, B, or C to determine the level of environmental assessment required to address the potential impacts. The project has been categorized as B. Stakeholder consultation was an integral part of the IEE, and an environmental management plan (EMP) specifying mitigation measures to be adhered to during implementation of the project has been prepared.

15. **Government of Bangladesh**. The implementation of the project will also be governed by laws, regulations, and standards for environmental assessment and management of the Government of Bangladesh. Table 1 summarizes the main requirements of the government for environmental management that will apply to the project.

Table1: Government Environmental Policies, Laws, Regulations, and Standards

Statute	Outline	Relevance
National Environment Policy 2018	National Environment Policy envisages environment conservation, pollution control, biodiversity conservation, and mitigation of the adverse effect of climate change to ensure sustainable development.	Primary policy statements are articulated here and totally relevant in all phases of BRT project implementation.
Environmental Conservation Act 1995	Conservation of environment, improvement of Environmental standards, and control and mitigation of environmental pollution	The provisions of the act apply to all Project interventions in the construction and operation stage.
Environmental Conservation Rules (ECR),1997	Prescribes processes and requirements for obtaining environmental clearance by rules, through an environmental clearance certificate (ECC) from the Director General of the Department of the Environment (DOE) must be secured. Projects are classified according to Impact on the environment.	The project is categorized as red. All requisite clearances (LCC and ECC) from the DOE shall be obtained prior to commencement of civil work. RHD will proceed with the application for clearance in due course.
Environmental Court Act, 2000 (amended in 2002, 2010 and 2019)	Establishes environmental courts and procedure to make rules for the protection of environmental pollution. Environmental courts are at district level, but the government may establish courts outside the districts.	An environmental court has been established in Dhaka.
City Corporations Act 2009	Provide primary and public health services, sanitation, water supply, vector and infectious disease control, etc. to ensure public awareness and safety of the residents.	The project must integrate community health and hygiene of the residents and workers during the construction stage, and take forward appropriate issues to the Operational stage.

Statute	Outline	Relevance
National Forestry Policy,1994	Under the policy, due to dearth of forests, forestation is actively pursued with targets to implement programs of tree plantation and forestation on fallow and hinterland, the bank of the pond and homestead land, which are under private ownership.	There is no statutory requirement to replace street trees planted for beautification, but it is desirable to incorporate tree planting in the project corridor wherever it is practicable to do so as requested by the Conservator of Forests.
Dhaka Forest Transit Rules 1959	Applies to all timber transported in the Dhaka area. The project is located in the Dhaka north area. Some street trees may be under forestry authority control, whereas others may be trees planted for beautification.	The Commissioner of Forests should be consulted to confirm trees planted for beautification and other protected trees and as certain rules for marking and removal.
National Biodiversity Strategy and Action Plan, 2016-2021 (NBSAP)	NBSAP urges with the perspective of conservation, sustainable use and sharing the benefits of biodiversity of the country.	Forest department and Department of Environment are the two main govt agencies should be consulted during construction of this project.
Biodiversity Act, 2017	This law prohibits activities that may have an adverse effect on endangered animals or organisms, etc. important from the country perspectives of (a) adversely affect or may effect on endanger species; (b) adversely affect or may affect the environmental characteristics of the endangered ecological community; or (c) in accordance with the Ramsar Convention, the wetland may adversely affect or affect the environment and environmental characteristics of the declared area.	Forest department and Department of Environment are the two main govt agencies should be consulted during construction of this project.
Ecologically Critical Areas (ECAs) Management Rules, 2016	Need compliance during construction and operation phase. The rule prohibits many activities and processes in ECAs which are detrimental to the natural condition of habitat, tranquility, biodiversity, etc.	Relevant during demolition and construction of bridge on Turag river which is gazette as an ECA.
Fire Prevention & Extinguish Act, 2003	This law provides preparedness and response guidelines for safety against fire hazards.	It is relevant in regard to the prevention, the successful extinguishing of fire, and also reduction of damages and consequences of fire.
Fire Prevention & Extinguish Rules, 2014	Provides specific rules against violation of the Fire Prevention and Extinguish Act 2003.	It is relevant in regard to the prevention, the successful extinguishing of fire, and also reduction of damages and consequences of fire.
National Environmental Management Action Plan, 1995	Provides environmental sustainability and environmental pollution prevention action plans for improvement natural environment and biodiversity conservation for quality of life of the country's people.	Important from the perspective of identification of key environmental issues affecting the country, improvement of natural environment, conservation of habitats and bio-diversity, sustainable development, and quality of life of the people.
Vehicle Act 1927, the Motor Vehicles Ordinance 1983, and Bengal Motor Vehicle Rules 1940	This law is originated by the Bangladesh Road Transport Authority (BRTA) to control registration, traffic management rules, speed control, fitness, etc.	Relevant with respect to air pollution, noise, safety etc. Borrower compliance to be ensured and considered during construction and operation phases of the project.

Statute	Outline	Relevance
Noise Pollution (control) Rules, 2006	This provides noise standards for day-time and night-time along with approved guidelines for measuring noise at noise generation as well as noise receptor points.	Relevant to control high noise emanating from projects; compliance to be ensured during project implementation.
National 3R Strategy for Waste Management, DOE 2010	Provides guidelines for improved waste management, through reuse, recycle and	Relevant to borrowers who need to comply during construction and operation stages of project particularly with respect to solid and hazardous waste management, source reduction and disposal.
Bangladesh Labor Act 2006 (amendment 2018)	Provide labor engagement and their health-safety related legal guidelines and compliance requirements.	Relevant to borrowers who need to comply during construction and operation of projects particularly with respect to child labor, working environment, health-safety issues.
Bangladesh Labor Rules 2015	Provides rules of business for labor engagement, health safety related compliance standards, child labor prohibition related age limits, etc.	Relevant to project proponents to comply with applicable rules during the construction and operation of projects.
Fish Protection Ordinance and Rules (1982,1985 as amended).	Provides power by which the government may introduce rules to protect the destruction of, or any attempt to destroy, fish by poisoning the water, or depletion of fisheries by pollution, trade effluent, or otherwise.	The project must comply with any rules set out to protect inland water ways.
Inspection and Enforcement Manual (2008)	The manual was written to provide national standard and uniformity of environmental sampling for the inspection, investigation and chemist in the Department of Environment (DOE).	To be complied with where relevant to sampling and analysis
Acquisition Properties Ordinance (1982)	The government made these rules in exercise of the powers conferred upon by section 46 of Acquisition and Requisition of Immovable Property Ordinance, 1982 (Ordinance No. II of 1982).	To be complied with, see resettlement plan

RHD = Road and Highways Department.

16. The main provisions for environmental protection and pollution control in Bangladesh are contained in the Environmental Conservation Act (ECA, 1995) and Environmental Conservation Rules (ECR 1997). This legislation also provides the principal mechanism for assessing and mitigating the environmental impacts of projects, both existing and proposed. Under the ECR, projects are classified as green, orange, or red to determine the level of environmental assessment and requirements involved. According to ECR Schedule1, the project is red category because it involves construction, reconstruction, and extension of roads and bridges.[3] In due course an environmental assessment must be prepared in the prescribed format and be submitted to the Department of Environment (DOE) for approval. Table 2 shows the summary of environmental regulatory compliance required for the project.

B. Environmental Clearance Requirements

17. Rule 7 of the ECR requires that the application for environmental compliance certificate (ECC) must be made to the DOE divisional officer. Under the ECR, DOE has 60 days to respond from receipt of the ECC application for a red category project. The environmental assessment

[3]Consultation with the DOE during the course of this environmental assessment confirmed that the project is category red and requires EIA under the ECA and ECR.

process is summarized in Figure2.

Table2: Environmental Regulatory Compliance

Component Description	Government of Bangladesh		ADB	
	Category in Accordance with ECR	Environmental Assessment	Category in Accordance with SPS	Environmental Assessment
BRT	Red category: Construction, re-construction, and extension of roads and bridges	IEE, EIA and EMP	Category B	IEE

ADB=Asian Development Bank, BRT=bus rapid transit, ECR=environmental conservation rules, EMP=environmental management plan, EIA = environmental impact assessment, IEE = initial environmental examination, SPS= Safeguard Policy Statement.

C. Occupational Health and Safety

18. During construction, the project will conform to the labor laws and occupational and health related rules as outlined in Table 3.

Table 3: Relevant Occupational Health and Safety Laws and Rules

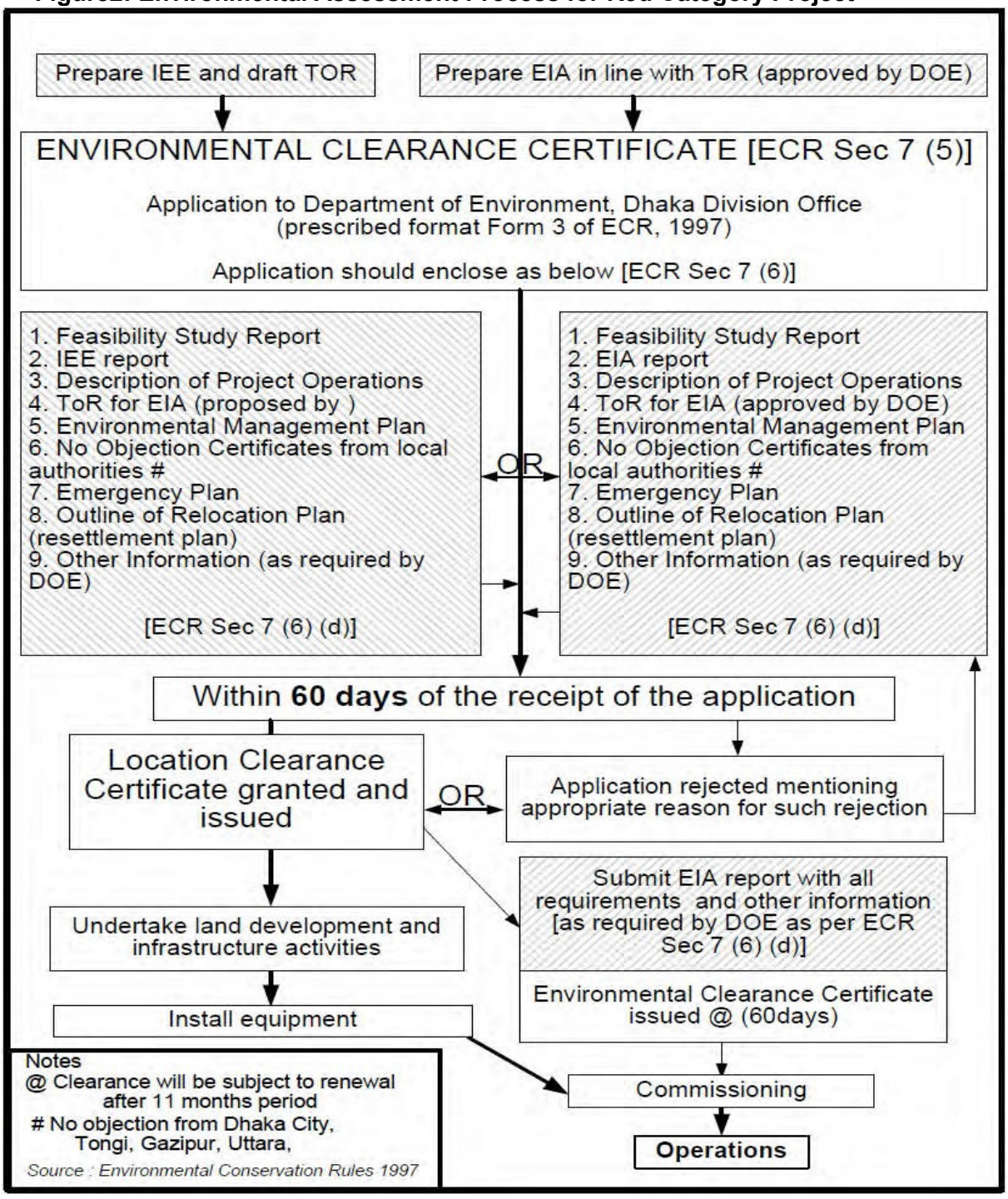
Title	Overview
Bangladesh Labor Act, 2006	Provides for safety of work force during construction period. The act provides guidance of employer's extent of responsibility and the workman's right to compensation in case of injury caused by accident while working.
Water Supply and Sewerage Authority Act,1996	The act calls for ensuring water supply and sewerage system to the public, preservation of system, and other related health and environmental facilities for the community.
Labor Relations under Labor Laws, 1996 (Revisions to scattered Acts and Ordinances to formulate a unified code.)	General concerns during the project implementation state that the project manager must recognize labor unions.
Public Health (Emergency Provisions) Ordinance,1994	Calls for special provisions with regard to public health. In case of emergency, it is necessary to make special provisions for preventing the spread of disease, safeguarding the public health, and providing adequate medical service, and other services essential to the health of respective communities and workers during construction-related work.
Bangladesh Factory Act, 1979	Work places provisions: these Act and Labor Laws require medical facilities, first aid, accident and emergency arrangements, and child care services to be provided to the workers at workplace.
The Employees State InsuranceAct,1948	Health, injury and sickness benefit should be paid.
The Employer's Liability Act,1938	Covers accidents, risks, and damages with respect to employment injuries.
Maternity Benefit Act,1950	Framed rules for female employees, who are entitled to various benefits for maternity.

Source: Bangladesh Government Rules and Regulation book.

D. International Conventions

19. Bangladesh is a party to several international conventions that are relevant to environmental management (Appendix6). None of these conventions have any director specific relevance for this IEE, as the project does not encounter any areas of environmental sensitivity covered by the conventions.

Figure2: Environmental Assessment Process for Red Category Project



DOE=Department of Environment, EIA=environmental impact assessment, ECR=environmental conservation rules, IEE =initial environmental examination, Tor= terms of reference.

IV. DESCRIPTION OF THE PROJECT

A. Background

20. Transportation is a major issue in Dhaka city. Public transportation in Bangladesh is inadequate to meet the growing demand for efficient travel. Increasing traffic congestion is becoming a serious impediment to mobility in the city and will have environmental, social, and economic impacts on Dhaka. This situation limits development and economic growth. Vehicular use is increasing, but most of the population still relies on bus and rickshaw services. However, the public transport system lacks service quality and the capacity to meet increasing travel demand. This in turn affects social conditions, urban environment, and quality of life.

21. In order to improve the road based public transport system, the government of Bangladesh has requested ADB to assist in financing the first section of a north-south bus rapid transit corridor from Gazipur to Uttara (near the airport). The implementation of BRT services along the first section is a critical first step to starting an integrated public transport system in Dhaka.

B. Existing Road and Traffic Conditions

22. The existing road that will become the proposed BRT corridor is located in the northern fringes of Dhaka. There is severe traffic congestion caused by high vehicular traffic flow with conflicting pedestrian and non-motorized transport (NMT) movements. The road is one of the main routes into and out of the city to the north.

23. There are numerous intersections (Figure 3.1) and more than 150 roads (some narrow, some wide) that lead to the proposed BRT corridor from the east and west sides. Road side trading is common and thousands of commercial premises such as offices, roadside shops, and factories are in the city.

24. During daylight, the traffic in this highway consists of public motor vehicles, cars, motor bikes, small trucks, and other non-motorized vehicles. The project corridor's length is approximately 20 km from the terminal airport to the terminal at Gazipur (Figure 3.2). The road is fairly flat from the origin to km 20, and has an altitude of 7 meters above sea level (masl).

C. Project Components

1. Urban Transport Corridor

25. The scope of the BRT Airport-Gazipur and the major project activities are summarized as follows:

i. At-grade, centrally located BRT lanes for 16.0 km with one segregated lane per direction between the Airport station and Gazipur Station with additional lanes for passing at designated stations;

ii. 4.5 km long elevated section of BRT between House Building and Cherag Ali Market (Km 2+600 to Km 7+100) includes the reconstruction of the bridge over the Turag River incorporating the interchange with the Ashulia Road at Abdullahpur.

iii. 6 additional flyovers at main junctions including a major interchange at Chowrastra with

the Mymensingh road.

iv. At grade BRT lanes will use flexible pavement construction with reinforced concrete pavement provided through the station areas where braking and acceleration forces are high.

v. 25 island type or staggered island type closed stations with pedestrian foot over bridges for access at 14 stations including escalators and lifts for passengers, entry/exit sliding doors for control at edges of platforms.

vi. 1 bus depot at Gazipur with parking for 94 buses and including a maintenance and administration building, electrical sub-station, fuel storage and filling station, bus chassis/outer washing station, waste materials store, effluent treatment plan, water reservoir, boundary wall with gate/guard house and access road.

vii. Two mixed traffic lanes and one NMT lane per direction and sidewalks along either side of the BRT.

2. Urban Quality Improvements

30. The project will also improve the urban quality of the corridor through

(i) procuring and installing 1000 energy-efficient street lighting along the corridor;

(ii) 113 access feeder roads improved in favor of NMT for a distance of 100 meters from the corridor totaling 49 km.

(iii) High Capacity Drainage system along the restructured corridor.

(iv) improving municipal infrastructures, including ~~8 local markets,~~ local drains and local roads;

(v) Installation of BRT priority traffic lights and closed-circuit cameras (CCTV) at main junctions, and mobile vehicle emission testing devices;

(vi) The project will also undertake institutional developments to efficiently manage BRT operations with the private sector and ensure efficient operations;

(vii) Deploy necessary resources for implementation of environmental safeguards activities;

(viii) Social Safeguards involving monitoring of Land Acquisition and the Implementation of the Resettlement Plan.

D. Proposed Alignment

31. The project alignment will mainly run north along the Dhaka-Mymensingh road. The alignment will start at a terminal station near the main entrance to the airport and continues in a northerly direction for about 16 km to Joydebpur Chowrasta roundabout. From this point the alignment will run to the east to Gazipur to a BRT terminal located in front of the Gazipur railway station within the Right of Way of RHD, on public land, and a depot located nearby in Gazipur, 2kilometer west of BRRI on the north side of the Chowrasta-Joydevbpur Road, on a public land belonging to the Bangladesh Telecommunication Company Limited (BTCL), under the Ministry of Posts and Telecommunications (MoPT). From the southern end for about 4 km, the alignment is at ground level (Figure 4). The section from Km 2.6 to Km 7.1 is elevated. There are six overpasses for BRT buses and other vehicular traffic at the major intersections. Figures 3 – 5

illustrate the major features of the preliminary design.

E. Stations and Terminals

32. There are 31 stations planned in between the two terminal locations. There are 28 stations between the airport and Joydevpur Chowrasta and three more stations between Joydevpur Chowrasta and Gazipur terminal (Table 4). The stations will be located in the center of the Dhaka-Mymensingh Road or Joydevpur Chowrasta to Gazipur Bazaar Road. There are several variations of station layout as shown in Figure 6. Stations between Tongi Bazaar and Dewra are on the elevated section. There is a terminal at each end of the BRT, near the airport railway station (Km 0) and one at Gazipur (Km 20). The Gazipur BRT terminal will be located in front of the Gazipur railway station within the Right of Way of RHD, on public land, and a depot located nearby in Gazipur, 2 kilometer west of BRRI on the north side of the Chowrasta-Joydevbpur Road, on a public land belonging to the Bangladesh Telecommunication Company Limited (BTCL), under the Ministry of Posts and Telecommunications (MoPT) (Figure 3).

Table 4: Summary of Proposed BRT Stations

Serial	Chainage	Type	Location	Proposed Access
01	0+250	D	Airport Railway Station, BRT Terminal	F.O.B
02	0+650	B	Civil Aviation	Underpass
03	1+300	B	Sector-1 Uttara-Jashimuddin Sarani	Underpass
04	2+000	B	Sector– 4 Uttara (Rajlakshmi)	Underpass
05	2+500	C	Sector– 6 Uttara –Rabindra Sarani, Azampur	Underpass
06	2+850	B	Sector–6 Uttara–Sonargaon Road (Muscat Plaza)	Underpass
07	3+550	B	Abdullapur (House Building)	Underpass
08	4+075	C	**Tongi Bazar**	Underpass
09	4+700	C	**Esthema Field**	Underpass
10	5+400	C	**Station Road, Tongi**	Underpass
11	6+000	C	**Mill Gate**	Underpass
12	6+750	C	**Cherag Ali Market**	Underpass
13	7+400	C	**Tongi College**	Underpass
14	7+900	C	**Dewra**	Underpass
15	8+400	C	Gazipura	Underpass
16	8+900	B	Kunia	Underpass
17	9+650	B	Takpara	Underpass
18	10+250	C	Borobari Bazar	Underpass
19	11+000	C	Board Bazar	Underpass
20	11+450	B	Islamic University (IUT)	Underpass
21	12+150	B	National University	Underpass
22	12+525	B	Khondokar Market	Underpass
23	13+050	B	Hazi Pukur/Chaydana	Underpass
24	13+650	C	Maleker Bari	Underpass
25	14+250	B	Bashan	Underpass
26	14+700	C	Bhogra	Underpass

Serial	Chainage	Type	Location	Proposed Access
27	15+500	B	Chowrasta South	Underpass
28	15+950	C	Chowrasta	Underpass
29	16+550	C	Chowrasta East	Underpass
30	17+450	A	Darus Salam Mosque (ctg1)	At grade
31	18+250	A	Arong Milk Factory (ctg2)	At grade
32	19+450	A	Gazipur Bazar (ctg3)	At grade
33	20+100	D	Gazipur Terminal	F.O.B

BRT = bus rapid transit, F.O.B. = foot over bridge.
Source: Consultants Final Report TA 7415. Stations in bold are elevated.

F. Station Access

33. There will be underground tunnel access (underpasses) from the side foot paths to the 28 stations planned in between the airport and Joydevpur Chowrasta. There will be grade access to the three stations between Joydevpur Chowrasta and Gazipur Bazaar, and option of grade access or overhead foot bridge access to the two terminal stations at airport and Gazipur.

G. Pavement

34. Under GDSUTP-AF, pavement design of the existing road is changed for both C-01 and C-02 from single layer overlay, that was assumed adequate during the design, to full reconstruction with new Polymer Modified Bitumen wearing course and bitumen binder base course after widening, due to poor condition of the existing pavement and high volume of heavy trucks. Other design changes included: large amount of drainage facilities to be added during the implementation, change of concrete type for C-01, increased maintenance works of existing roads, and change of girder type for C-01.

H. Bridge

35. The Tongi Bridge over the Turag River/Tongi Khal at Km4+000 needs to be rebuilt to allow water-based transport to pass under the bridge. The old bridge will also be removed (Figure 6).

I. Initial Implementation Schedule Planned in 2012

36. Initially, the project was planned to follow below design, procurement and implementation schedule:

(i) Detailed design (2012–2013, 12 months approximately): To refine the designed road and busway improvements, shelters, stations, terminals, traffic signal priority system, traveler information system, circulation plan, and detailed engineering designs with corresponding detailed bills of quantities (BoQ).

(ii) Procurement and bidding process (2013-2014, 12 months approximately).

(iii) Construction (2014–2017, 24 months approximately): Acquire land, construct road and bus way improvements, construct bus shelters and terminals, acquire vehicles, implement traffic signal priority and real-time traveler information systems, etc.

37. The commencement and duration of construction works were depended to large extent on

the duration of the detailed design phase, land acquisition and handing over of the ROW within stipulated time, so that construction period scheduled to be concluded by 2014 could be succeeded. The original implementation schedule is shown in Appendix 4.

Figure 3: Location of Bus Rapid Transit (BRT) Stations

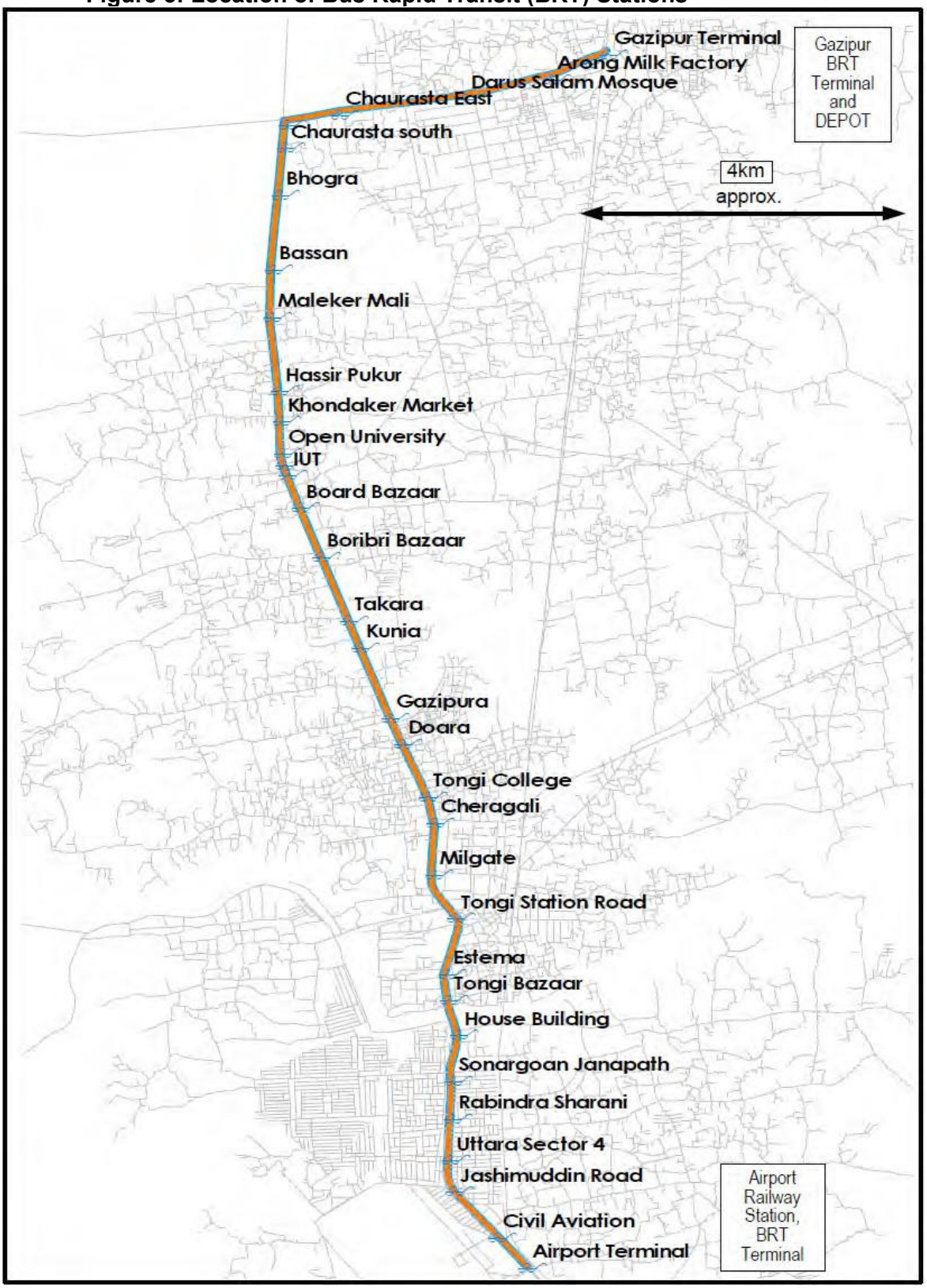


Figure 4: Typical Cross-Sections of Ground Level Sections

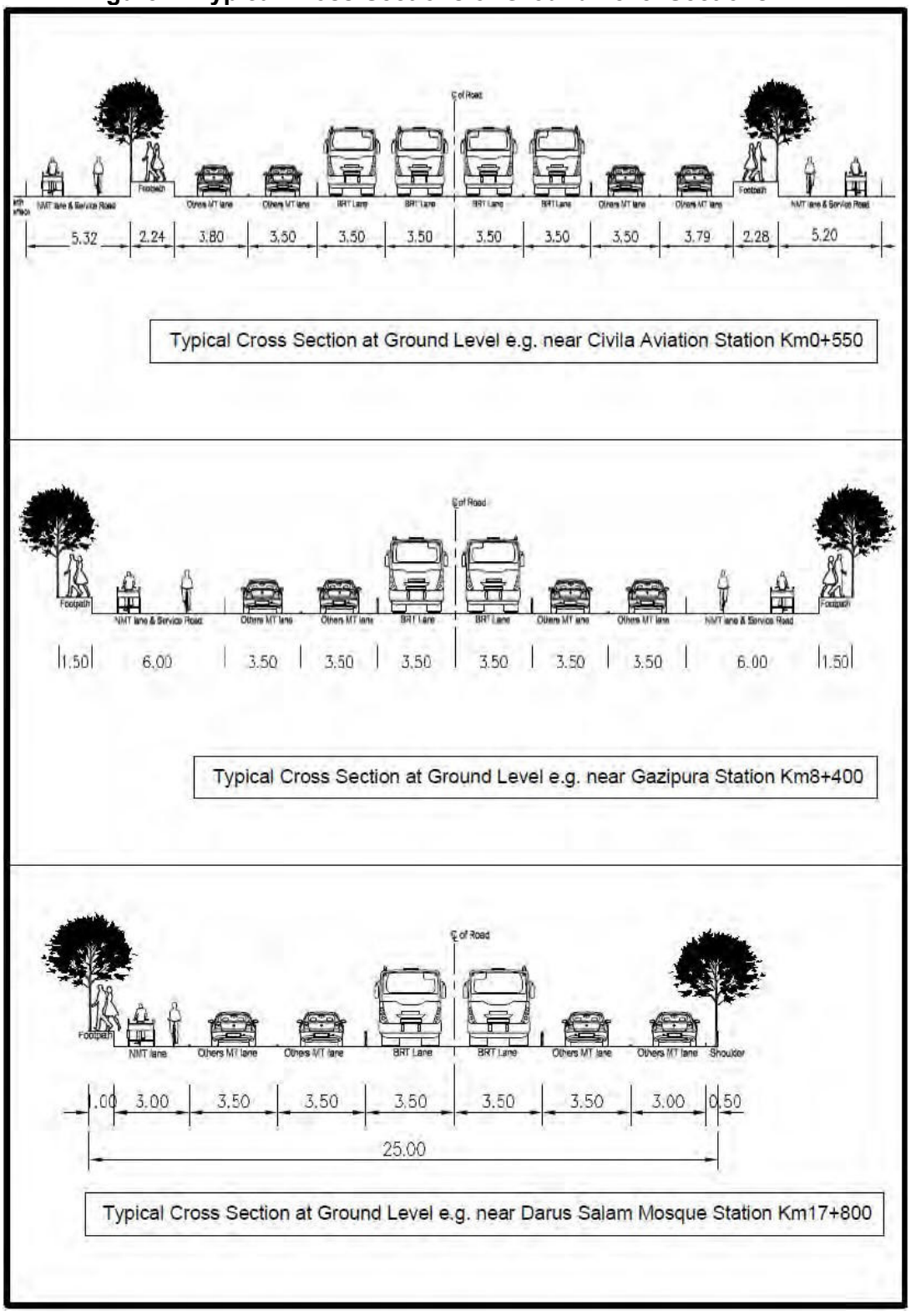


Figure 5: Cross-Section of Ground Level Stations and Elevated Section

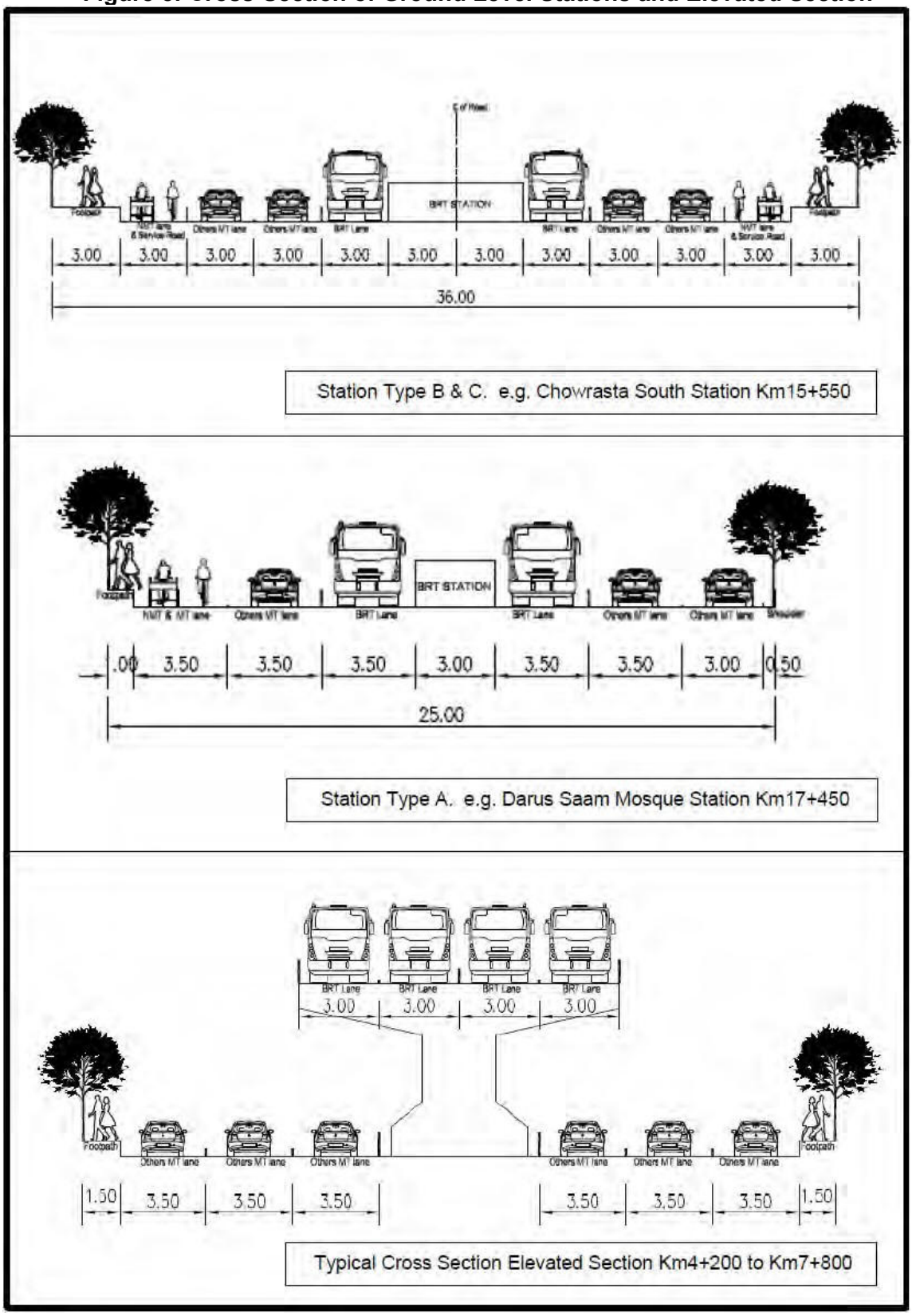


Figure 6: Layout of Flyovers

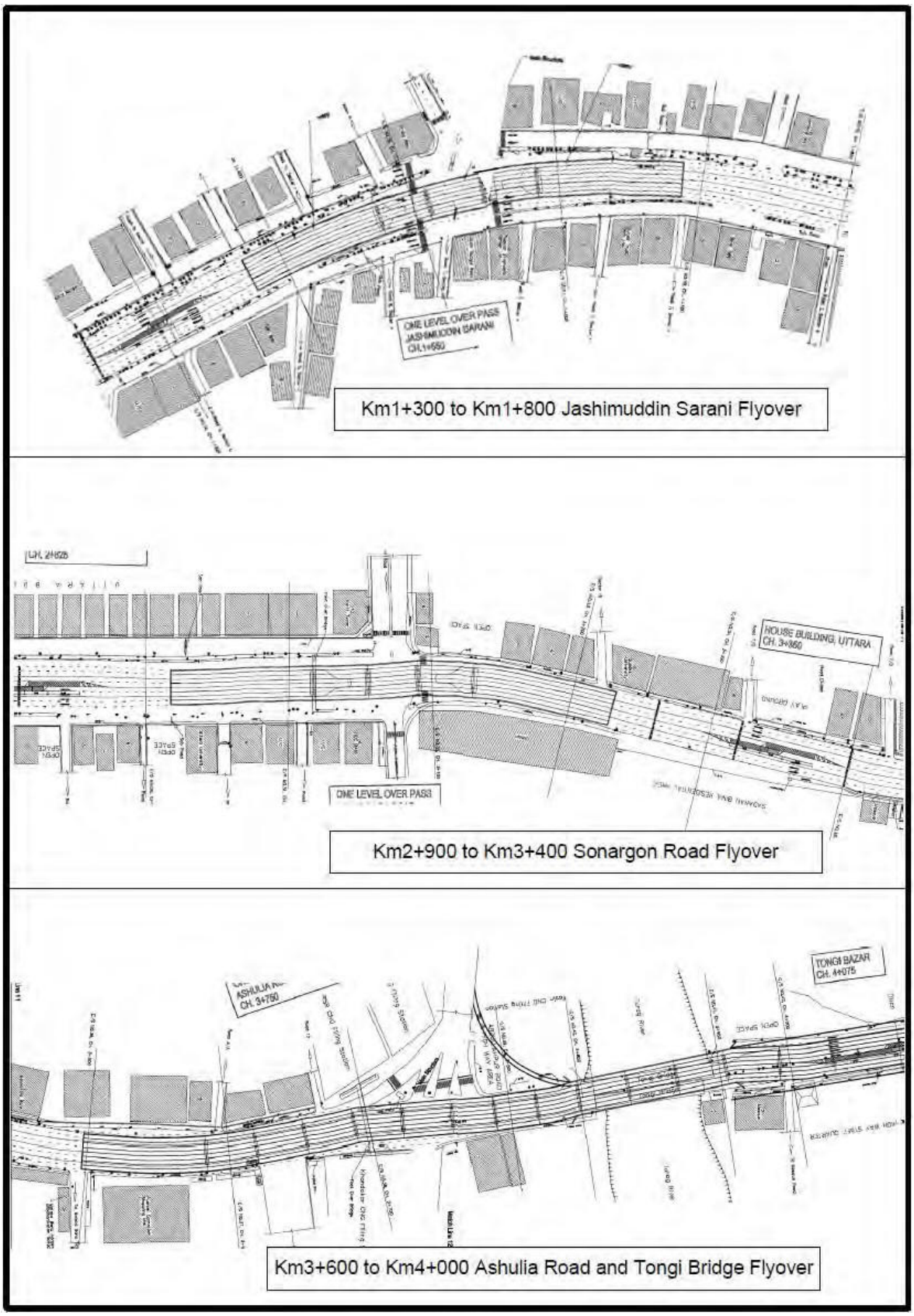

OME LEVEL OVER PASS
JASHIMUDDIN SARANI
CH.1+650
Km1+300 to Km1+800 Jashimuddin Sarani Flyover
HOUSE BUILDING, UTTARA
CH. 3+360
OME LEVEL OVER PASS
Km2+900 to Km3+400 Sonargon Road Flyover
ASHULIA
CH. 3+750
TONGI BAZAR
CH. 4+075
Km3+600 to Km4+000 Ashulia Road and Tongi Bridge Flyover

Figure 7: Layout Elevated Sections and U-Turn

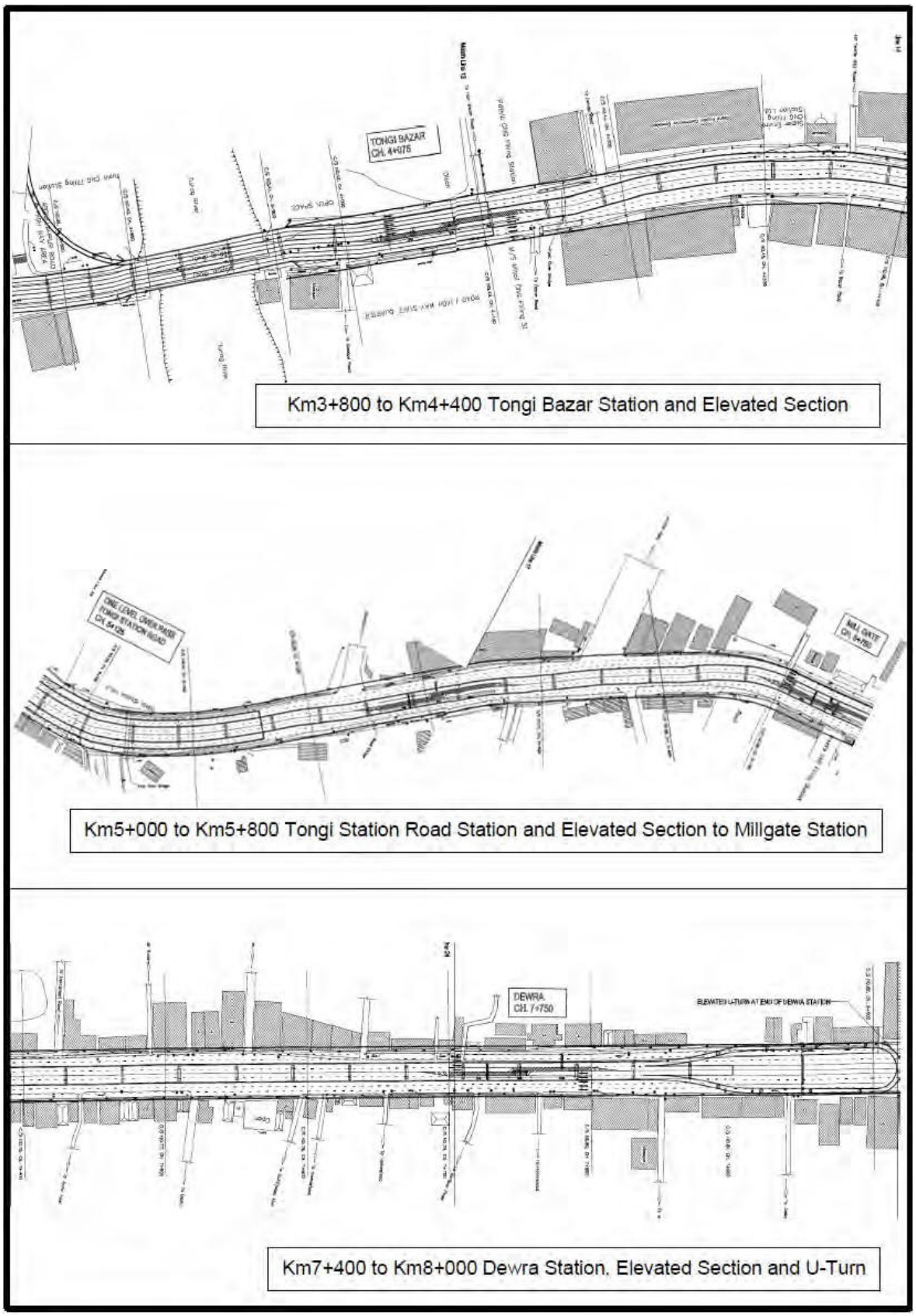
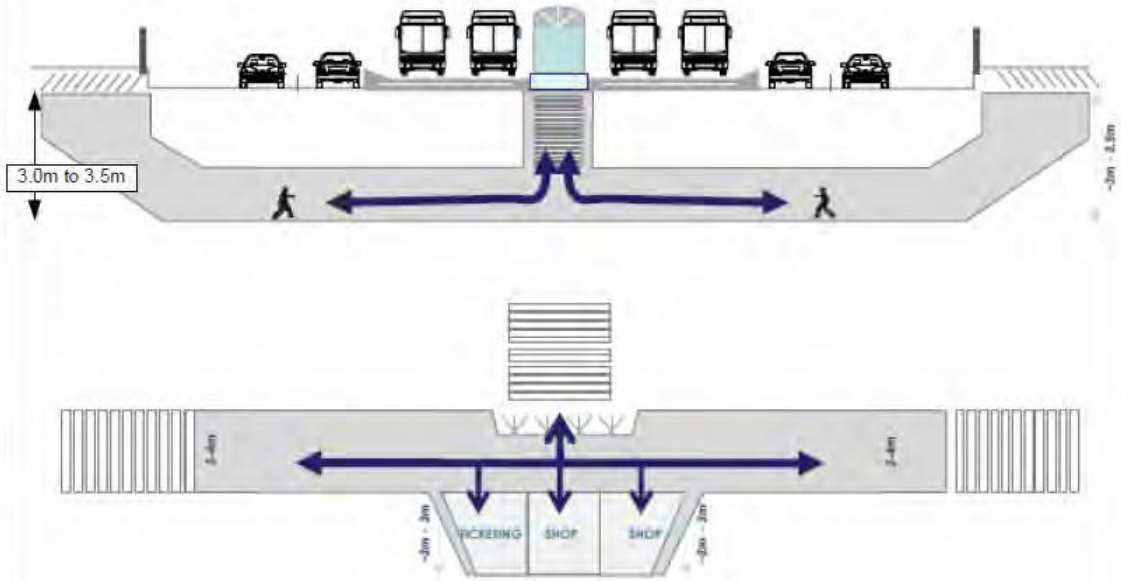

TONGI BAZAR
CH. 4+075
Km3+800 to Km4+400 Tongi Bazar Station and Elevated Section
ONE LEVEL OVER RAISE
TONGI STATION ROAD
CH. 5+125
MILL GATE
CH. 5+750
Km5+000 to Km5+800 Tongi Station Road Station and Elevated Section to Millgate Station
DEWRA
CH. 7+750
ELEVATED U-TURN AT END OF DEWRA STATION
Km7+400 to Km8+000 Dewra Station, Elevated Section and U-Turn

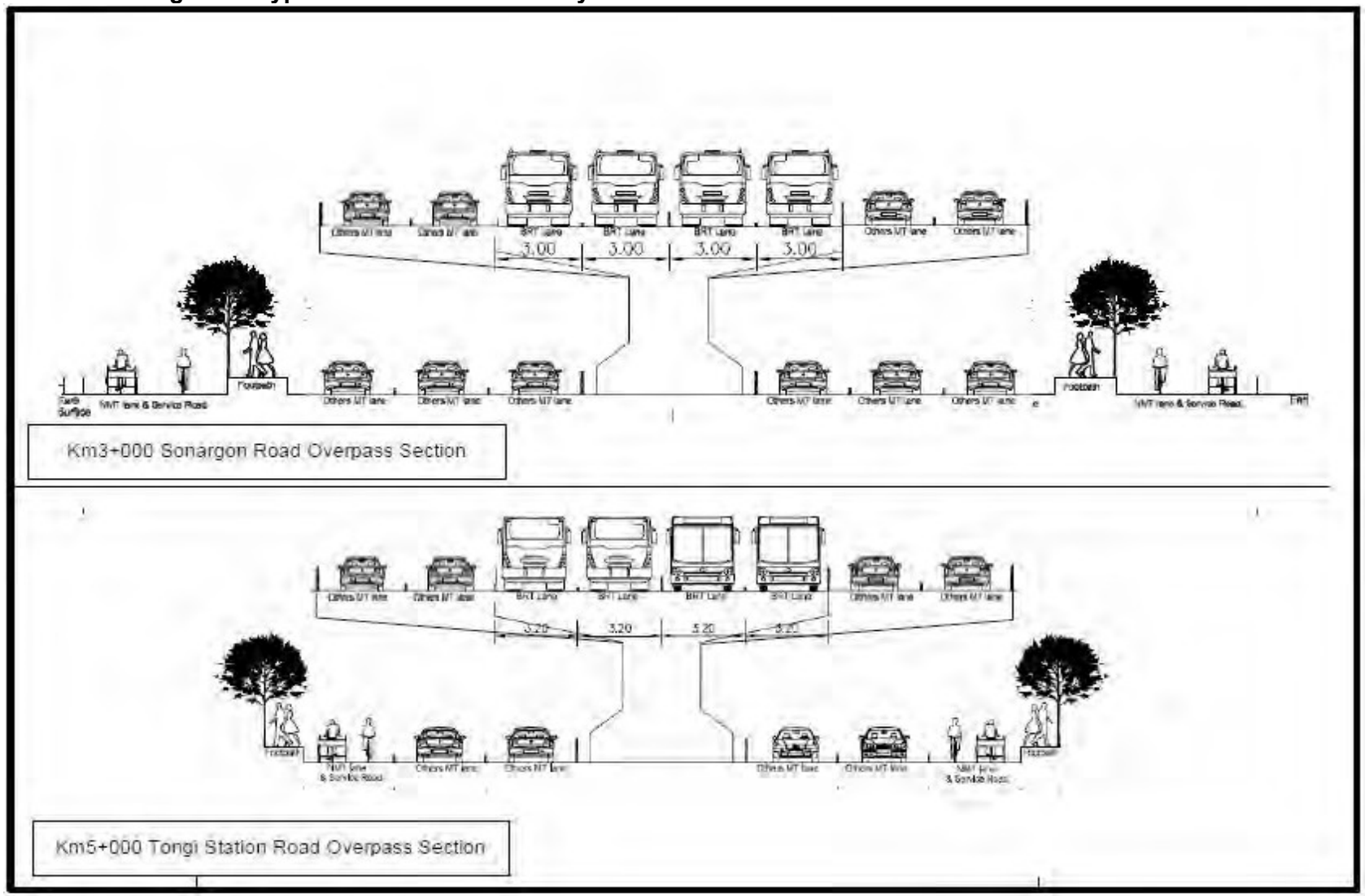
Figure 8: Access to Stations



Typical access to stations at ground level Km0 to Km3 & Km8 to Km16

Typical access to stations at elevated level Km3 to Km8

Figure 9: Typical Cross-Sections of Flyovers



V. DESCRIPTION OF ENVIRONMENT

A. Physical Environment

1. Meteorology and Climate

40. Bangladesh has a tropical monsoon climate characterized by high temperature, heavy rainfall, high humidity, and seasonal variations. The reversal of the winds between summer and winter results in two marked seasons and there is generally also a transitional period from September to early November. The rainy monsoon season is from May to October, during which more than 85% of the total annual rainfall occurs. The cooler dry season is from November to February. The pre-monsoon hot season is from March through May. The beginning of the rainy season can vary from year to year. Heavy rains, typical of monsoon, may commence between mid-April and early June and May end between the end of September and mid-November.

41. Mid-November to February is the coolest and driest period and March to May is the hottest period with periodic heavy thunderstorms. June to mid-September is the most rainy and humid period. Mid-September to early November is a transitional period with decreasing rainfall, with frequent thunder storms but with relatively high temperature and humidity.

42. Squally winds of 50 mph and above, usually from the northwest, often accompany thunderstorms in the pre-monsoon period and may damage property and crops. Cyclonic storms occurring in the Bay of Bengal in April–May and October–November rarely penetrate as far as the project area in Dhaka-Mymensingh district, but they may occasionally cause serious damage to property, crops, and livestock.

2. Rainfall

43. Dhaka meteorological station is relatively close to the project. Rain mostly falls in the few months of the monsoon season, usually about 1,000–2,000 mm. Dhaka is located in the middle of the country and has average conditions. Monsoon rains are generally not stormy, but down pours of 50–75 mm per day are not common, and storms of more than 250 mm a day are occasionally experienced. Rainfall follows the general climate pattern with the highest rainfall in May–September and minimum rain fall in the cooler and drier months of November–March.

3. Temperature

44. The temperature of the country is related to rainfall. In general the cool season coincides with the period of lowest rainfall. The yearly average temperature ranges between 21°C and 31°C. Average annual maximum temperature is 36°C and minimum average is 13°C. The maximum temperature can sometimes exceed 40°C.

4. Relative Humidity

45. Relative humidity during the wet season is significantly higher. The average humidity is about 70%-78%, whereas the maximum relative humidity for Dhaka is about 85% in July and August, and minimum relative humidity is 57% in April.

5. Topography, Geology, and Soils

46. Dhaka is situated at the southern tip of a Pleistocene terrace of the Madhupur Tract. Two characteristic geological units cover the city and surroundings, the Madhupur clay of the Pleistocence age and alluvial deposits of recent age. The Madhupur clay is the oldest sediment exposed in and around the city area, having characteristic topography and drainage. The major

geomorphic units of the city are: (i) the high land of the Dhaka terrace; (ii) lowlands or floodplains; and (iii) depressions and abandoned channels. Low-lying swamps and marshes located in and around the city are other major topographic features. The elevation is below 10masl.

6. Seismic Activity

47. Bangladesh is seismically active and has experienced numerous large earthquakes over the past 200 years, at intervals of every 30 years. There were catastrophic earthquakes in 1762 and 1782 that were so severe, they diverted the flow of rivers and are believed to have been partially responsible for the diversion of the Old Brahmaputra River to the Jamuna Channel, as well as other topographical impacts. Since 1860, over 20 shallow and intermediate major earthquakes have been recorded with epicenters in Bangladesh.

48. Bangladesh has been classified as falling into three seismic zones. Zone III is the most severe and Zone I the least. The project area falls under Zone II. As a result, the land buildings and land-based structures for this project should be designed in line with the Bangladesh National Building Code (2006).

7. Surface Waters and Drainage Pattern

49. Dhaka City is bounded by the Buriganga River to the south, Turag River to the west, Balu River to the east, and Tongi Khal to the north. The major surface water body near the project is the Tongi Khal (a Turag River tributary) that crosses under the bus rapid transit (BRT) project at about Km 3+850 to Km 3+950. The Tongi Khal is navigable by shallow draft transportation where it crosses under the project. Most of the streams and creeks are discharged all year round.

50. The river channels surrounding Dhaka enter into the Meghna River. Rapid urbanization has modified the hydrological system. Water extraction and blocking of some drainage channels have caused localized waterlogging, accumulated pollution, localized land subsidence, and collapsed buildings in parts of the metropolitan area.

51. The hinterland of the project area beyond 100 m from the alignment provides some aquatic resources for subsistence and trade, as well as water for crop irrigation. There are numerous surface ponds and ditches within 50 m of either side of the project. Many of these catch the drainage from either side of the road upon which the project will be constructed.

8. Flooding

52. Flooding in Bangladesh is a recurring phenomenon. Records show that severe floods occur about every 7 years, and catastrophic floods every 33-50 years. The annual rise in river water levels from Padma, Bhramaputra and Meghna Rivers combine to pass through are stricter outlet and into the Bay of Bengal. The tidal levels in the Bay affect the discharge capacity of the lower Meghna. The effects of these high river water levels extend over to most of the country, and are main determinant of the drainage condition and capacity. The surface drainage by gravity is limited, but land in the project area is above prevailing flood levels.

53. The closure of some important canals within Dhaka city has also aggravated the situation and caused drainage congestion. It has enhanced localized flooding from rainfall due to drainage system failure. The combination of external floods from the rivers surrounding Dhaka city and localized drainage problems has aggravated the flooding situation. However, the project area along Dhaka-Mymensingh Road is not subject to flooding.

54. In 1988, dykes were built north and west of Dhaka bounded by rivers Buriganga, Turag, Balu, and Tongi Khal. Large pumping stations are planned to draw off the rain water. The encircling

embankment has been used to form the city ring road. This embankment protects the city from flooding from Tongi Khal's right bank in the north as far as the left embankment of Buriganga River in the south and west. The city's embankment also increased the flooding outside the embanked area, particularly in the low pockets of land, left and right of the project corridor north of Tongi Bridge (Km 4+000), which may cause periodic floods. Several low pockets occur within a few kilometers from the project area. However, these low pockets of land are far away from the project, and have interconnected channels draining to the south; thus, the project corridor is itself raised above the surrounding land. Both sides of the corridor are served with large surface drains, and surface water is diverted away from the project area along Dhaka-Mymensingh Road. Therefore, no inundation or flooding of the project corridor is expected.

9. Surface Water Quality

55. The quality of the surface water surrounding Dhaka and the district is poor. Untreated discharge of industrial and municipal effluents into the rivers, swamps, and natural channels causes water pollution. The Department of Environment has collected water quality data around Dhaka district as part of the national water quality monitoring program.

56. There are many factories along the length of the BTR corridor, and the drainage channels and streams nearby are subject to industrial pollution. The manufacturing industries in the area of Tongi Pourosova discharge their effluent into Tongi Khal, which also discharges to the Balu and the Shitalakhya Rivers. The principal industries at Tongi are aluminum, textiles, pharmaceuticals, and cosmetics. Close to the Gazipur municipality, the industries include machine tools, heavy diesel plant, security printing presses, armaments and weapons, ceramics, packaging, bricks, and garments factories. There are new factories near the alignment under development, which will also affect the water quality in the future.

57. There is only one sewage treatment plant at Pagla (Figure 4.1), which is currently operating below capacity because of system failures. Few factories in Dhaka Metropolitan Area (DMA) operate effective effluent treatment systems. Most liquid and some solid waste from the residents, industry, and millions of urban farm animals, pesticides, and fertilizers are dumped in Dhaka's surface water. Some of the wastes also infiltrate the ground and pollute ground water.

58. For nearly half of the year, the flow rate of the rivers remains negligible, or often only a tidal pulse, but the volume of effluent flowing into the canal and river remains about the same during wet season. Consequently, dilution of the contaminants is reduced in dry season. Figure 4.1 shows the improving water quality nearer the mouth of the estuaries, but the quality of water in the project area remains very poor as there is no appreciable tidal flushing.

59. The most polluted water bodies are the Buriganga and Shitalakhya Rivers, Tongi Khal, and the canal system in Dhaka East, where very low dissolved oxygen levels, 1.5~4 mg/l, reflect contamination caused by organic waste, domestic sewage, and chemical residues from factories. These water bodies are almost biologically dead during the dry season. The high levels of biological oxygen demand (BOD Standard 6 mg/l) that are 10~30 mg/l in the Buriganga and Shitalakhya Rivers reflect mainly the high density of discharged untreated industrial waste water into the rivers. Some tidal back flow of relatively clean water from the Meghna and Dhaleswari Rivers results in dilution of contaminants in the southern reaches of both the Buriganga and Shitalakhya Rivers up to a limited extent. The high ammonia levels, particularly in the canal system in Dhaka East, the Balu River, and the southern reaches of the Buriganga River, reflect the discharge of sewage into these water ways. Ammonia in Dhaka East area increases from 0.3 mg/l in October to more than 20 mg/l in March-April, which is almost 20 times higher than the national environmental quality standard (1.2 mg/l).

60. The levels of dissolved oxygen and BOD of Balu River in 2002-2006 are shown in the

following figures separately for April-May and July-August. Investigative surface water quality monitoring for dissolved oxygen, BOD, pH, EC, and turbidity of Balu River at Tongi for April-May and July-August for 2006 are shown in a diagram. The general water quality of the project area is reflected in Figures 10and 11.

10. Ground water and Ground water Quality

61. In and around Dhaka, groundwater is a stable source of water for various activities including irrigation (both shallow and deep tube wells), domestic purposes (handpumps) and industrial applications (deep wells) in the project area. The ground water table in most of Bangladesh exists at a shallow to moderate depth (generally less than 3 m below surface). There are semi-confined and unconfined aquifers, which are being recharged by major river systems and by infiltration of rain water. The ground water table fluctuates with seasons approaching near ground surface (less than 1 m below surface) over most of the country during wet season (July-September). The level of groundwater in the project area in the dry season is lowered to about 6 m below surface before the end of monsoon. Groundwater extraction has increased more than 900% over the last 30 years, resulting in the lowering of the water level by 20 m below surface in some places. The ground water salinity has also increased.

11. Air Quality

62. Motor vehicles and traditional brick kilns are two of the main causes of air pollution in the Dhaka area. More recently, several industrial under takings have also contributed to increasing air pollution. The main air pollutants in Dhaka City are nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter (PM_{10}, i.e. PM with diameter of 10 microns or smaller, and $PM_{2.5}$, i.e. PM 2.5 microns or smaller), carbon monoxide (CO) ozone, volatile organic compounds (VOCs), and lead (Pb). Motor vehicles are the major source of PM pollution. Most of the PM pollution (greater than 80%) comes from diesel-run vehicles. In the low-lying agricultural land surrounding Dhaka city, hundreds of brick kilns operate during the dry months of November–April. These generate smoke and dust, including SO_2, NOx, and hydrocarbons that contribute to worsening ambient air and damage to public health that can contribute to cardiovascular and respiratory diseases or lung cancer.

63. Motorized transport has grown rapidly in Dhaka in recent years. The total number of registered vehicles in Bangladesh rose from 70,000 in 1970 to 460,000 in 2006. Dhaka has more than 3,000 old minibuses, which run on diesel fuel. About 80% of these buses are unfit to run on the city roads because of their high emissions. Even though aging trucks are not allowed to run in the city during day time, the trucks cause significant air pollution, particularly during the dry winter months. Despite the phasing out of two-stroke three-wheeler baby taxis in 2003, air quality cannot be sustained because of the great number of smoky diesel vehicles. Dhaka city has witnessed a tremendous increase in vehicles fueled by compressed natural gas (CNG) in recent years. Many gasoline-fueled vehicles have been converted to run on CNG.

64. Emission inventories of mobile sources in Dhaka show that contributions from different vehicles are dominated by specific types of pollutants. Petrol-fueled light-duty vehicles and auto-rickshaws contribute most of the carbon monoxide (CO), while diesel-fueled buses and trucks contribute most of the nitrogen oxides (NO_x). Two and three-wheeled auto-rickshaws contribute to about half of hydrocarbon emission. Particulate matter (PM) emission comes mostly from diesel buses, trucks (45%), and auto-rickshaws (40%). According to a study conducted by the Bangladesh Atomic Energy Commission, approximately 55% of the PM_{10} are attributable to suspended soil and motor vehicle (31%), and $PM_{2.5}$ is mostly attributed to motor vehicles (29%) and natural gas/diesel burning (46%). The average levels of PM_{10}, NO_x, and SO_2 have increased since the 1990s. However, the annual average levels of NO_x and SO_2 are 40~60 μg/m3 and 15~20μg/m3

respectively, and have remained below Bangladesh national ambient air quality standards (NO_x: 100 µg/m3, SO_2: 80µg/m3) from 2002 to 2007. The most important pollutant from the health point of view in Dhaka is PM. The PM_{10} and $PM_{2.5}$ levels continue to exceed Bangladesh national ambient air quality standards (PM_{10}:24h150µg/m3 and annual 50 µg/m3, $PM_{2.5}$: 24h 65 µg/m3 and annual 15 µg/m3), especially during the dry winter months, which last about 100 days per year (Figure 6).

65. The other source of air pollution is dust arising from ground or soil disturbance. Dust concentration will be higher, intermittently, within 10 m of the project road, caused by vehicles. However, it is not high enough to obscure vision significantly, based on field observations.

66. **Air Quality Management Project (AQMP)**. The pilot project supported by World Bank had the objective of identifying options and develop components of urban air quality management by means of pilot activities and institutional support, with the ultimate goal of reducing human exposure to vehicular air pollution. The components were designed to promote learning, develop institutional capacity for air quality management, test technical options for financial, environmental, and social viability, and raise stakeholder awareness of the issues and options related to vehicular air pollution. The project was initiated in July 2004 and consisted of two main components: (i) Vehicle Emission Reduction: Enforcement, Standards and Control; and (ii) Air Quality Monitoring and Management (Annual Report: DoE, 2006).

67. **Clean Air Sustainable Environment (CASE) Project**: The earlier AQMP project helped create an air quality network of five continuous air monitoring stations (CAMS) and equipped DOE with nine satellite air monitoring stations (SAMs) and laboratory equipment. The CASE project will build on the progress made under AQMP, and will support provision of appropriate hardware and software facilities, selected studies to strengthen DOE's various functions, enhancements for reporting, use of air quality information for planning, public awareness (via website and other media), and development of public alert systems. Six new CAMS will be installed and industrial facility monitoring undertaken, in order to complement ambient air quality data with source-oriented emissions data. Strengthened air quality monitoring arrangements, combined with analysis and reporting, will help in identifying the sources of emissions and developing targeted action plans for reducing air pollution. Bangladesh criteria (Environmental Conservation Rules1997) will be used for monitoring during project implementation.

12. Noise

68. Noise from vehicles is a major feature of the streets around Greater Dhaka Sustainable Urban Transport Project (GDSUTP) BRT, as vehicular traffic is more or less continuous during the day and lorries run mostly at night. The national standards (ECR-Schedule 4 and Schedule5) will be applied to the project. There is no specific criterion for road traffic noise in Bangladesh, so the World Bank criteria will also be applicable. The ECR provides an ambient Standard of Leq70 dB(A) (daytime) and Leq60 dB(A) (nighttime) for commercial areas that cover most of the project area. Within 100 m of schools and hospitals, the ambient standard is Leq 45 dB(A) (daytime) and Leq35 dB(A) (night time). The standard for residential areas is Leq50 dB(A) (daytime) and Leq 40 dB(A) (night time).

Table 5: Ambient Noise Standards for Bangladesh

Category of Areas	Standard dB (A)	
	Day	Night
Industrial	75	70
Commercial	70	60
Residential	50	40
Silent zone	45	35

Mixed areas (mainly residential area, and also simultaneously commercial and industrial)	60	50
NOTES The time from 6 a.m. to 9 p.m. is counted as daytime. The time from 9p.m. to 6a.m. is counted as night time. Area up to a radius of 100 m around hospitals or educational institutions or special institutions/establishments to be identified by the government is designated as silent zones where use of horns of vehicles or other audio signals and loud speakers is prohibited.		

dB(A) = decibel (A-weighted)
Source: Environmental Conservation Rules 1997(Schedule4).

69. The World Bank[4] criterion for residential, school, and hospital sensitive receivers is Leq55 dB(A) or background +3 dB(A) where background exceeds the criterion. Spot measurements of background noise were taken at 5 minute intervals over an hour at two locations; Km 4 near Tongi Bridge and Km 12. At Km 4, background noise ranged from Leq72.4 dB(A) to Leq75.8 dB(A). At Km 12, noise ranged from Leq71.6 dB(A) to Leq74.9 dB(A) with traffic. Therefore, in the project area where traffic runs throughout the day, both the World Bank and Bangladesh criteria are exceeded at times by the existing noise. Therefore, a criterion of background +3dB(A) will be applied in the assessment. The Bangladesh criterion of Leq45 dB(A) during daytime and Leq35 dB(A) at night time can be used at hospital sensitive receptors if the background is below Leq45 dB(A) for 1 hour in daytime or Leq35 dB(A) for 1 hour in night time(although this seems unlikely in the developed areas near the project). However, there is a general presumption that no night time work should be done, except when important.

Table 6: Standards for Sound from Motor Vehicles or Mechanized Vessels

Category of Vehicles	Unit dB(A)	Distance from Exhaust Pipe for Measurement.(m)	Remarks
*Motor vehicles (all types) (a)	85	7.5.m	* At the time of measurement, the motor vehicle shall not be in motion
Gasoline engine (b)	100	0.5m	
Mechanized vessels	85	7.5.m	Not in motion, not loaded and is at two-thirds of its maximum rotating speed.
Motorcycle(c)	100	0.5m	Not in motion, not loaded and is at two-thirds of its maximum rotating speed.

(a) Diesel engine–maximum rotating speed at two-thirds of its maximum rotating speed and without any load.
(b) Motorcycle – If maximum rotating speed is above 5,000 rpm, two-thirds of the speed, and if maximum rotating speed is less than 5,000 rpm, three-fourths of the speed.
dB(A)=decibel(A-weighted), m–meter
Source: Environmental Conservation Rules 1997(Schedule4)

B. Biological Environment

1. Agriculture

70. Most of the land adjacent to the project area for GDSUTP is being used for commercial and industrial purposes. Traffic is very congested and noisy. The alignment is mainly surrounded by commercial buildings, shops, industrial factory units, educational institutions, and mosques. The areas in the hinterland about 50–100 m from the project centerline are used for wet-paddy and vegetable cultivation due to the flat terrain of the project area. A variety of vegetables are grown here, such as cabbage, cucumbers, tomatoes, lettuce, chili eggplant, and pumpkin.

71. Human impact has removed all vegetation in the project corridor. There are few trees planted for street beautification. In the hinter land areas, the removal of natural vegetation is

[4]World Bank Group, 2007. *Environmental, Health, and Safety General Guidelines.* Washington, DC

almost all due to clearance for agriculture. A few of the areas near the alignment have remnant paddy fields. Isolated trees are within the right of way (RoW) in some places.

2. Forestry

72. The Chief Conservator of Forest is the authority for the removal/cutting of trees in Bangladesh. Consultations with the Department of Forest in Dhaka confirmed that there are no protected forests in the project area. The nearest protected forests are found several kilometers north of the intersection at Km16+300 (Joydevpur). Occasionally there are isolated trees and a few street trees on each side of the BRT in the RoW. There is no national park or nature reserve near BRT.

73. The Dhaka Forest Transit Rule (1959) will apply. Trees within RoW can be removed/cut with permission from the forest authority, which must be notified in advance. However, the tree ownership will need to be identified at the detailed design stage and must be agreed between the Roads and Highways Department (RHD) and the Chief Conservator of Forests. For infrastructure forests in the metropolis, the Chief Conservator of Forests requests that specimen trees or champion trees be avoided wherever possible, and that the project proponent (RHD) should plant replacement trees on any available land under RHD control. Therefore, a tree cutting and compensatory plan will need to be agreed between RHD and the Chief Conservator of Forest at the detailed design stage. Any cut trees will go for local use, but if trees are to be cut for the BRT, there will be a need for the forest authority to mark and agree with RHD during the detailed design stage.

3. Fauna and Flora

74. The whole project area is urban development, and there are no rare, threatened, or endangered species of terrestrial and aquatic flora and fauna in the impact zone of the project. The GDSUTP alignment is not an area to be protected for the natural habitats or rare/endangered species. The Bhawal National Park area is the nearest habitat, and is over 5km north from the GDSUTP at its nearest point (Figure10).

75. The vegetation of Dhaka city has a variety of indigenous and exotic species in parks and gardens. There are over 40 municipal parks and gardens (310 ha) in Dhaka city. None of these parks and gardens are directly affected by the project works. Baldha garden and the National Botanical Garden have a wide variety of plants and trees. Besides local species, many exotic species were planted along the roadside, especially by the old secretariat area and in residential properties, for the beautification of the city in the early 20th century. Various species of migratory birds can still be seen in Dhaka (especially in the lake of the National Zoo) during winter, including ducks, seagull, falcons, harriers, plovers, curlews, and sandpipers. Most poisonous snakes and non-poisonous snakes have disappeared, but a few species including cobra are occasionally encountered. Numbers of other reptiles, amphibians, and fishes have decreased. The biodiversity of fish species has been reduced severely due to pollution of surface water.

C. Social and Cultural Environment

1. Human Environment

76. The capital City of Dhaka was founded about 400 years ago by the side of Buriganga River. The earliest available map shows Dhaka extending over an area of 105 km^2 near the junction of Dholai Kasha and Buriganga River. In 1947, Dhaka gained the status of city and became the capital of East Pakistan. Presently, the population is 3.39 million. The area under Dhaka City Corporation (DCC) is 360 km^2 and extends as far as north of the Tongi Bridge at

Km3+850 on the project alignment. The present population of Dhaka Statistical Metropolitan Area (DSMA) is about 9.0 million.

77. The 19th century saw the construction of some buildings built in the Indo-British style. The parliament building designed by Luis Kahn became a prime architectural specimen of modern Dhaka. Baldha Garden, with its rich collection of indigenous and exotic plants, is one of the most exciting garden attractions of naturalists and tourists. The National Botanical Garden at Mirpur lies on 205 acres of land, and has a large collection of local and foreign plants. Dhaka city's open spaces perform an important function for the mixed community, especially during national holidays. No parks or gardens are near the area which will likely be affected by the project.

2. Land Use

78. The GDSUTP project is along a busy commercial urban thorough fare called the Mymensingh Road. This runs about 16 km from the origin near the airport to the intersection at Joydevpur. The whole section of the alignment is built up on either side. The dominant land use is commercial, and has been developed over many years. There are also industrial factories, colleges, and occasional mosques. At intervals there are also drainage ponds just off the main thorough fare. Very occasionally there are a few rice and vegetable fields.

79. After the intersection at Joydevpur, the alignment turns east towards Gazipur into another section along a busy commercial urban thorough fare. The whole of this section of the alignment is built upon either side. Land use acquisition requirements are in the resettlement plan.

3. Cultural and Historical Sites, Schools, and Housing

80. Dhaka plays a significant role in the political, economic, social, cultural, and sporting life activities of the region. Dhaka is one of the most important centers of entertainment in the country, with numerous cinemas, theaters, and musical halls. The city is dotted with museums, libraries, art galleries, clubs, and restaurants. With a population of more than 10 million, Dhaka has about 14 public universities and 42 private universities in the greater metropolitan area. Dhaka is known for its mosques, many of which are built in the Indo-Islamic style and date back to the days of the Mughal rulers. It is also famous for its archeological and historical sites such as the Lalbagh Fort, also built during the Moghul period. The National Parliament Building is widely regarded as a masterpiece of architecture. Dhaka has also been the host of international sporting events.

81. Schools and colleges are located in proximity to the main GDSUTP in many locations. The boundaries of the colleges' walls and gates are generally next to the alignment (within10m), but the noise-sensitive facades of the school buildings are generally setback from the BRT alignment by more than 50 m, outside the corridor of impact. The memorial statue at Joydevpur Chowrasta will be carefully dismantled and put in storage before construction begins. It will be reassembled in place after the completion of construction works.

Table7: Large Schools Near GDSUTP within 50 m from Alignment Axis

Schools South of GDSUTP	Chainage	Schools North of GDSUTP
Nabab Habibullah Model School (under construction)	2+300	
Queens University 15-m high-rise building (temporary location)	3+230	
Tongi College (over100m)	7+100	
Islamic University (50m)	11+700	
Open University (50m)	12+100	
	12+300	Madrasa(25m)

GDSUTP = Greater Dhaka Sustainable Urban Transport Project, m = meter Source:

consultants project surveys. Distance to sensitive receptors in parentheses.

82. There are several places of worship located along the alignment of the proposed BRT. The mosque structures are outside the corridor of direct impact, and no physical impacts will occur. However, some slivers of land area belonging to mosques bordering the RoW may be taken. The locations of these are shown in Appendix 3.

Table 8: Major Places for Worship within Project Corridor

West Side	Chainage	East Side
	Terminal	Railway Station Mosque
Mosque(15m)	0+700	
	2+500	Uttara National Jame Mosque(30m)
	3+420	Mosque(30m)
	3+975	Mosque(20m)
Mosque(25m)	4+330	
	5+160	Mosque(20m)
Mosque(25m)	5+710	
Mosque(50m)	6+400	
	6+500	Mosque(15m)
	7+350	Mosque(20m)
	7+840	Mosque(40m) (shielded by high building at roadside)
	9+210	Mosque(25m)
West Side	**Chainage**	**East Side**
Mosque(25m)	10+160	
	10+760	Mosque(20m)
Mosque(15m)	11+320	
	12+100	Mosque(20m)
Mosque(20m)	17+420	
Mosque(20m)	18+440	
Gazipur Mosque (100m to Gazipur terminal).	20+400	

Source: consultants project surveys. Distance to sensitive receptors in parentheses.

4. Power Supply

83. Electrical power is supplied throughout the project area from the grid. The low voltage distribution network runs on poles adjacent to the project, and will need to be protected during works. Most of these poles and lines are inside the right of way (RoW), and many will need to be reprovisioned before the upgrading work commences to ensure continuity of power supply. Some cables also run from pylon to pylon across the BRT corridor.

5. Water Supply

84. Water is supplied throughout the project area from the pipes maintained by the city division of WASA between the airport and Tongi Bridge. From this point, north of the jurisdiction are Tongi Pourosova and Gazipur Pourosova. Tongi and Gazipur Pourosovas are supplied by the Department of Public Health. Some lines may need to be reprovisioned before the project work commences to ensure continuity of services.

6. Telecommunications

85. Telecommunication cables run along and sometimes across the BRT project corridor area. The network runs on poles adjacent to the project and will need to be protected during the works. Many of these poles and lines may need to be reprovisioned before the upgrading work commences to ensure continuity of the system.

7. Rail Transportation

86. Railway was first introduced in Bengal in 1862. In 1997, the railway had 2,706 km of tracks. Of this, 884 km was in broad gauge, with 337 stations and 1,822 km in meter gauge with 152 stations. The railways in Bangladesh carried 2,936 million tons of cargo and 37,494 million passengers in 1997. The length of the railway has not increased, but the services have expanded, like container handling from port to inland and fast intercity trains mostly connecting Dhaka. Within metropolitan Dhaka and surrounding areas, the railways are using more than 100km of tracks for commuter services. Two of the most important stations connecting the Dhaka metropolitan area are located near the BRT project at Gazipur and the airport.

8. Air Travel

87. Biman Bangladesh Airlines was created in 1972, with aircraft taken from the air force. In 2001, Biman operated a seven-destination network at home and had 26 major international destinations serviced by a fleet of five wide-body DC-10s, three wide body Airbuses, three F-28 executive jets, and two ATPs. Airport location is near the southern end of the project corridor.

Figure10: Summary of Surface Water Quality

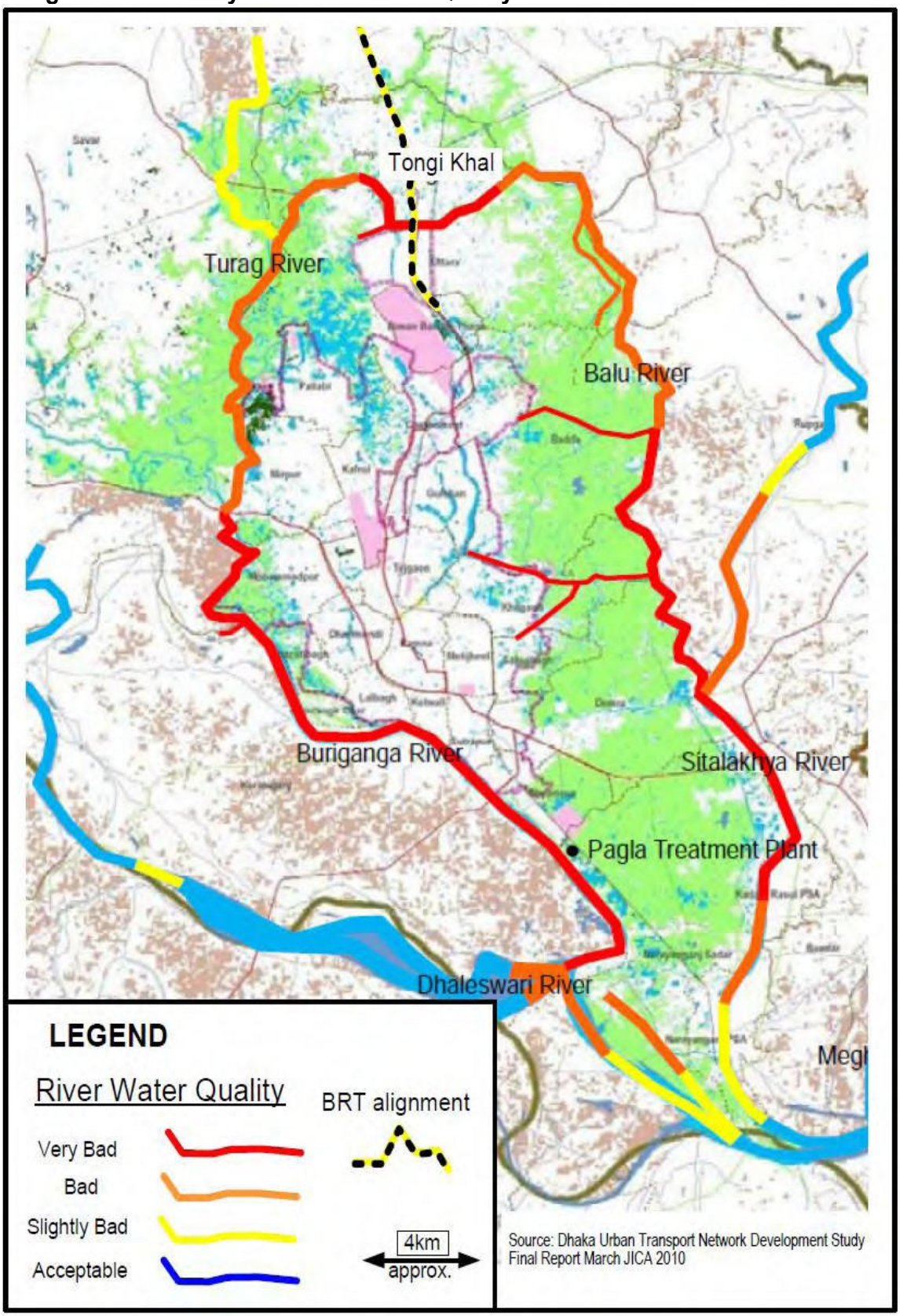


Figure11: Measurement of Surface Water Quality

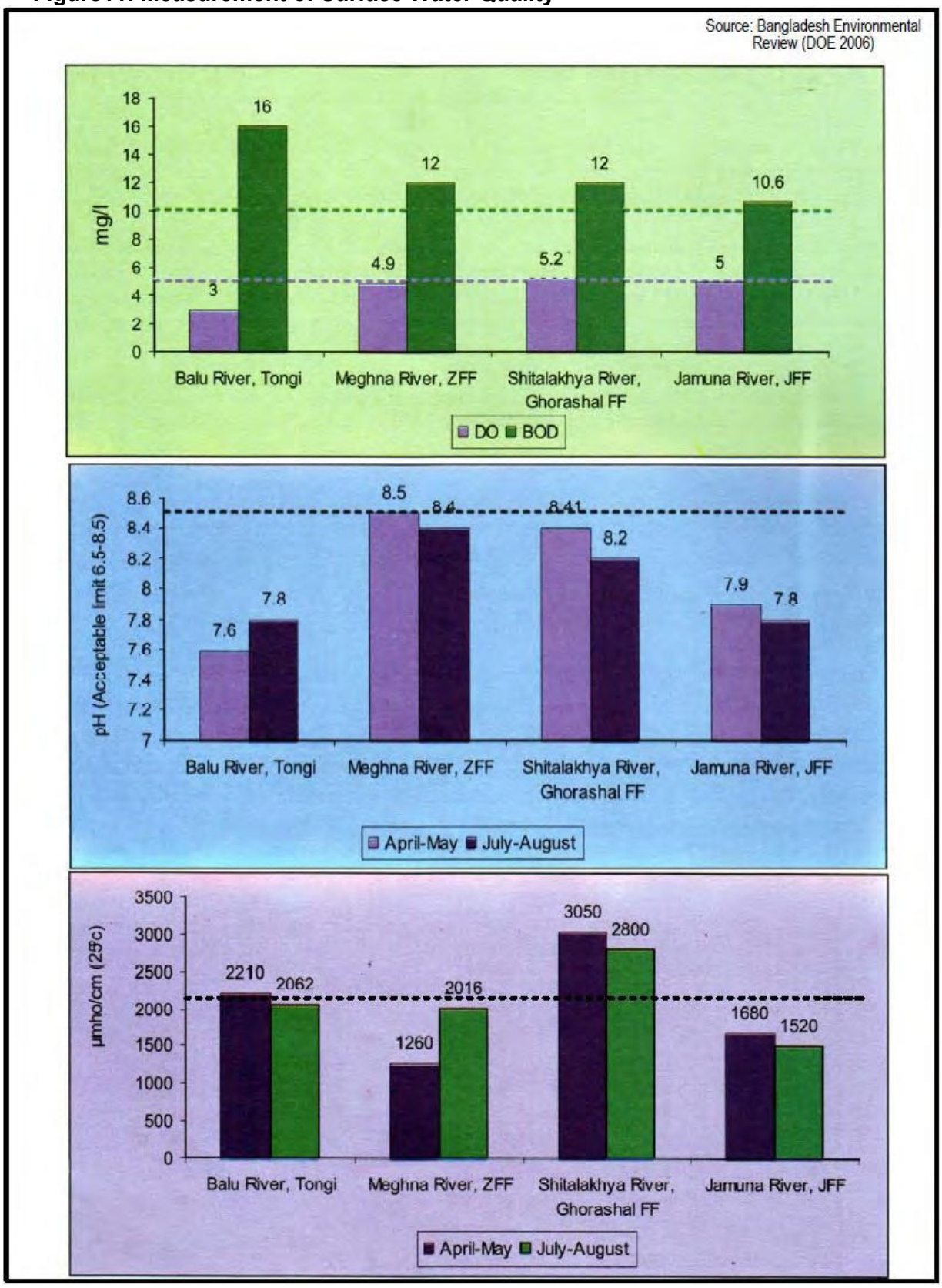
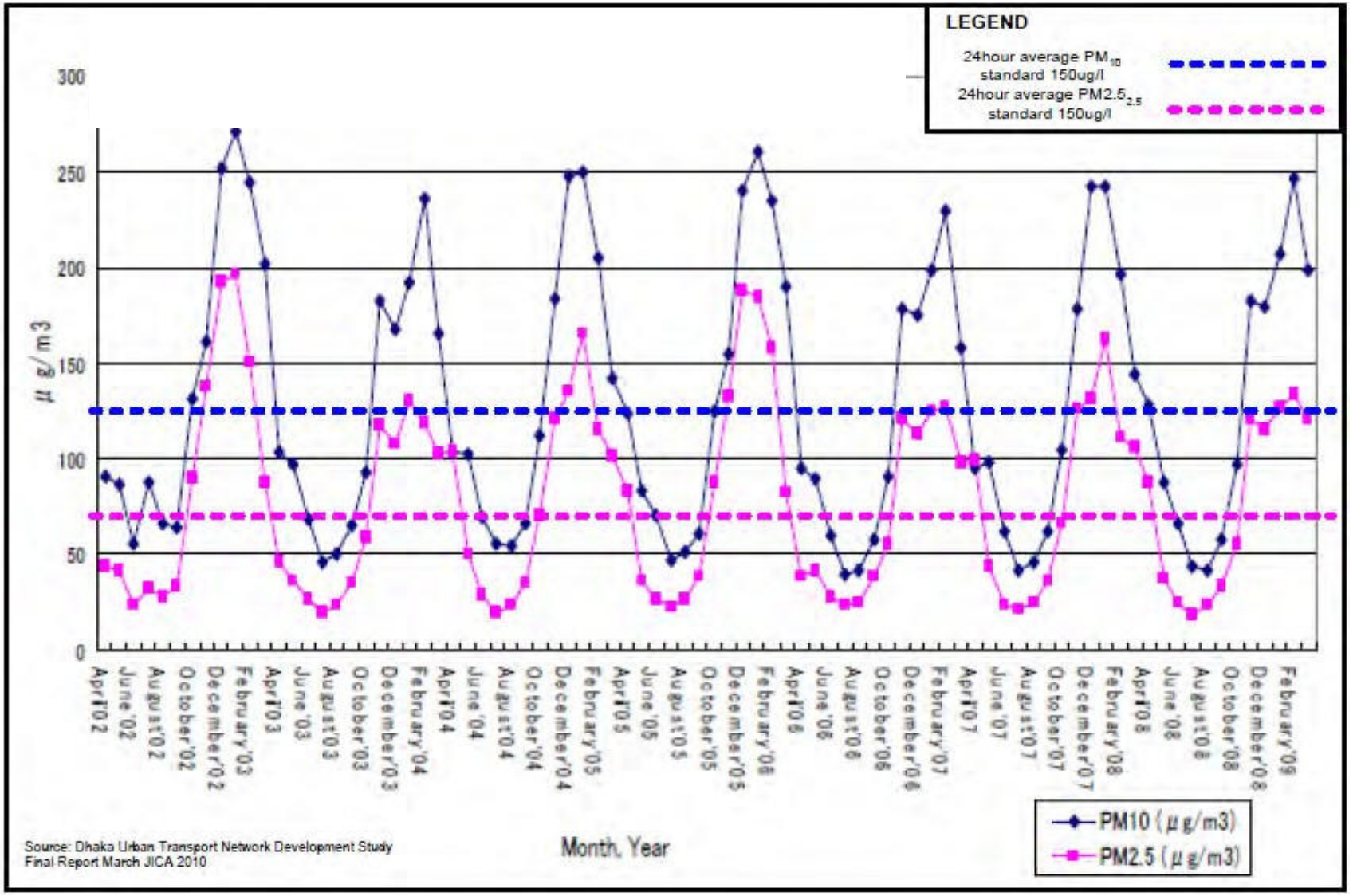
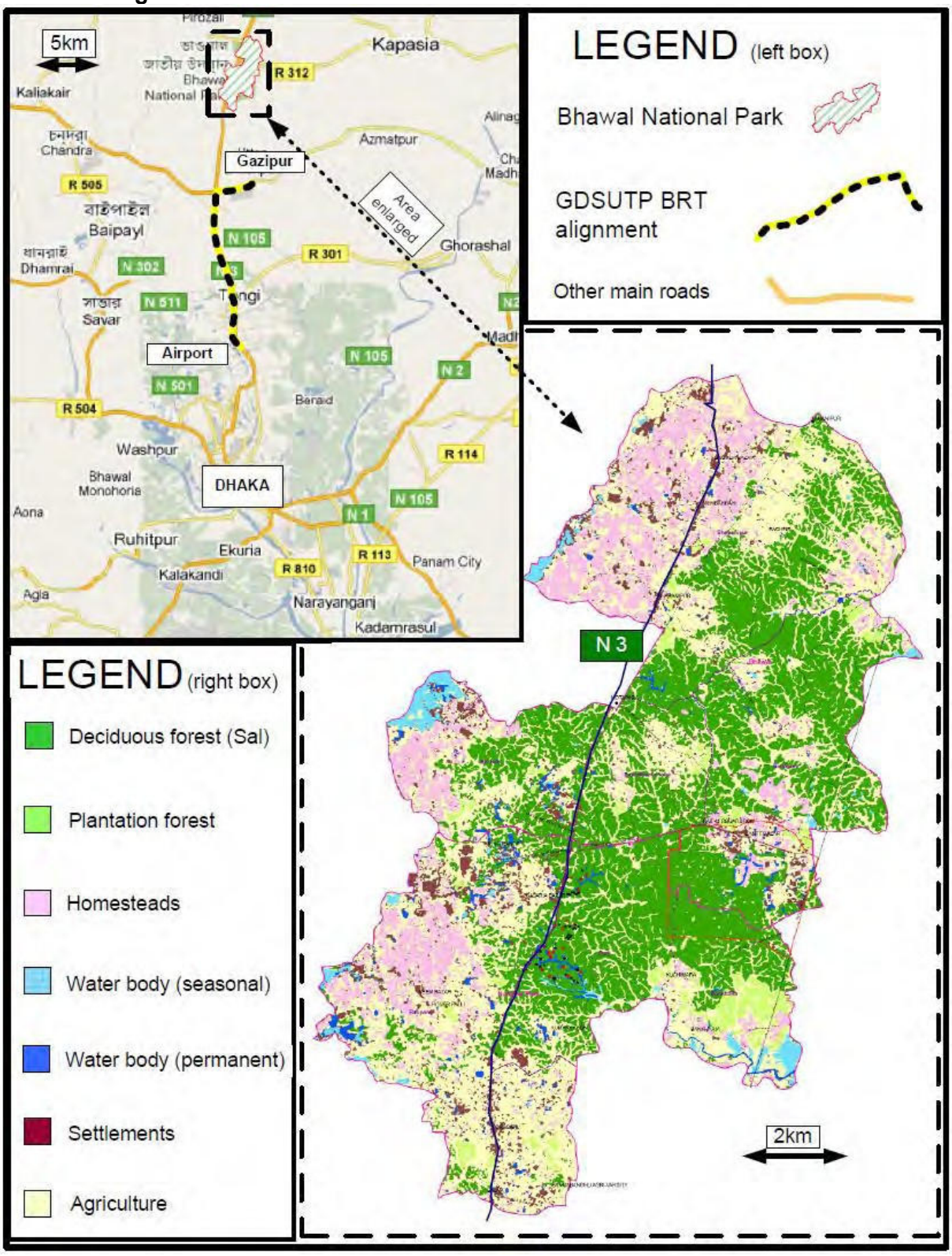


Figure 12: Measurement of Air Quality



Source: Dhaka Urban Transport Network Development Study
Final Report March JICA 2010

Figure13: Location of Bhawal National Park



VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Environmental Impacts Associated with the Project

88. This section discusses the potential environmental impacts of the proposed project and identifies mitigation measures to minimize the impacts in the design, constructions both original and AF, and operational phases. Environmental analysis covered potential direct, indirect, cumulative, and induced impacts but primarily focused on the physical impacts within the BRT corridor along Dhaka-Mymensingh Road and Chowrasta-Gazipur Road.

89. **Physical impacts**. The main physical issues relate to impacts such as (i) new construction of the BRT; (ii) reconstruction of the road and associated earthworks to utilize the full width of the RoW; (iii) construction of the BRT road way and stations at grade; (iv) construction of the BRT flyovers, terminals, and other elevated sections; (v) obtaining rock-based construction materials; (vi) supply and installation of bitumen surfacing; (vii) casting of concrete components for bridges flyovers, terminals, and other elevated sections; (viii) noise, dust, spoil, and sediment disposal; (ix) disposal of other waste; and (x) water quality. Blasting can be ruled out unless there are unforeseen subterranean boulder masses to be removed. The construction for the civil works will create some unavoidable dust, noise, and vibration and all need to be addressed. Since scope of works of the BRT project will be revised or changed under AF, all physical issues will be same as these have been considered during the main construction phase.

90. **Management issues**. The main management issues relate to impacts such as (i) re-provisioning electric power lines; (ii) gas and water mains and telecommunication cables; (iii) planning temporary traffic management measures; (iv) management of waste and spoil disposal; (v) wastewater treatment for proper disposal in BRT bus depot; (vi) materials supply; (vii) drainage; (viii) prevention of flooding and protection of the construction works; (ix) managing tree-cutting and replanting; (x) controlling noise and dust; (xi) managing workers and public safety; and (xii) implementation of COVID 19 health guidelines.

91. **Biological impacts**. The main biological issues relate to (i) possible removal of road side trees in the work areas and compensatory planting; (ii) acquisition of small parcels of open amenity spaces or agricultural land near the alignment; and (iii) impacts on rivers. There is no issue of interference with sites protected for their biodiversity, as the project is more than 10 km from the nearest nature reserve buffer zone. There will be no interference with protected forests as the works will be in the urban area, within the RoW for the project.

92. **Social impacts**. The social and human impacts to street level activities and impacts to social infrastructure will be mitigated through implementation of the resettlement plan. Most impacts are directed to vendors/hawkers operating businesses within the RoW. The project will provide alternative sites for continued business activities along with other entitlements to ensure no significant negative impacts.

B. Cumulative, Indirect, and Induced Environmental Impacts

93. The transportation network that the BRT will be a part of is already well developed. Planning efforts aim to completely overhaul mass transportation modes in line with the Strategic Transport Plan for Dhaka.

94. **Cumulative impacts**. As assumed during the design phase of the project, cumulative negative impacts would likely to be mainly construction related, relatively short-lived, and could be mitigated by implementing mitigation measures and a suite of temporary transport management arrangements to those identified in the EMP, however construction phase has been lingered couple of times than the initial stipulated construction time. Hence the project have posed long term environmental impacts on the local environment particularly due to construction-time traffic congestion, dust generation, occurrence of accidents, public nuisance due to mishandling of waste and health-safety conditions. If similar slow construction pace is continued under AF of the BRT, then additional resources must be deployed for proper implementation of EMP.

95. **Indirect impacts**. The use of more fuel-efficient vehicles and the development of better sealed roads will improve the system overall and reduce some of the pollution arising, and will therefore have some indirect benefits on the respiratory health of some of those living near to roads.

96. **Induced impacts**. The BRT would promote transportation and land use linkages which are consistent with more sustainable urban development. More planned development using principles of transit oriented development (TOD) could be induced, leading to less private car reliance and more public transit use. The BRT will be carried out on existing built-up roads and there will be many more traveling passengers as the BRT system develops. The origins and destinations of the traveling public may remain much the same in the existing transport corridor, but overall patterns of movements will change, and the BRT and road upgrading should make travel more efficient. Therefore, overall there would appear to be some opportunity for beneficial induced impacts with better strategic transport planning and general improvement to the road and transportation network overall.

97. The potential environmental impacts in the design, construction and operational phases are assessed below. Where impacts exceed accepted environmental standards, mitigation measures are proposed in order to reduce residual impact to acceptable levels and achieve the expected outcomes of the project. The criteria for assessment are in line with the Safeguards Policy Statement (SPS), or if the Government of Bangladesh standard is stricter, the national standards and criteria set by the government. Where the government has no set of standards or guidelines, the standards given in World Bank's Environmental Health and Safety Guidelines (2007) are used. The EMP (Chapter VIII) provides a matrix of mitigation and monitoring measures to prevent or minimize the impacts. For purposes of this assessment, the project implementation unit (PIU) will engage one detailed engineering, procurement, construction management, and supervision consultant (EPCM) to cover both detailed design and construction supervision. All guidelines including ADB SPS 2009, national environmental laws and environmental mitigation measures as identified in the EMP will be followed under AF phase of the BRT project.

C. Design/Preconstruction Phase

98. As the existing alignment of the road will be followed, route selection is established, but there may be some later adjustment of alignment to avoid existing structures in the RoW. There are a number of mitigation measures that will need to be carried out by EPCM to avoid construction impacts, and by good design, to minimize operational environmental impacts. Detailed design will be required to ensure that the BRT can cope with flooding from a 100-

year return storm event. In line with ADB policy on environmentally responsible procurement, opportunities to provide environmental enhancements will also be identified in the detailed design as well as routine matters such as avoiding unnecessary removal of trees and compensatory and enhancement planting. The opportunities for design, construction for both original and AF phases, and operational enhancements have been included in the EMP.

1. Design Measures and Project Disclosure

99. The EPCM, in cooperation with PIU, will prepare the detailed designs and detailed management plans to address the requirements below, including, but not necessarily limited to, the following design requirements, and all items in the EMP (Table 12):

(i) Land acquisition, resettlement, and environmental impacts will be avoided or minimized to the extent possible by basing the detailed designs within the RoW as proposed in the preliminary designs. Most impacts will be to commercial vendors within the RoW who will be relocated and compensated in accordance with their settlement plan.

(ii) Potential solution spaces to ensure sufficient disposal space for cut surface spoil materials and to avoid fly-tipping will be identified in advance by the EPCM and approved by PIUs and the local community before bidding.

(iii) Arrangements will be made to facilitate the timely production and supply of rock and bitumen-based materials for construction, and to avoid impacts due to un-necessary stockpiling near the BRT route.

(iv) Extensions and improvements of drainage culverts for BRT drainage and the adjacent road will be designed to account for increased rain due to a once-in-100-years return storm event.

(v) Hydrologicalanddrainageimpactsduringconstructionwillbeminimizedbyincludi ng in the detailed design the early phasing of replacement of side drains, culverts, and other infrastructure.

(vi) Disruption to current facilities for water supply will be avoided and facilities will be retained or reprovisioned before construction work begins; provisions will be made to preserve the operation of current facilities for water supply in sufficient quantity in agreement with the local community.

(vii) Disruption to current power supply will be avoided and movement of power lines will be planned in advance. Power distribution circuitry will be reprovisioned before construction works begin; provisions will be made to preserve the operation of current facilities for power supply in sufficient quantity in agreement with the local power supply company.

(viii) Disruption to telecommunications will be avoided and movement of telecommunication lines will be planned well in advance. Telecommunication lines will be reprovisioned before construction works begin; provisions will be made to preserve the operation of current facilities for telecommunications in sufficient quantity in agreement with the local power supply company.

(ix) Disruption to current facilities for main gas supply will be avoided and facilities will be retained or reprovisioned before construction works begin; provisions will be made to preserve the operation of current facilities for gas supply or provide an alternative supply in sufficient quantity in agreement with the local community.

(x) Plans to minimize disturbance of vehicular traffic and pedestrians during construction will be included in the detailed designs. It will be discussed and agreed with the police authorities and other local authorities along the project corridor. Plans to avoid or minimize disturbance of vehicular traffic and pedestrians during construction will be included in the detailed design. Phasing and programming for construction will retain passing lanes along the road during construction and avoid community severance. Guidance and general principles of traffic management planning are provided in Appendix 5.

(xi) Acquisition of land will be minimized for temporary facilities (if needed) by selecting preferred locations in detailed designs for construction yards and asphalt plant on barren or marginal land, and agreeing on terms with the local community.

(xii) Aim to provide enhancements under ADB policy on environmentally responsible procurement, and avoid negative impacts due to unnecessary removal of trees. Include compensatory tree plantation plan in line with the guidelines provided by the Forest Department.

As discussed with the PMU of BRT project, compensatory plantation plan will identify locations for planting saplings, plant varieties and provide a plating schedule so that plantation could be completed before ending of the construction phase. There must be a post plantation nursing phase to ensure proper growth and survival of the planted saplings.

100. The roads upon which the BRT will run requiring improvement are part of the existing road corridor, and although the RoW is wide enough for the implementation, there are some encroachments, and there will be some requirements for land acquisition and resettlement. This is confirmed in the resettlement plan.

101. The final alignment plan will be disclosed to the Department of Environment (DOE) under the environmental conservation rules (ECR) and ADB requirements, and a check will be made at the detailed design stage that the BRT alignment has been designed as planned to avoid and mitigate impacts. The initial environmental examination (IEE) / environmental management plan (EMP) shall be updated by the EPCM and resubmitted to ADB for review and approval prior to contract award. Further, if during detailed design there are any changes to the project design (such as change in alignment) that would result in environmental impacts or risks that are not within the scope of the current IEE, the project management unit (PMU), assisted by EPCM and during the detailed design phase, shall update the IEE (to gather with the EMP) or prepare a new environmental assessment report for submission to ADB. Prior to preparation of the updated or new environmental assessment report, the proposed project changes shall be screened by ADB for potential environmental impacts and risks to determine the appropriate extent and type of environmental assessment to be undertaken. During

project implementation, either an updated IEE, an updated EMP, or a new environmental assessment report shall be submitted to ADB for clearance, if any unanticipated environmental risks and impacts arise. The appropriate document for submission shall be determined by ADB. SPO will also establish the grievance redress mechanism at this stage before site works commence.

2. Project Boundary Changes Near Sensitive Receivers

102. The alignment runs mainly through mixed commercial and industrial areas and will not run through a residential developed area, but the alignment is subject to detailed design, and some affected persons may have their land acquired or be resettled. The places of worship, educational institutions, and residential sensitive receivers on the roads of either side of the BRT are set back sufficiently for traffic fumes to be dispersed, and road traffic noise will not increase enough to affect the sensitive receivers. The World Bank criterion of 3 dB(A) above background at the sensitive receiver for new noise sensitive developments such as residences, schools, colleges, and hospitals will be achieved. Noise and dust in construction will need to be controlled. There are some medical facilities near the BRT. The nearest setback is more than 30 m from the BRT and along a side street. The roadside vendors and tea and food stalls will be relocated away from the likely working areas on the BRT road. There are many educational establishments and mosques along the corridor, but the sensitive facades are also generally set some way back from the road.

103. As with most transportation projects, there will be some as yet unidentifiable refinements to the alignment at the detailed design stage, so work must take place over a slightly different area. Therefore the assessment will need to be updated at the detailed design stage when the final footprint and alignment and the relative location of the sensitive receptors is known. As mentioned above, a new environmental assessment or an updated IEE (together with the EMP) shall be prepared by SPO and EPCM if refinements or changes to the project alignment, based on the detailed design, would result in environmental impacts or risks that are not within the scope of the current IEE. Such documents shall be submitted for ADB's review before changes are implemented.

3. Environmental Capacity Development of Project Management Units (PMU) / Project Implementation Unit (PIUs)

104. The environmental specialists in EPCM will make sure that the PMU, roads and highways department (RHD), PIU, Bangladesh Bridges Authority (BBA), local government engineering department (LGED), and the environment and social circle (ESC) are trained and prepared to ensure that future contractors will be primed to cooperate with the implementing agency, project management, EPCM, and local population in the mitigation of environmental impacts. ESC indicated that there were several staff in RHD who, of their own volition, had taken post-graduate qualifications in environmental management, but these particular individuals were currently not designated in ESC. ESC will not have the resources to dedicate staff to undertake environmental management for the project. Therefore, it is proposed that the RHD's PIU will engage staff as environmental officer and resettlement officer to undertake environmental management and resettlement planning for the RHD works on the project. These staff will have qualifications and experience in environmental management and may be qualified individual staff in RHD seconded from other departments

or engaged by other means. It is also proposed that BBA's PIU and LGED's PIU also engage staff as environmental officers to undertake environmental management for the BBA and LGED project responsibilities. Under GDSUTP-AF environmental management capacity of the PMU should be strengthened through deployment of fulltime Environmental Specialist and a Junior Environmental Officer in the EPCM, and these staff should be supervised by the Environmental Focal of the PMU. Details of the proposed environmental capacity building are provided in Chapter VIII (environmental management plan).

4. Preparation of Site-Specific EMPs

105. The contractor will be primed by including the EMP in the bidding and contract documentation. Prior to bidding, the EPCM will produce a series of method statements or site-specific environmental management plans (SEMPs) that the contractor will subsequently be required to update, assisted by the EPCM. The broad content of the SEMPs is included in the construction mitigation section. The SEMPs will demonstrate the manner (location, responsibilities, schedule/timeframe, budget, etc.) in which the contractor will implement the mitigation measures specified in the EMP. Under AF current environmental management is seriously considered and hence all contractors will update their respective SEMP based on the updated EMP attached here in this report for subsequent implementation at their construction sites.

106. Based on the EMP, the following method statements shall be drafted by the EPCM in the preconstruction/detailed design stage for updating by the contractor (assisted by EPCM) before construction commences:

(i) temporary traffic management plan (TTMP) to minimize disturbance of vehicular traffic and pedestrians during construction. Access arrangements for vehicles accessing the project area will be formulated based on a traffic impact assessment including requirements from the district transport police forces, such that this will avoid community disturbance and severance and will at least retain necessary passing lanes along all roads used during construction;
(ii) utilities and telecommunications reprovisioning plan (UTRP) to minimize interruption to power, water, and gas supply and telecom systems;
(iii) waste management and spoil disposal plan (WMSP) for handling, storage, treatment, transport, and disposal of solid and liquid wastes, hazardous materials, hazardous wastes, and excavation spoils;
(iv) materials management plan (MMP) detailing arrangements to be made to facilitate the timely production and supply of construction materials to avoid impacts due to unnecessary stockpiling inside and near the project site area;
(v) drainage management plan (DMP) to ensure that construction works will not cause ponding/flooding within the project site, construction camps, borrow/quarry areas, other areas used for project-related activities, and areas adjacent to the project;
(vi) excavation protection and runoff control plan (ERCP) to ensure that construction works are protected and will not cause excessive runoff and siltation of waterways adjacent to or within the project site, have sufficient provisions to protect the works, ensure stabilization of exposed soils and other runoff-prone areas, minimize hydrological impacts, flooding, and uncontrolled runoff to adjacent areas, and protect the works under construction;
(vii) tree-cutting and replanting plan (TRP) to ensure that indiscriminate tree-

cutting shall be avoided by clearly defining areas where tree removal is necessary based on project requirements, and that replanting shall be done to compensate for lost trees;

(viii) noise and dust control plan (NDCP) to minimize impacts to sensitive receptors (educational establishments, hospitals, residential areas, etc.) due to construction works, sourcing, and transport of construction materials and other project-related activities; and

(ix) Accident Prevention and Occupational Health-Safety Plan to identify interfaces between the works and public and ensure worker and public safety, prevent accidents due to the construction works, and report all accidents due to the project activities.

5. Environmentally Responsible Procurement

107. All the above plans will be agreed in advance by PMU/PIUs/EPCM in the project preparation phase after consultation with all relevant authorities, and will be included in contract bidding documentation. The requirements in the contract will include full implementation of the EMP, including all the above plans, to ensure contractors are fully aware in advance of their environmental responsibilities and obligations. PMU/PIUs/EPCM shall ensure that the EMP and above plans are included in the bid and contract documents for civil works. PMU/PIUs shall require the contractor to engage capable and trained staff or site agents to take responsibility for the environmental management at the working level and to audit the effectiveness of the contractor's SEMP and review mitigation measures as the project proceeds. The effective implementation of the SEMP will be audited as part of the loan conditions, and the executing agency (MOC/PMU) will be prepared for this. In this regard, the RHD, BBA, and LGED (the implementing agencies) will also prepare to allow sufficient resources for their PIUs, assisted by EPCM, to fulfill the requirements of the law. The international and national environmental specialists in EPCM will train environmental staff in the PMU and environmental officers in the PIUs of RHD, BBA, and LGED to guide the contractors on the environmental aspects of project construction. This process has begun on other road-based transport projects, and will be carried forward in this project. Any recent recommendations and initiatives from the Ministry of Environment Forests and Climate Change (MOEFCC)/DOE or other local environmental and forestry authorities will be incorporated in the EMP, and updated and audited as necessary as the project is rolled out.

6. Utilities and Telecommunications Coordinating Committee

108. Considering the number of government and private agencies that need to be involved in implementing the reprovisioning of electrical power, water, and gas supply and telecom systems, it is recommended that a steering group or coordinating committee be set up early at the commencement of the detailed design stage. This will facilitate the identification of all foreseeable constraints and preparation of the utilities and telecoms reprovisioning plan (UTRP) by the EPCM. The objective will be to identify all potential hindrances to construction in the field and the lead time and processes necessary to ensure reprovisioning of the utilities and telecoms in good time. The process will establish preparedness of the utilities to facilitate reprovisioning. The aim will be to include the UTRP (as part of the EMP) in the bidding documents so that contractors are fully aware of the constraints. The bidding process can subsequently establish preparedness of contractors to facilitate reprovisioning by the utilities of the electrical power, water and gas supply and telecom systems in order to minimize any

interruptions to service and avoid delays in the commencement of construction works due to lack of preparedness.

109. The steering group or coordinating committee should be set up under the chairmanship of MOC as secretary, with specialized working groups meeting at least monthly for the first six 6 months of the design period. The membership should include all interested groups from the implementing agencies (RHD, BBA, and LGED, ESC, and EPCM), contractors, all utilities, police, and local authorities as necessary. As the project moves into the construction phase, additional coordinating committee meetings should be conducted as necessary if problems occur. As the project construction gears up, awareness workshops should be conducted periodically by the EPCM as every new contractor is engaged to ensure awareness of the constraints and processes needed to ensure reprovisioning of utilities, and to share experience in the implementation of the works in case unexpected difficulties occur.

7. Ambient Environmental Baseline Data

a. Air Quality and Noise

110. Baseline data on air quality and noise levels shall be collected before commencement of civil works. Such data will help in assessing project impacts during implementation. EPCM shall collect baseline data on total suspended particulates (TSP) and noise levels at locations along the alignment in the calendar month before construction begins. Four locations shall be checked for air quality and noise. Measurements shall be taken at least 2 weeks before commencement of civil works. Field sampling for TSP and noise will be conducted at representative sensitive receptors, i.e., sampling stations shall be established and sampled for each sensitive receptor type as follows: (i) residential area, (ii) school or educational establishment, (iii) mosque or temple, and (iv) hospital/health center. Field measurements for TSP shall be carried out using 1-hour averaging periods based on the prescribed methodology in the ECR, or as prescribed by the Department of Environment (DOE).

111. Noise impacts may be of short duration, although they can be very intrusive if not controlled properly. Noise measurement shall be undertaken at the same sites sampled for TSP and shall follow the methodology specified in ECR. Noise shall be measured in dB(A) over 24 hours covering different periods (i.e., 6 hours–18 hours, 18 hours–22 hours and 2 hours–6 hours). Measurement will also be taken to establish if the World Bank criterion of Leq55 dB(A) 1hour is exceeded at the measurement points, and at what time of day or night it is exceeded. If the Bangladesh criterion is exceeded by the existing noise (as seems very likely based on background spot measurements made for this IEE), the World Bank criterion of background +3 dB(A) will be applied in the monitoring. The criterion of Leq50 dB(A) can be used where background is below Leq50dB(A) 1hour. Works are not expected to be carried out at night, but if this is unavoidable for unexpected reasons, separate measurements will also be taken before construction commences to establish if the Bangladesh night time criteria are exceeded, and the monitoring assessment criteria will be established accordingly.

112. Information such as recent rainfall will be documented as part of the baseline measurement. The sampling report will also specify if the sampling was undertaken during the rainy or dry season. Time and date of sampling, sources of dust and noise emissions during the sampling period, and comparison of results to applicable standards shall also be included in the report. Actual location of the sampling stations shall be described in the report

and plotted on a map together with GPS readings. The noise and TSP baseline monitoring will be reported by EPCM at the end of the detailed design period, either in the detailed design report or in a dedicated baseline monitoring report before the bidding documents are completed.

b. Water Quality

113. Baseline data on surface water quality and sediments shall be collected by EPCM. Sampling points shall be established near the Tongi Bridge River crossings, where the bridge construction and repairs and replacement will be undertaken. If construction camps are set up near the river sampling points, sampling points shall also be established on river/stream sections close to construction camps (i.e., rivers that will most likely receive run-off/discharge from workers' camps). Baseline sampling shall be conducted at least 2 weeks before contractors are deployed. Parameters will include pH, temperature, turbidity, dissolved oxygen, oil and grease, and total suspended solids (TSS). For rivers/streams close to workers' camps, the following additional parameters shall also be analyzed: biological oxygen demand–5 days (BOD5), coliform, and fecal coliform. Sampling and analytical methodology shall be consistent with Environmental Conservation Rules 1997 (Schedule10, Standards for Waste from Industrial Units or Projects Waste).

114. EPCM shall collect water samples 50 m upstream and 50 m downstream, at least at the Tongi Bridge site (Turag River/Tongi Khal) at mid-width and mid-depth at the river crossing to establish a reference baseline. An industry standard multiparameter water quality meter could be used for regular measurement of pH, dissolved oxygen, turbidity, and temperature as indicator parameters, and this would also be useful in the construction phase.

115. EPCM shall collect sediment samples as near as possible to the positions for the new piers for the New Tongi Khal bridge/flyover and 50 m downstream of the Tongi Bridge site (Turag River / Tongi Khal) river crossing to establish a reference baseline. Parameters will include pH, temperature, dissolved oxygen, oil and grease, and heavy metals like copper (Cu), cadmium (Cd), mercury (Hg), and lead (Pb) as indicator parameters.

116. Information on weather conditions during sampling, recent rainfall, etc. will be documented as part of the baseline measurement. The report will also specify if the sampling was undertaken during the rainy or dry season. Time and date of sampling, potential sources of contaminants/pollutants during the sampling period, and comparison of results to applicable standards shall also be included in the report. Actual location of the sampling stations shall be described in the report and plotted on a map together with GPS readings. The water quality and sediment baseline monitoring will be reported by EPCM at the end of the detailed design period, either in the detailed design report or in a dedicated baseline monitoring report before the bidding documents are completed.

Table 9: Maximum Allowable Concentration of Pollutants in Surface Water

Ref.	Parameter	Unit	Permissible Limit	
			Inland surface water	Irrigated land
1	pH		6-9	6-9
2	Dissolved oxygen	mg/l	4.5–8	4.5–8
3	Total suspended solids (TSS)	mg/l	150	200
4	Oil and grease	mg/l	10	10

5	BOD 5	mg/l	50	100
6	Electrical conductivity	micromhos/cm	1200	1200

cm=centimeter, mg/l=milligram per liter, pH=a negative decimal logarithm of the hydrogen ion activity in a solution.
Source: Environmental Conservation Rules1997 Schedule10.
Note: Inland surface water means drains/ponds/tanks/waterbodies/ditches, canals, rivers, springs and estuaries. Irrigated land means such land area which is sufficiently irrigated by wastewater, taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.

Parameters1 to 4 and 6: to be analyzed for all river/stream samples.

Parameter 5: to be analyzed only for samples from river and stream sections which are likely to receive or will receive run-off/discharge from workers' camps.

117. The water in the Turag River is highly polluted and may not mix well. For rivers that do not mix well, and/or are highly polluted such that it is likely that there will be different dissolved oxygen and TSS values at river bottom rather than at mid-depth, samples shall be collected near river bottom and at mid-depth if possible.

8. Enhancements

118. It has been common practice in many places to plant trees along Dhaka streets and highways to provide visual interest in line with best international practice for highway design. Whereas water supply is not likely to be limited along much of the BRT road, there will be some good opportunity sites for tree planting especially around stations, terminals, depots, and parking areas. These locations may provide a chance to create some local soft landscaping where successful planting of trees and shrubs could be accomplished and should be investigated during detailed design phase. Since plantation activities are still pending, under AF PMU will adequate efforts to prepare a compensatory tree plantation plan. For identifying plantation locations and post plantation nursing local communities and other stakeholders could be engaged. Proper compensation of trees removed must be considered in terms of varieties and numbers from an environmental and ecological point of view.

D. Construction Phase

119. The source of the construction impacts from BRT will include (i) construction of the BRT pavement, stations, underpasses, flyovers, BRT viaducts, terminals, and depot; (ii) excavation and reconstruction of the road and nonmotorized traffic (NMT) lanes and associated earth works to utilize the full width of the right of way (RoW); (iii) excavation and reconstruction of the side drains and lead-off drains and upgrading road drainage; (iv) construction, repair, and reconstruction of bridges at Tongi Khal; (iv) ensuring drainage and access near adjacent street developments and at other key areas is unimpaired by construction/extension of numerous culverts and BRT underpasses; (v) ensuring security of supply and reprovisioning of electrical power, gas, and water supply mains and telecommunications lines to adjacent street developments and at other key areas; and (vi) installing signals, signs, road markings, landscaping, and accessories. Reconstruction of the adjacent BRT road will result in a lot of surface cutting, which will give rise to large amounts of spoil for disposal. The EPCM consultant will cover both detailed design and construction supervision.

1. Activate Site-Specific Environmental Management Plans (SEMPs) and Obtain Permits and Licenses

120. The EPCM will be engaged by the PMU in line with ADB policy on environmentally responsible procurement. The EPCM will train and supervise the contractors to carry forward the environmental mitigation measures and enhancements identified in the detailed designs. On behalf of PIUs, the EPCM will assist contractors to prepare updates of the management plans/SEMPs prepared by EPCM at the design stage. The benchmark for monitoring and reporting on the contractor's environmental performance are the updated SEMPs, all the mitigation measures in the EMP (Table 12), and any additional mitigation measures that may be included by the EPCM in the EMP during detailed design stage. Prior to commencement of construction, the updated SEMPs/management plans shall be approved by the EPCM and PIUs. PIUs shall ensure that contractors and their suppliers comply with all statutory requirements for permits from DOE with regard to use of mechanical equipment, establishment and operation of construction plants such as asphalt plant, concrete batching plant, rock crusher, spoils disposal, etc. PIUs shall ensure that contractors and their suppliers use licensed sources of rock-based materials that comply with all statutory permits and DOE requirements.

2. Orientation of Contractor

121. EPCM shall orient the contractors on implementation of construction mitigation measures in the SEMPs/management plans and all other construction phase mitigation measures included in the project EMP (i.e., EMP included in the IEE), and any mitigation measures that may be included by the EPCM during detailed design stage. The EPCM will monitor the implementation of mitigation measures by the contractors, and if the required measures are not installed, payments will be withheld as per the bidding documents. This will include implementation of malaria controls and HIV-AIDS education in line with social plans and the requirements for an HIV/AIDS awareness and prevention program to be implemented under the project. These requirements, including the EMP table on mitigation measures (Table 12), will be included in the particular specification for the contract.

3. Loss of Trees/Deforestation and Impacts to Fauna

122. The tree-cutting and replanting plan (TCRP) designed by the EPCM will be prepared with the designs. The plan will be agreed on with the forest authorities prior to commencement of construction and should be approved by the chief conservator of forests as acceptable before contractors are engaged and before any tree-cutting is undertaken. The TCRP shall be updated by the contractor (assisted by the EPCM) as part of SEMP. Road excavation will be designed not to undercut or destabilize adjacent tree-lined pavements and verges, and clearing of trees will be minimized in SEMP. The local forestry authority will be informed in advance, and based on the tree-cutting and replanting plan, may also monitor marking of trees that will be removed under its jurisdiction.

123. The EPCM will supervise and monitor the contractors to carry forward the mitigation measures and environmental enhancements identified in the SEMP, as well as routine matters such as avoiding unnecessary removing of trees and compensatory and enhancement planting. The EPCM will supervise and monitor to check that the contractors do not remove any trees not covered by tree-cutting and replanting plan during construction,

unless agreed in advance with the EPCM and forest authority.

124. The EPCM will supervise and monitor a ban on use of local trees for timber, and workers shall be prohibited from using cut trees for firewood. During replanting/revegetation, new alien plant species (i.e., species not currently established in the region of the project) shall not be used unless carried out with the existing regulatory framework for such introduction. All replanting and compensatory planting will be planned in full agreement with the local forest authority.

125. The contractor will not use or permit the use of wood as a fuel for the execution of any part of the works, including but not limited to the heating of bitumen and bitumen mixtures. To the extent practicable, the contractor shall utilize reusable shuttering for concrete works and shall ensure that fuels other than wood are used for cooking and water heating in all his camps and living accommodations. The contractor shall not buy or use wood from illegal sources (illegal logging). The contractor will take all precautions necessary to ensure that damage to vegetation is avoided due to execution of the works. The contractor will keep a fire watch at all times and immediately suppress any occurrence of fire, and shall undertake replanting to replace damaged vegetation due to fire or execution of the works. The tree-cutting and replanting plan (TCRP) will include the following minimum considerations:

(i) Identification of trees to be cut and their locations;
(ii) ban on use of timber for fuel;
(iv) justification for tree-cutting as an alternative to BRT realignment;
(v) permission from the Forest Department for tree-cutting;
(vi) methods for marking and protection of uncut trees and limitations to cutting;
(vii) methods and timing for safe cutting to minimize interference with normal traffic;
(viii) methods to remove trees and cut timber and avoid stock piling of cut wood onsite;
(ix) methods to avoid under cutting adjacent tree-lined pavements;
(x) program for cutting trees and enhancement planting;
(xi) compensatory tree planting program agreed with authorities and CCF;
(xii) discussion of the EPCM/PIU inspection/monitoring role; and
(xiii) agreement on publicity/public consultation requirements.

4. Drainage and Hydrology

126. The drainage system, irrigation, and water resources on surrounding lands will be affected by construction activities as follows: (i) local water supplies will need to be tapped to meet construction requirements, bringing project-based water use into competition with local use; (ii) surface and subsurface water resources in the project area could be contaminated by fuel and chemical spills, or by solid waste and effluents generated by the kitchens and toilets at construction campsites; (iii) rebuilding of drainage channels crossing the work areas and required reprovisioning; and (iv) natural streams are few but adjacent drainage pathways may become silted by borrow material (earth) in the runoff from the construction area, workshops, and equipment washing yards.

127. The contractors will incorporate the following design features into the SEMP after review of the detailed design to minimize alterations in the project corridor’s surface drainage patterns as far as possible:

(i) Contractors will review the detailed designs for side and cross-drainage structures, provided there is an agreement with PIU/EPCM if redesign is required or if new structures will be constructed or existing ones repaired.
(ii) Contractors (assisted by DCS) will update the drainage management plan as required.
(iii) In areas close to the sensitive receptors, appropriated rains will be constructed so that the outfalls of the surface runoff from the carriage way are diverted away from the sensitive receptors.
(iv) Measures will also be taken during the construction phase to ensure that storm drains and highway drainage systems are regularly cleared to maintain storm waterflow.

5. Utilities and Reprovisioning

128. Local water supplies, electrical power supply, telecommunications, and irrigation water supply must be maintained during the works. Therefore, the need to reprovision for power supply cables, telecommunication cables, irrigation, or other water supplies needs to be reassessed and reconfirmed by the contractors before work commences. Therefore, the contractor will:

(i) discuss with EPCM and update utilities and telecommunications reprovisioning plan;
(ii) reconfirm power and water supply and telecommunications systems likely to be interrupted by the works;
(iii) contact all relevant local authorities for utilities and local village groups to plan reprovisioning of power, water supply, and telecommunication systems;
(iv) relocate and reconnect utilities ahead of commencement of construction works, and coordinate with relevant utility company and allow sufficient lead time at the provincial and district levels for relocation and reconnection before work commences;
(v) inform all hospitals, schools, places of worship, and affected communities well in advance;
(vi) arrange reconnection of utilities and telecommunication systems in the shortest practicable time before construction commences;
(vii) if utilities are damaged during construction, it shall be reported to the EPCM and utility authority and repairs shall be arranged immediately at the contractor's expense.

6. Materials Exploitation and Management of Quarry and Borrow Areas

129. The EPCM will produce a draft materials management plan (MMP) in the detailed design stage for confirmation in the preconstruction phase and for updating in the construction phase (in the SEMP) by the contractor. The MMP will seek, as far as reasonably practicable, to minimize the use of non-renewable resources and rock-based materials, and also to balance cut-and-fill requirements which will contribute to the minimization of impacts. As a first priority, where surplus materials arise from the removal of the existing surfaces, these will be used elsewhere on the project for filling (if suitable) before additional rock, gravel, or sand extraction is considered.

130. The materials management plan will include the following as minimum considerations:

(i) Required materials, potential sources, and estimated quantities available;
(ii) impacts to identified sources and availability;
(iii) excavated slope material for reuse and recycling methods to be employed;
(iv) endorsement from DOE and local groups for use of sources;
(v) methods of transportation to minimize interference with normal traffic;
(vi) constraints of regular delivery schedule to reduce stock piling onsite;
(vii) program for reuse of underground excavated material for reuse;
(viii) program for delivery of quarry and borrow materials;
(ix) discussion of the PIUs/EPCM inspection/monitoring role; and
(x) agreement on publicity/public consultation requirements.

131. In the detailed design stage, the EPCM will produce a draft mass haul chart for the aggregate and asphalt materials needed for the construction works. The mass haul chart will also be updated and modified as necessary by the contractors as part of the SEMP before construction begins to produce a materials management plan (MMP), including mitigation for the extraction of materials, to specify (i) the methods to be employed prior to and during the extraction and transportation of rock based materials for construction; (ii) all other measures to be employed to mitigate nuisances to local residents; and (iii) any additional measures needed (such as compensatory planting when considered necessary, if trees have to be removed for gravel extraction or quarries). Contractual clauses will be included to require the contractors to update the draft MMP regularly and report monthly to monitor the production and use of materials. The contractor will be responsible for updating the cut-and-fill estimates in the MMP and reporting to the PIUs. The MMP can then be used to plan for asphalt and aggregates management and to provide an overall balance for asphalt and cut-and-fill materials and minimize impacts on other local resources outside the road corridor. The contractor will be responsible for:

(i) Updating draft MMP from the detailed design phase;
(ii) Balancing cut-and-fill requirements to minimize impacts from extraction of aggregates;
(iii) Procuring materials only from DOE-authorized quarries and borrow sites;
(iv) Prioritizing use of existing quarry sites with suitable materials and updating the list of quarries and borrow pits monthly in MMP, and reporting to PIUs and minimizing impacts on other local resources;
(v) Securing required environmental permits prior to operation of quarry/borrow areas, if the contractor shall operate the quarry site;
(vi) ensuring borrow/quarry sites shall not be located in productive land and forested areas;
(vii) following compensatory planting if trees have to be removed;
(viii) stockpiling top soil for later use, and fencing and recontouring borrow pits after use;
(ix) properly removing topsoil, overburden, and low-quality materials stockpiled near the site, and preserving them;
(x) using quarry with highest ratio between extractive capacity (both in terms of quality) and loss of natural state;
(xi) using quarry sites close to the alignment, with a high level of accessibility and a low hill gradient;
(xii) not using quarries in areas of natural woodland or near rivers which provide food and shelters for birds and other animals;

(xiii) reinstating damaged access roads due to transport of quarry/borrow materials and other construction materials due to various project-related activities, upon completion of construction works at each section;

(xiv) providing adequate drainage to avoid accumulation of stagnant water during quarry/borrow site operations;

(xv) avoiding or reducing the sections of quarry sites located on riverbeds. If it is not possible to locate quarries out of riverbeds, quarry sites lying on small rivers and streams shall be avoided;

(xvi) opting for alluvial terraces or alluvial deposits which lie on the river beds but are not covered by water under normal hydrological conditions;

(xvii) ensuring borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of water bodies favorable for mosquito breeding;

(xviii) implementing measures such as fencing, providing floatation devices such as a buoy tied to a rope, etc. to avoid drowning when pits become water-filled; and

(xix) dewatering quarries and borrow pits and installing fences upon completion of extraction activities, as appropriate, to minimize health and safety risks.

7. Spoil Disposal

132. The works will require cutting to construct the Greater Dhaka Sustainable Urban Transport Project (GDSUTP) BRT. It is estimated that there will be a surplus of soil-based materials for reuse or disposal as spoil elsewhere. Only a small proportion will be suitable for filling. Therefore, there will be a surplus of rock and soil-based materials as spoil, and if disposal is not planned in advance there will be impacts and environmental degradation due to the improper disposal of these materials.

133. In some locations, the use of this immediately available material will minimize the need for additional extraction of rock-based materials. The surplus material should be graded and the suitable cut materials directed for reuse as far as possible on BRT and subsequently on other road and other local infrastructure projects. This will reduce the need to extract other rock and gravel resources from vulnerable hills ides and riverbeds. The surplus can then be stockpiled at locations agreed on with local authorities for use on other local district projects or other nationally planned infrastructure.

134. The surplus rock and soil-based materials for disposal must be controlled to avoid potential impacts due to improper disposal. A waste and spoil management plan (WSMP) will be required to ensure waste from BRT construction is managed properly, and to reduce, reuse, and recycle waste wherever possible. Contractors will initially review the EPCM's options for stockpiling and disposal locations for cut surface materials in the draft WSMP, and reconfirm or propose alternative disposal locations for agreement with PIU and local authorities. The contractor will prepare the WSMP (with the assistance of the EPCM) 1 month before the commencement of construction, including disposal sites identified for agreement by EPCM/PIUs and local authorities. The WSMP will cover all aspects of construction waste disposal. It is preferred that government land is used for dumping of material. If private land is to be used for the purpose of dumping, this shall commence only after written permission from the landowner is checked and recorded by the EPCM/PIU and is agreeable to DOE.

135. Contractual clauses will be included to require the contractors to update the draft WSMP one month before construction commences to identify all the agreed disposal sites and to balance cut-and-fill as far as practicable for the duration of the work.

136. Mitigation measures will seek to control the impacts at source. The EPCM will be responsible to report the update of the cut-and-fill estimates in conjunction with asphalt and aggregate materials planning (MMP) between the different areas and contractors, and advise on overall balancing for cut-and-fill materials to minimize impacts on local resources. (Mitigation measures for cut areas are covered under runoff control.)

137. The spoil disposal section of the WSMP will include considerations of the following:

(i) agreed locations for disposal/endorsement from DOE and local groups;
(ii) methods of transportation to minimize interference with normal traffic;
(iii) establishment of acceptable working hours and constraints;
(iv) agreement on time scale and program for disposal and chain of custody;
(v) programming issues, including time of year and available resources;
(vi) discussion of the PIUs/EPCM's inspection/monitoring role;
(vii) establishment of complaints management system for duration of the works; and
(viii) agreement on publicity/public consultation requirements (advance signing, etc.).
(ix) locations and quantities of spoil arising from the construction works;

138. Mitigation measures will seek to prevent surface collapse impacts and control the impacts at source. The EPCM will be responsible for monitoring the progress of excavations and the implementation of mitigation measures to minimize impacts. The mitigation measures in the spoil disposal section of the WSMP will include, but not necessarily be limited to, the following considerations:

(i) Spoil will not be disposed of in rivers and streams or other natural drainage paths.
(ii) Spoil will not be disposed of on slopes, floodways, wetland, farmland, forest, religious or other culturally sensitive areas, or areas where a livelihood is derived.
(iii) Surplus spoil will be used where practicable for local repair works to fill eroded gullies, depression areas, and degraded land inconsultation with the local community.
(iv) Spoils shall only be disposed of in areas approved by local authority.
(v) Spoil disposal will be monitored by EPCM/PIUs and recorded using a written chain of custody (trip ticket) system to the designated disposal sites.
(vi) Spoil will be disposed of in disused quarries and abandoned borrow pits where practicable.
(vii) Disposed spoil will be spread in 15-cm layers and compacted to optimum moisture content, covered with topsoil, landscaped, and provided with drainage and vegetation to prevent runoff in line with best practice.
(viii) Spoil disposal shall not cause sedimentation and obstruction of flow of watercourses, or damage to agricultural land and densely vegetated areas.
(ix) Under no circumstances will spoils be dumped in to water courses (rivers, streams, drainage, irrigation canals, etc.).
(x) The spoils disposal site shall be located at least 50 m from surface water courses and shall be protected from runoff by avoiding formation of steep

slopes and grassing.

8. General Construction Waste Management

139. Uncontrolled waste disposal operations can cause significant impacts. Mitigation measures will seek to reduce, recycle, and reuse waste as far as practicable. The EPCM will be responsible to monitor the contractor's progress in updating the WSMP and the implementation of mitigation measures to minimize impacts.

140. The general waste section of the WSMP will include consideration of all matters related to solid and liquid waste disposal, including the following:

(i) Expected types of waste and quantities of waste arising;
(ii) Waste reduction, reuse, and recycling methods to be employed;
(iii) Agreed reuse and recycling options and locations for disposal/endorsement from DOE and local groups;
(iv) Methods for treatment and disposal of all solid and liquid wastes;
(v) Methods of transportation to minimize interference with normal traffic;
(vi) establishment of regular disposal schedule and constraints for hazardous waste;
(vii) program for disposal of general waste/chain of custody for hazardous waste;
(viii) discussion of the PIUs/EPCM's inspection/monitoring role;
(ix) establishment of complaints management system for duration of the works; and
(x) agreement on publicity/public consultation requirements (advance signing.).

141. The contractors' mitigation measures in the waste management plan (WMP) will include but not necessarily be limited to the measures listed below. The contractors shall ensure implementation of these measures.

(i) Update the draft WSMP (in EMP, assisted by EPCM) to cover all aspects of waste storage, disposal, and accidental spills, all to be approved in writing by the EPCM1 month prior to start of work.
(ii) Areas for disposal will be agreed with local authorities and checked, recorded, and monitored by the EPCM/PIUs/environmental and safety officer (ESO).
(iii) Segregation of wastes shall be observed. Organic waste (biodegradables such as tree trimmings) shall be collected and disposed of onsite by composting (no burning is allowed on site).
(iv) Recyclables shall be recovered and sold to recyclers.
(v) Residual and hazardous wastes shall be disposed of in disposal sites approved by local authorities.
(vi) Construction/workers' camps shall be provided with garbage bins.
(vii) Burning of construction and domestic wastes shall be prohibited.
(viii) Disposal of solid wastes into canals, rivers, other water courses, agricultural fields, and public areas shall be prohibited.
(ix) There will be no site-specific landfills established by the contractors. All solid waste will be collected and removed from the work camps and disposed of in local waste disposal sites.
(x) Waste disposal areas approved by local authorities shall be rehabilitated, monitored, catalogued, and marked.

9. Hazardous Materials and Hazardous Waste Disposal

142. Use of hazardous substances such as oils and lubricants can cause significant impacts if uncontrolled, or if waste is not disposed of correctly. Mitigation measures will seek to control access to and use of hazardous substances and control waste disposal. The EPCM will be responsible for monitoring the contractor's progress in updating the WSMP to include implementation of mitigation measures and to minimize impacts from hazardous substances.

143. The contractors' mitigation measures in the hazardous materials and waste section of the WSMP of the SEMP will include but not necessarily be limited to the following measures, with implementation to be ensured by the contractors:

(i) Ensure that safe storage of fuel, other hazardous substances, and bulk materials are agreed on by PIUs/EPCM, and have necessary approval/permit from DOE and local authorities.
(ii) Hydrocarbon, toxic materials, and explosives will be stored inadequately protected sites consistent with national and local regulations to prevent soil and water contamination.
(iii) Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas shall be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency.
(iv) The contractor shall identify personnel in the WSMP/SEMP in charge of these sites, and ensure they are properly trained to control access to these areas; entry will be allowed only under authorization.
(v) Fuel and other hazardous substances shall be stored in areas provided with roof, impervious flooring, and bund/containment wall to protect these from the elements and to readily contain spilled fuel/lubricant.
(vi) Segregate hazardous wastes (oily wastes, used batteries, fuel drums) and ensure that storage, transport, and disposal shall not cause pollution and shall be undertaken consistent with national and local regulations.
(vii) Ensure all storage containers are in good condition with proper labeling.
(viii) Regularly check containers for leakage and undertake necessary repair or replacement.
(ix) Store hazardous materials above possible flood level.
(x) Discharge of oil-contaminated water shall be prohibited.
(xi) Used oil and other toxic and hazardous materials shall be disposed of in an authorized facility off site.
(xii) Adequate precautions will be taken to prevent oil, lubricant, or hydrocarbon contamination of drainage channel beds.
(xiii) Ensure availability of spill, clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored.
(xiv) Spillage, if any, will be immediately cleared with utmost caution to leave not races.
(xv) Spillage waste will be disposed of at disposal sites approved by local authorities and by EPCM.
(xvi) All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulations.

(xvii) For operation phase, if Battery Electric Buses (BEB) are used for BRT, then battery should be disposed of using proper disposal mechanism. As provision thought by the DBRTCL as an option, used battery should be replaced by the batter supplier, hence battery service will be procured not battery.

10. Asphalt Hot Mix Plant, Rock Crushing, and Bitumen Supply

144. The rock crushing activities will generate noise and dust, and pavement works will generate gas and odor from the asphalt hot-mix plant and noise from the compaction of the pavement. Construction of BRT will require rock-based material and asphalt. Although the emissions from powered mechanical equipment that supply crushed rock and asphalt will be rapidly dispersed, they will need to be sited carefully to avoid complaints.

145. In order to maintain the existing air quality of the project area in a condition acceptable to the local population, compliance with the following mitigation measures will be needed:

(i) Cement batching and aggregate mixing plant shall be located as far as possible (at least 500 m) from settlements and habitation near the project corridor, or as required by environmental regulations.
(ii) All conditions of DOE permits and local guidelines shall be observed.
(iii) Dust suppression equipment shall be installed at cement and aggregate mix plants.
(iv) Areas of construction on the BRT roads, as well as the haul road, shall be kept damp by watering the construction area.
(v) Where local roads are used for hauling, they shall be kept in serviceable condition, and any damage shall be repaired promptly without interference to local travel routes.
(vi) Storage sites, mixing plants, and asphalt (hot mix) plants will be at least 500 m down wind of the nearest human settlements or as otherwise required under DNRE permits and guidelines.
(vii) All hot-mix plants, crushers, and batching plants will be located in agreement with the local district or municipality, and installed in a sealed area only after receiving approval from the relevant local authority and DOE.

146. Fumes from asphalt chemicals are likely to be well dissipated in the wide-open street, and the criteria in the environmental conservation rules (ECR) should not be exceeded. However, phenol compounds in the bitumen have a very low odor threshold, and extremely low concentrations can cause nuisances. These are unlikely to accumulate to toxic levels, but the plant for the supply of molten bitumen should be sighted well away from rivers and streams, schools, health clinics, and other sensitive receivers.

147. Bituminous materials will generally be applied using machines supplied from the asphalt plant, but if bituminous compounds are to be applied by hand and melted in heaters, the fuel used shall be kerosene, diesel, or gas fuel. Fuel wood shall not be used for heating bitumen, and neither will bitumen be used as fuel.

148. Bitumen drums will be stored in a dedicated area, not scattered along the works, and any small accidental spills of bitumen or chemicals should be cleaned up immediately. The waste, including the top 2 cm of any contaminated soil, shall be disposed of as chemical waste in an approved landfill or approved local authority disposal site.

149. Bitumen plant and rock crusher activities (if required) will be controlled—e.g., hot-mix plants should not be located within 500 m of any sensitive receiver, riverbank, or irrigation channel, but located at convenient sites nearby, but downwind of and at least 500 m from sensitive receptors such as schools.

150. It is possible that contamination of soil may occur from oils and chemicals at asphalt/bitumen plant sites, workshop areas, and equipment washing yards. The contamination may limit the future use of land for agricultural purposes.

151. The following practices will be adopted to minimize the risk of soil contamination:

(i) The contractors will be required to instruct and train their workforce in the storage and handling of materials and chemicals that can potentially causes oil contamination.
(ii) Debris generated by the dismantling of existing pavement will be recycled subject to the suitability of the material.
(iii) Solid waste generated during construction and at campsites will be properly treated and safely disposed of only in demarcated off site waste disposal sites identified and agreed on with the PIU, local community, and local authorities.

11. Noise and Dust

152. Powered mechanical equipment such as generators, excavators, bulldozers, piling rigs, stabilizers, drills, stone crushers, graders, vibratory rollers, concrete-mixing plants, and screening plants will generate noise and vibration. Whereas various modern machines are acoustically designed to generate low noise levels and acoustically insulated plants may be available in Bangladesh, the cumulative effects from several machines can still be significant and may cause nuisances.

153. To minimize impacts, the contractors should be required by the PIU and EPCM to (i) provide evidence and certification that all equipment to be used for construction is fitted with the necessary air pollution and noise dampening devices to meet ECR and DOE requirements; (ii) maintain and service all equipment to minimize noise levels; (iii) locate equipment to minimize nuisances; and (iv) install acoustic insulation or use portable noise barriers where practicable to limit noise at sensitive receivers. Insulation should be provided to minimize noise impacts, such that the measured noise at the edge of the works nearest residential areas will be less than Leq50 dB(A) during night time (9p.m.–6a.m.) and Leq70 dB(A) at other times during the day.

154. There are some schools, educational establishments, and medical facilities near the project. The commercial premises are not set back from the likely working areas for the project. Where schools are nearby, the contractor shall discuss with the EPCM and the school principals the agreed time for operating these machines and completely avoid machine use near schools during examination times. Where noise is a major consideration (such as outside places of worship), construction should be avoided at sensitive times. As a fallback option to control noise, portable barriers can be introduced, using heavy thick plyboard or corrugated metal sheets. In addition to the physical effect of mitigating dust and noise, the installation of such measures should be discussed with the local population and serve as a means for further public consultation during implementation and for public relations.

155. BRT project is located in the busiest corridor of Dhaka. Contractors have been facing challeges in controlling dust pollution across the BRT corridor. Huge traffic jam interrupts regular schedule of water sprinkling activities. To cope with this challenge contractors installed additional pumps to refill water spraying vehicles in several points of the corridor. Contractors often deployed additional workers to remove dust from the main carriage of the RoW to reduce dust generation at source. Recently, EPCM with assistance from the PMU demonstrated use of chemical suppressant, calcium chloride flake, in various dust prone points of the corridor to observe effectiveness and expense viability. Implementation of various options of dust suppressing mechanism may help control dust pollution during construction period of the BRT project.

156. Earth works and rock-crushing activities will be the main sources of dust. In some locations (from origin to Km 4, Tongi Bridge) there will be some buffer distance between the work corridor and the existing sensitive receptors, such that no significant impact is expected from the construction works on residential and other sensitive receivers in terms of noise, vibration, and dust. However, in many areas, there will little practicable buffer distance between the work corridor and the commercial premises, and common noise and dust construction impacts are expected from the construction works on numerous commercial premises that line the route. At this stage there is no definite requirement for works to take place at night. Although most work is expected to be carried out during the day, some nighttime work will be allowed, especially in circumstances where major disruption to daytime traffic can be avoided by night work.

157. Although construction noise and dust were recognized as nuisances by the local population, they were also considered acceptable nuisances in view of the potential benefits from the BRT and future improved road conditions. Nevertheless it is good practice to control all dusty materials at source so that nuisances do not occur, visibility on the adjacent road is not impaired, and road safety can be maintained or improved. Water is available in the study area, and sufficient surplus water should be available to suppress dust at all locations in the dry season. In addition, as a general approach, it is recommended that if works are within 10 m of any sensitive receivers, the contractor should install dust barrier segregation between the works at the road edge and the sensitive receivers. A fixed metal site hoarding will not be practical in this situation. The segregation should be easily erectable barrier more than 2.5 m high and designed to retain dust and provide a temporary visual barrier to the works. The materials could be plastic or tarpaulin sheets. Where dust is the major consideration, the barrier can take the form of tarpaulins or fences strung between two poles mounted on a concrete base. These can be moved along the road as the work proceeds. In some cases, it will be necessary to seal the doors and windows with tarpaulins for the duration of the works to keep dust out as far as practicable. The other mitigation measure will include the following:

(i) If the surface is dry, water will be sprinkled on the road and exposed surfaces when work is carried out within 50m of residences or roadside food stalls.
(ii) Calcium Chloride Flakes can be used as a potential measure to control dust dispersion from worksites.
(iii) No work will be carried out within during the night (9p.m.–7a.m.).
(iv) If works have given rise to complaints over dust, the contractor shall investigate the cause, report it to the grievance facilitation unit, and in the monthly progress reports, review and propose alternative mitigation measures before works recommence.

(v) All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations (ECR 1997).

(vi) Fuel-efficient and well-maintained haulage trucks will be employed to minimize exhaust emissions. Smoke-belching vehicles and equipment shall not be allowed and shall be removed from the project.

(vii) Vehicles transporting soil, sand, and other construction materials will be covered with tarpaulin sheets to avoid impact from dust. Speed limits of such vehicles within the works site and on unpaved edge areas of the project roads will be established and agreed with the PMC.

158. The need for large stockpiles should be minimized through careful planning of the supply of materials from controlled sources. Stock piles should not be located within 100m of educational establishments and public amenities, and should be covered with tarpaulins when not in use and at the end of the working day to enclose dust. If large stockpiles (more than $25m^3$) of crushed materials are necessary, they should be enclosed with side barriers and also covered when not in use.

159. EPCM shall undertake semiannual monitoring of TSP and noise at the stations which were sampled during preconstruction. Field measurements shall also be carried out, as necessary, to validate complaints.

12. Vibration

160. At this stage, blasting is not expected. It is clear from discussions with the project team and observations that blasting will not be the method of choice because most of the surface materials can be removed with powered mechanical equipment (PME). It is therefore anticipated that powered mechanical equipment and a lot of local labor with hand tools will be used to implement the BRT.

161. In the event that blasting is required in special circumstances (for instance, if underground boulders are encountered at station excavations for access tunnels), only controlled blasting will be allowed. Blasting will only be carried out in line with the rules set down by DOE in the prescribed manner and after prior notice to all local residents and the local district authorities. One month prior to the blasting in any area, a building condition survey, including photographs, will be made of all residences within 500 m of the blast sites. The condition of the residences shall be agreed with the EPCM in case there are any future claims for damage to residences due to the blasting. All blasting shall be carried out in the daytime and at regular intervals after siren warnings. All residents within 500 m of the blast sites shall be kept informed of the plans and progress of blasting, and residents shall be temporarily evacuated and provided with alternative accommodation if required.

162. No blasting will be allowed at night unless under special circumstances, when blasting cannot be carried out at any other time. Controlled blasting will strictly follow the license requirements from DOE. Pre splitting should be undertaken. Where the vibration from blasting is exceeding the maximum permissible level, information from the blasting should be used to modify blasting patterns and calculate a reduced charge for future blasts, with the aim of eradicating or minimizing damage as far as possible. Blasting shall be under careful and strict management of properly trained and licensed personnel. During blasting, the contractor shall observe proper warning and precautionary measures to ensure safety of residents, pedestrians, motorists, and structures.

13. Excavation and Protection, Runoff Control, and Protection of Works

163. Engineering controls that include runoff protection measures will be designed and installed to controls oil runoff, both at all the constructed works and in peripheral areas, particularly in borrow areas and long haul tracks. Before construction commences, the contractor will update the draft runoff control plan (RCP) produced by the EPCM and implement excavation stabilization measures proposed in the detailed designs, and maintain them during construction to protect the works.

164. The excavation protection and runoff control plan will include consideration of the following:

(i) Climate and rainfall for the area and checking weather forecasts;
(ii) Terrain and typical locations susceptible to runoff;
(iii) Protection of the works and potential impacts to the environment;
(iv) Runoff control methods to be employed, locations, and installation timing;
(v) Limits to stock piling in sites near waterways and irrigation channels;
(vi) Discussion of the EPCM/PIU's inspection/monitoring role; and
(vii) Agreement on publicity/public consultation requirements.

165. Mitigation measures for excavated areas will be required by the contractors to prevent surface collapse. These will include but not necessarily be limited to the following:

(i) Minimize damage of surrounding facilities during excavation formation.
(ii) Protect the excavation and install final structures and surfaces as soon as practicable after excavation.
(iii) Prevent runoff and protect the excavation with temporary or permanent drainage as soon as practicable after excavation.

166. In order to preserve the constructed excavations and other works from runoff, the contractors are required to include appropriate measures for excavation protection, i.e. finish concrete works as soon as practicable as required in the detailed construction drawings and implement them accordingly.

167. Payments will be linked to the completion of the works as indicated by the installation of runoff and excavation control measures to protect the works to the satisfaction of EPCM/PIU.

14. River Protection, Bridge Demolition and Replacement

168. There is one main river (the Tongi Khal) crossing under the BRT alignment at about Km 4. Careless construction and poor materials control can cause blockage to rivers. Therefore, in areas along and near the river, the following will be carried out:

(i) Earth and stones will be properly disposed of so that they do not block the river, resulting in adverse impacts on water quality and flow regime.
(ii) In bridge repair and demolition sites, the bridge structure will not be dropped into the river, but alternative means will be used to avoid "dropping the bridge"

into rivers/streams. This will be done by "sawing" appropriate sections of the bridge and using cranes to lift the sections, or alternatively, by constructing, a platform onto which the bridge could be lowered.

(iii) Cofferdams, silt fences, sediment barriers or other devices will be used as appropriate, based on the design, to prevent migration of silt during excavation and boring operations within the stream. If cofferdams are used, these will be dewatered and cleaned to prevent siltation by pumping from cofferdams to a settling basin or a settling containment unit.

(iv) Other runoff control and excavation control measures and covering of open surfaces with concrete to reduce runoff will be implemented as early as possible in construction.

168. There are several foot bridges over the NH3 road that forms the project corridor, which will be demolished in preparation for the construction of the BRT. Careless deconstruction and poor demolition control could cause blockage of rivers. Therefore, in areas near the foot bridges, the following will be carried out:

(i) Demolition materials will be properly disposed of so that they do not block the road, resulting in adverse impacts on pedestrian movements and traffic flow.

(ii) In bridge demolition sites, the bridge structure will not be dropped to the road, but alternative means will be used to avoid "dropping the bridge" into the roadway. This will be done by "sawing" appropriate sections of the bridge and using cranes to lift these sections away on to flatbed lorries for removal from the site.

15. Water Quality

169. Water quality from incidents affecting ponds and ditches near the alignment and possible sources of water supply disruption will be investigated, and where the complaint can be substantiated, water samples should be taken and analyzed based on the baseline monitoring results in the preconstruction stage. Samples will be taken after the complaint is filed, which will be analyzed immediately and again 2 weeks after the complaint, to determine if water quality has been restored. The criteria will be based on the ECR (1997). The following precautionary measures will be undertaken by the contractors:

(i) Lubricants will be stored in dedicated enclosures with a sealed floor/base more than 50m from waterbodies.

(ii) Solid waste from construction activities will not be thrown into ditches, ponds, or rivers, and shall be disposed of as per the WMP, and there will be absolutely no burning of waste.

(iii) Construction storage/stockpiles shall be provided with bunds to prevent silted runoff.

(iv) Stockpiled materials will be covered to reduce runoff.

(v) Stockpiling or borrow sites will not be allowed within 50m of a waterbody.

(vi) Stockpile areas and storage areas for hazardous substances shall be located away from waterbodies.

(vii) If complaints occur, there will be monitoring and investigation of water quality.

(viii) Work in rivers will be scheduled during dry season and the duration shall be as short as possible.

(ix) Bare ground shall be stabilized immediately after works are completed.

(x) Washing of machinery and vehicles in surface waters shall be prohibited.

16. Water Resources

170. Ample water should be available, and local water resources could be used because sufficient yield is generally available. Other measures to mitigate the adverse impact on water resources and surface drainage patterns have been incorporated into other drainage mitigation measures.

171. The contractors will carry out the following measures to mitigate the impact of using local community water resources, where required:

(i) In all areas, availability of water will be assessed to evaluate the impact on community resources. If necessary, project water will be brought in by tanker without depleting local supplies.
(ii) Contractors will be required to maintain close liaison with local communities to ensure that any potential conflicts related to common resource utilization for project purposes are resolved quickly.
(iii) Guidelines will be established to minimize the wastage of water during construction operations and at campsites.
(iv) Avoid and minimize use of river bed for construction materials.
(v) Confine winning river materials to 20% of river width in any location, and keep away from river banks.
(vi) Reinstate river banks if necessary.
(vii) Carry out reprovision of drainage channels affected by works 2 weeks before commencement of works to the satisfaction of DC and local community.
(viii) In case of obstruction or damage, irrigation ditches and ponds shall be cleaned or repaired immediately.

17. Construction Camps and Canteen Facilities

172. The requirement for contractors' construction camps and maintenance yards is not yet known, but contractors will adopt good management practices to ensure that fuels and chemicals, raw sewage, wastewater effluent, and construction debris/scarified material are disposed of under controlled conditions to reduce the risk of contamination. The proposed measures include the following:

(i) Workers' camp location and facilities will be located more than 500 m away from residential areas and agreed on with local communities, with facilities approved by EPCM and PIUs and camps managed to minimize impacts.
(ii) Construction camp will be established in areas with adequate drainage in order to prevent water logging at the camp and formation of breeding sites for mosquitoes in order to facilitate flow of the treated effluents.
(iii) Potable water, clean water for showers, hygienic sanitation facilities/toilets with sufficient water supply, worker canteen/rest area, and first aid facilities will be provided. Separate toilets shall be provided for male and female workers.
(iv) Hire and train as many local workers as possible.
(v) Provide adequate housing for all workers at the construction camps and

establish clean canteen/eating and cooking areas.

(vi) Portable lavatories shall be installed and open defecation shall be prohibited, and use of lavatories shall be encouraged by cleaning lavatories daily and by keeping lavatory facilities clean at all times.

(vii) Wastewater effluent from contractors' workshops and equipment washing yards will be passed through gravel/sand beds, and all oil/grease contaminants will be removed before discharging it into natural streams. Oil and grease residues shall be stored in drums awaiting disposal in line with the agreed WSMP.

(viii) Predictable wastewater effluent discharges from construction works shall have the necessary permits from DOE and local authorities before the works commence.

(ix) Borrow pits and natural depressions with prelaid impervious liners will be used to dispose of scarified/scraped asphalt, and then covered with soil. This will check potential groundwater contamination. Options for completely or partially recycling scraped scarified materials will also be taken in to account.

(x) Camp site will be cleaned up to the satisfaction of the PIU and the local community after use.

(xi) All waste materials shall be removed and disposed of in disposal sites approved by local authorities.

(xii) Land used for campsites shall be restored to the original condition as far as practicable, and the area shall be restored to a condition acceptable to the local community and EPCM (planted with appropriate trees/shrubs as practicable) after it is vacated and cleaned.

18. Sanitation and Disease Vectors

173. Potential sanitation and impacts from disease will need to be controlled by maintaining hygienic conditions in the workers' camps and along the construction sites, implementing the social and health programs for the project. The contractor will ensure that:

(i) Measures to prevent malaria shall be implemented (e.g., provision of insecticide-treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.).

(ii) Standing water will not be allowed to accumulate in the temporary drainage facilities or along the road side to prevent proliferation of mosquitoes.

(iii) Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds.

(iv) Malaria controls will be implemented in line with social plans for the project.

(v) HIV/AIDS awareness and an HIV-AIDS education and prevention program shall be implemented in line with social plans under the social and poverty assessment report.

19. Corona Virus Disease 2019 (COVID-19): Pandemic Control

174. The Corona Virus Disease 2019 (COVID-19) outbreak is a one of the deadliest global health crisis in the history. COVID-19 had caused more than 6.3 million deaths in the world and

more than 29 thousand in Bangladesh during the last 2 and half years. COVID-19 has big impacts on the health and safety issues of all walks of life, including the workforces and workplaces all around the world. The construction industry has been significantly affected by the COVID-19 pandemic and has been facing challenge to improve the safety and wellbeing of its workforce.

175. ADB as well as the office of the Director general of Health Services of the Government of Bangladesh provided Heath-Safety Guidelines to protect employees and workers of the country from corona virus. Starting from early 2020, Government of Bangladesh imposed several lockdown across the country to control spread of COVID-19. Irrespective of low, medium or high prevalence of COVID-19 breakdown, citizens of the country have been instructed to follow health-safety guidelines of COVID-19 pandemic condition. Below health-safety general instructions and guidance are important to follow at construction to control COVID-19 pandemic:

1. COVID-19 general guidance developed by ADB for construction projects should be followed in BRT project. Project proponent should conduct risk assessment and prepare site specific health safety plan.

2. Follow guidance for worksite entrance, as below:

    - Maintain physical distance of minimum 1 m (3ft) during worksite entry queue;
    - Everyone entering the worksite must wear a mask and gloves. Display hand washing protocol at entrance;
    - All personnel should wash their hands with soap for 20 seconds before, during and after work;
    - Spray bottom of shoes entering worksite/ campsite with disinfectant;
    - Disinfect all vehicles entering the site;
    - Check body temperature of all at the time of reporting to site. If temperature is above 37^{o}C send to the designated medical facility.

3. Worksite management

    - Physical distance min. 1m (3ft) all the time at work;
    - Rotated schedule for break to minimize gathering;
    - Frequently clean and disinfect highly used tools, machineries and surfaces (e.g. tables, toilets) by workers;
    - Mandatory morning briefing on COVID awareness at site maintaining physical distance;
    - Use alcohol-based wipe to clean tools, equipment, vehicle before and after use;
    - Discourage gathering at site. Discourage unnecessary entrance and exit at site.

4. Camp management

    - Ensure personal distance at least 1m (3ft) during lunch, dinner and prayer.
    - Encourage frequent hand washing. Provide soap, sanitizer, washing facility and safe water at the workers' dwelling.
    - Ensure separate covered bin for disposal of PPEs.
    - Protect against heat, cold, damp, noise, fire, and disease-carrying animals.
    - Maintain good housekeeping and social distancing in kitchens, meal rooms, canteens.
    - Ensure ample ventilation at the camp**.**

5. Work site awareness raising is important to take prompt action by the project management and environment health safety (EHS) personnel. Aware people as below through place awareness raising posters at common spaces of worksite and camp:

   - Inform ESH personnel immediately if any of the employee or workers having symptoms of COVID-19;
   - Practice respiratory etiquette – not to touch nose/eye/ mouth, not to spit;
   - Shorten gathering, even toolbox meetings;
   - Initiate remote meeting protocol to avoid physical contact;
   - Cover nose while coughing or sneezing;
   - Wash hands with soap for 20 sec;
   - Use wastepaper basket more often;
   - Disinfect bottom of shoes frequent interval;
   - Disinfect tools frequently.

6. Measures to be taken before resumption of construction at the worksites after pandemic lockdown:

   - Re-open the site at limited scale - engage essential labor force;
   - Locate closest health facilities for emergency communication;
   - Provide thermometer, soap, sanitizer, disinfectant, PPE at worksite/camp;
   - Place adequate washbasins, disinfectant tub, dispenser, covered trash bin;
   - Ensure all equipment and vehicles used are routinely disinfected;
   - Ensure all to use the Personal Protective Equipment (PPE);
   - Assign/engage health and safety supervisor;
   - Establish electronic payment system to pay the daily wage;
   - Prepare COVID-19 awareness posters throughout the worksites;
   - Prepare a mechanism for monitoring and reporting at worksite.

7. Monitoring and Reporting

   - Monitor level compliance of employees and workers with the ADB COVID-19 guidance through daily checking.
   - Reporting - Share health and safety status with ADB (QPRs and Semi-Annual EMR)

176. Status of Implementation of COVID-19 Guidance of ADB: Contractors of BRT project upon instructions from PMU and EPCM consultants have implemented the General Health Safety Guidance of ADB across the work sites and camps. EPCM Consultant shared the following COVID-19 safety measures guidelines with the Contractors (i) Safe Work Procedures (ii) Health and Safety Guideline, and (iii) Risk Assessment. It is vital, however, to conduct health and safety risk assessments, require employees to comply with scientific and policy requirements regardless of their work environment, and ensure that the workplace is safe. All the efforts extended by the EPCM Consultant and Employers to promote the health and safety of employees during period of COVID-19 pandemic resulted to maintain partially compliance status against the provisions of the ADB's "COVID 19 Health and Safety Guidance for the Construction Workforce".

20. Occupational Health and Safety

177. Worker occupational health and safety are generally governed by the Bangladesh Labor Act 2006. A worker and public safety plan will be submitted by the contractor in the SEMP to establish routine safety measures as required by the Bangladesh Labor Act, and by good engineering practice, as well as to provide first aid facilities.

178. Mitigation measures to be implemented by contractors to ensure health and safety of workers are as follows:

(i) At least 1 month before construction commences, the contractor will demonstrate to the PIU that the safety plan will be properly resourced and a qualified safety officer will be identified by the contractor in their bid, and the safety plan will be approved by the PIU and EPCM before construction commences.
(ii) Before construction begins, the contractor will conduct training for all workers on safety and environmental hygiene. The contractor will instruct workers in health and safety matters as required by law and by good engineering practice, and provide first aid facilities.
(iii) The contractor will instruct and induct all workers in health and safety matters (induction course) before they start work, and site agents/foremen will follow up with toolbox talks on a weekly basis. Workforce training for all workers starting onsite will include safety and environmental hygiene.
(iv) Fencing shall be installed in all areas of excavation greater than 1 m deep and at sides of temporary works.
(v) Workers shall be provided (before they start work) with appropriate personnel safety equipment such as safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and ear protection at no cost to the workers. Site agents/foremen will follow up to see that the safety equipment is used and not sold.
(vi) Ensure audible reversing signals are installed on all construction vehicles.

179. The contractor will include provisions in the worker safety section of the worker and public safety plan in the SEMP for:

(i) Instruction of all workers in health and safety matters;
(ii) Provision of potable water supply in all work locations;
(iii) establishment of safety measures as required by law and by good engineering practice, and the provision of first aid facilities;
(iv) fencing on all excavation, borrow pits, and sides of temporary bridges;
(v) providing to all workers appropriate personal protective equipment (PPE) such as safety shoes, hard hats, safety glasses, ear plugs, gloves, etc.;
(vi) scheduling of regular sessions (e.g., weekly tool box talks) to orient the workers on health and safety issues related to their activities as well as on proper use of PPE;
(vii) where worker exposure to traffic cannot be completely eliminated, protective barriers provided to shield workers from traffic vehicles. Alternatively, another measure is to install channeling devices (e.g., traffic cones and barrels) to delineate the work zone; and
(viii) construction camps provided with toilets/sanitation facilities in accordance with local regulations to prevent any hazard to public health or contamination of land, surface or groundwater. These facilities shall be well maintained to

allow effective operation.

180. Facilities for workers and public safety, construction site offices, and canteens will be regulated in line with the Bangladesh Labor Act 2006. Complaints will be monitored and investigated, mitigation measures revised, and the SEMP updated as necessary if unexpected impacts occur. All measures related to workers' safety and health protection shall be free of charge to workers. The worker occupational health and safety plan is to be submitted by the contractor before construction commences, and can be extended to cover public safety and approved by PIUs/EPCM.

21. Community Health and Safety

Public safety, particularly of pedestrians and children, can be threatened by the excavation of the trenches for side drain construction and station access tunnels. Fencing will be installed prior to excavation work commencing on all sides of temporary and permanent excavations. The plans will include provisions for site security and guards, trench barriers, and covers for other holes and any other safety measures as necessary. The contractor will provide warning signs at the periphery of the site, warning the public not to enter, and define this in the SEMP. The contractor will restrict the speed of project vehicles and also control traffic by counter flow and providing flag men and warning signs at either end of the work areas where the traveling lanes must be temporarily reduced. The safety measures for the public in the worker and public safety plan will include the following:

(i) Barriers (e.g., temporary fence) shall be installed at construction areas to deter pedestrian access to the roadway except at designated crossing points.
(ii) The general public/local residents shall not be allowed in high-risk areas, e.g., excavation sites and areas where heavy equipment is in operation, and these sites will have a watchman at the entrance to keep public out.
(iii) Speed restrictions shall be imposed on project vehicles and equipment traveling within 50m of sensitive receptors (e.g., Residential, schools, temples, etc.).
(iv) Upon completion of construction works, borrow areas will be backfilled or fenced.
(v) Provisions for site security, trench barriers, and covers for other holes and any other safety measures will be made as necessary.
(vi) Provide warning signs at the periphery of the site, warning the public not to enter, and define this in the SEMP.
(vii) There will be strict imposition of speed limits along residential areas and where other sensitive receptors such as schools, hospitals, and other populated areas are located.
(viii) Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances (fuel and oil) and other construction materials during transport.

181. The contractor will provide information boards near the work sites to inform and instruct the public on how to conduct themselves, and to make them aware of their surroundings if they must approach the works. The public safety section of the worker and public safety plan will include but not necessarily be limited to the following:

(i) Statement of contractor's safety policy for workers and public;
(ii) Legal requirements (Bangladesh Labor Act 2006);
(iii) work safety and public safety issues;
(iv) training the workforce and informing the public on work safety issues;

(v) establishment and monitoring of acceptable working practices to protect safety;
(vi) overlap with traffic and road safety (e.g., Traffic flow/delay requirements);
(vii) discussion of the EPCM/PIUs 'inspection/monitoring role;
(viii) establishment of complaints management system for duration of the works;
(ix) agreement on publicity/public consultation requirements;
(x) reporting of accidents; and
(xi) complaints management.

22. Traffic Management

182. Construction activities on the BRT road are likely to cause hindrance in traffic flow if not mitigated properly. A temporary traffic management plan will be developed with the assistance of the EPCM and submitted by contractor at least 1 month before commencement of construction. The main objective of the plan shall be to maximize the safety of the work force and traveling public. The secondary objective will be to keep traffic flowing as freely as possible. Coordination with local traffic police is critical in implementing an effective traffic management plan. The temporary traffic management plan will include consideration of the following:

(i) Consultations and coordination with local police and traffic authorities;
(ii) Lane availability and minimizing interference with traffic flows past the worksite;
(iii) Establishment of acceptable working hours and constraints;
(iv) Agreement on time scale and establishment of traffic flow/delay requirements;
(v) Programming issues, including the time of year and available resources;
(vi) Discussion of the EPCM/PIUs' inspection/monitoring role;
(vii) establishment of complaints management system (grievance redress mechanism or GRM) for duration of the works; and
(viii) agreement on publicity/public consultation requirements (advance signing.).

183. The plan will be reviewed by PIU/EPCM, and if found appropriate, will be approved. Resources from the contractor and PIUs will be provided based on the plan before construction commences for:

(i) Implementation of construction temporary traffic management plan and awareness program;
(ii) Communication to the public through local officials regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restrictions;
(iii) coordination with local traffic authorities to implement appropriate traffic diversion schemes to avoid inconvenience to road users due to project operations, ensure smooth traffic flow, and minimize accidents, traffic hold-ups, and congestion;
(iv) in coordination with local traffic officials, schedule transport of materials to avoid congestion, and set up clear traffic signal boards and traffic advisory signs at the roads going in and out of the construction sites to minimize traffic build up;
(v) provision of safe vehicle and pedestrian access around construction areas;
(vi) installation of bold diversion signs that would be clearly visible even at night and provide flag persons to warn of dangerous conditions over 24hours, if necessary;
(vii) provision of sufficient lighting at night and in other dark conditions, within and

in the vicinity of construction sites; and
(viii) designation of traffic officers in construction sites.

23. Archaeological and Cultural Artifacts

184. Bangladesh has a rich archaeological heritage, but no archaeological site is known within 100m of the Greater Dhaka Sustainable Urban Transport Project (GDSUTP). However, as a fallback measure, the contractor will take the following precautions to avoid disturbance of any as yet undiscovered archaeologically valuable artifacts.

(i) Site agents will be instructed to keep a watching brief for relics in excavations.
(ii) Should any potential items be located, the EPCM will immediately be contacted and work will be temporarily stopped in that area.
(iii) If the EPCM determines that the item is of potential significance, an officer from the Department of Culture and Information (DCI) will be invited to inspect the site and work will be stopped to allow time for inspection.
(iv) Until DCI has responded to this invitation, work will not recommence in this location until agreement has been reached between DCI and PIU/MOC as to any required mitigation measures, which may include structured excavation.

24. Enhancements

185. Environmental enhancements such as tree-planting near the road will be explored in the detailed designs and included in the tree-cutting and replanting plan. Enhancements shall be reassessed prior to construction, and proposed enhancements should be discussed by the contractor with the local population to identify stewardship of any planting, and also to serve as a vehicle for further public consultation at implementation stage and to assist in public relations.

E. Operational Phase

1. Noise

184. The Bangladesh noise criteria (ECR Schedule 4–Leq60 dB(A) for mixed areas, Leq50 dB(A) residential, Leq40 dB(A) for schools and hospital sensitive receivers) and World Bank criteria of Leq55 dB(A) for residential areas, schools, hospitals, and sensitive receivers are all potentially exceeded at most times by the existing road traffic noise. At Km 4, background noise ranged from Leq72.4 dB(A) to Leq75.8 dB(A). At Km 12, noise ranged from Leq71.6 dB(A) to Leq74.9 dB(A) with traffic. Therefore, a criterion of background +3dB(A) will be applied. The main noise source in most areas is traffic noise, and in order for the existing background to be exceeded by +3dB(A), the existing traffic would have to be more than doubled. Traffic forecasts indicate that traffic cannot be doubled as the road is already near saturation. Therefore the project is believed to be sustainable in terms of noise. No operational mitigation measures are required based on the current alignments.

2. Gaseous Emissions

185. Gaseous emissions will result from the fuel consumed by the BRT buses, but this will be much less than at present for the equivalent number of passengers (Appendix G). The

BRT Phase 1 will introduce 94 efficient modern CNG-fueled buses. These buses will be able to transport approximately 70 persons seated (with more standing at peak times). The full 20 km journey from the origin to Gazipur Terminal will take about 40 minutes. Therefore, it will be possible to transport about 87,500 persons along the full length of the corridor by running all the busses over a typical 18-hour day (6 a.m.– midnight). Based on transport modeling, buses currently make about six trips per day along the same corridor. In this case, the fuel consumed by the BRT buses will be less than that consumed by mini-buses and large buses to provide the same level of service. Consequently, it can be expected that the equivalent emissions from buses traveling on the new BRT system will be much reduced (Appendix).

186. Under operation phase, GDSUTP-AF has planned, as one of the options, to operate Battery Electric Buses (BEB). As BEB technology is changing fast, particularly regarding the capacity and autonomy of batteries, procurement of batteries could be under a leasing scheme, where manufacturer of batteries will remain as owner and replacement of batteries will be their responsibilities - battery will then be supplied as a service. This process of operating BRT will bring no risk of battery dumping after life time. Through this approach environmental impacts especially gaseous emission will nearly be zero during operation phase of BRT.

3. Particulate Emissions

187. Vehicle emissions (particulate contamination) such as dust and fumes will also be air pollution sources during operation. However, toxic residues from vehicle emissions near the GDSUTP road should be less likely under the improved conditions when the BRT is implemented, and are unlikely to accumulate or create worse impacts than at present under local conditions. Dust from the existing road will be reduced due to the better asphalt surface for the sides of the new road. Therefore, the project is believed to be sustainable in terms of particulate emissions, and no operational mitigation measures are required.

4. Wastewater Discharge

188. BRT bus fleet comprising of more than 100 buses will necessary to be detergent washed in the BRT bus depot almost everyday, besides servicing once or twice a month. The wastewater to be generated in the process will mostly be detergent washed effluent, however there is possibility of effluent outflow from the washing and lubricant changing chambers containing residual oil and lubricant. Although dilution will reduce pollution load, there may a requirement of operating an Effluent Treatment Plant (ETP) to treat generated wastewater before discharging to nature. For designing a proper sized and type of ETP, DBRTCL should conduct a study to assess volume of wastewater, pollution load and nature of pollutants. Considering the space constraints in the bus depot, type of pollutant of depot a physico-chemical ETP would be suitable to treat wastewater flow of the depot. DBRTCL should allocate adequate resources for construction of the ETP and its operation and maintenance during the operation period of the BRT service.

5. Driving Conditions and Community Safety

189. The introduction of the BRT and widening of the usable width of the GDSUTP corridor road will improve traveling conditions along the BRT corridor and on the road. Increase in

traffic flow indicates additional future traffic should be moderate and unlikely to create many community safety issues. The improvements of the GDSUTP road will be monitored and the BRT authority will monitor accidents in the operational phase and conduct awareness campaigns. Overall, the condition of the road facilities will be enhanced and driving conditions should improve. Routine safety measures, signage, and road markings will be introduced to reduce driving risk further in accident-prone areas and provide enhancements to driving conditions near the GDSUTP BRT.

VII. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

190. The objectives of the stakeholder consultation process was to disseminate information on the project and its expected impact, long-term as well as short-term, among primary and secondary stakeholders, and to gather information on relevant issues so that the feedback received could be used to address these issues in the early stages of project design. Another important objective was to determine the extent of the concerns among the community, to address these in the project implementation, and to suggest appropriate mitigation measures.

A. Identification of Stakeholders

191. The stakeholders consulted for the project included local affected persons, local authorities, utility and telecommunication services, representatives of local transportation associations, transport police, educational institutions, research institutes, and other groups with an interest in services in the project corridor where the BRT will be implemented. Government departments were also consulted. Individuals representing several hundred persons from more than 300 family groups in all the municipalities, districts, wards, and union *parishads* all along the alignment were informed about the project and invited to comment on their environmental concerns. These stakeholders were considered to be representative of the community living in the area, the road users, the business people associated with the road, and the locally elected representatives. Consultations took place between January and March 2011. The dates and locations of consultations are presented in Appendix B.

B. Consultation with Stakeholders

192. The summaries of results of the public consultations are recorded in Appendix B. Many local affected people were pleased to respond, but requested anonymity. The main environmental and other concerns can be summarized as follows.

193. **Interest in the survey**. About 45% of the respondent general public along the project corridor indicated they had some comments to make on the project. About 40% said the project would affect their working and home lives.

194. **Support for project**. Almost all respondents were in favor of the project (99%) and 80%said that they could think of nothing that would cause them not to support the project. The respondents who did not support the project said they would support if it will be implemented quickly. About 40% of respondents also saw rapid implementation of the project as a means to reduce/control environmental impacts. The major cause for loss of support would be if there was no provision of flyovers and alternative travel options. A small proportion (about 7%) had doubts about the sustainability of the project and the sustainability of other bus and transport services after the BRT is implemented.

195. **Overall environmental impact**. When questioned on the overall environmental impact of the project, about 68% of respondents had ideas to share. More than 50% of respondents identified potential benefits in terms of easier transportation mode, travel time reduction, better life standard, and quality of environment. More than 30% did not know enough to express an opinion or saw no potential improvement. About 20% identified some disadvantages in terms of temporary increased pollution and increases in accidents, and

expressed that although impacts were moderate, the implementing agency should be more environmentally aware.

196. **Controlling environmental impacts**. When questioned on ideas for how to control the overall environmental impact of the project, about 72% of respondents had some ideas to share. About 28% did not know enough to express an opinion. More than 15% of respondents wanted the implementing agency to be more aware of the environmental impacts, and 11% said that the project should be environmentally friendly. About 10% said the project should be completed as soon as possible and 5% said that environmental control needed proper planning. About 5% suggested that some construction could take place at night or on holidays to reduce impacts.

197. Prompt completion of the works and minimization of land acquisition were requested by many local stakeholders. Increased traffic noise, controlling project workers, and sanitation during construction were also concerns. Many affected people were more concerned about social issues, such as receiving full and prompt compensation for land acquisition, than environmental issues. No significant operational phase impacts were identified, and the communities along the project corridor generally indicated they would fully support the project.

Table 10: Summary of Main Environmental Concerns from Public Consultation

	Concerns Expressed	How Concerns are Addressed in IEE
1	Rapid implementation	Project will start soon and complete as soon as practicable, and PIU and EPCM will monitor progress of the works.
2	Provision of flyovers	Flyovers and elevated sections are provided in the preliminary design at the major intersections.
3	Provision of alternative travel options	Alternative travel options and connecting routes will be retained along the BRT corridor such as buses mini-buses, taxis, and rickshaws and dedicated NMT lanes are provided.
4	Sustainability of the project	Sustainability the BRT is demonstrated in the economic assessment of the design in the final feasibility report.
5	Sustainability of other bus and transport services	Sustainability of other bus and transport services after BRT implementation is demonstrated in the economic assessment of the final feasibility report.
6	Temporary increased pollution	EMP provides for controls on noise and dust during implementation.
7	Increase in accidents	EMP provides for worker and public safety plan during implementation.
8	Implementing agency should be more environmentally aware	EMP provides for awareness building for implementing agency and work force during implementation.
9	Environmental control needs proper planning.	EMP provides for site-specific environmental management plans and organized monitoring of implementation of mitigation measures by design team, contractors, and work force during design and implementation.
10	Construction could take place at night or on holidays to reduce impact.	Construction may take place at night in special circumstances if this will reduce impacts.
11	Contractors should be responsible for environmental controls*.	The contractor(s) will commit to implementing the mitigation measures identified in the EMP and updated in the site specific environmental Management plan (SEMP) and agree monitoring with PMC.
12	Contractors should publicize schedule for works.	Requirement of EMP to disclose to local authorities and update during the works
13	Large proportion of female travelers in some areas e.g. near colleges	Request for gender-segregated areas to be provided in stations and buses has been passed to the design team.

14	Request for additional bus parking to be integrated in terminal and depot at Gazipur	Additional bus parking integrated in terminal and depot at Gazipur is being considered by the team of designers.
15	Parties should agree on compensation before work starts.	Start land acquisition soon and complete as soon as possible.

BRT=bus rapid transit, EMP=environmental management plan, EPCM=engineering, procurement, construction management and supervision consultant, IEE=initial environmental examination, NMT=non-motorized traffic
Note: In many cases, the interviewees were at first reluctant to discuss. The concerns are inferred from the replies in the field.

198. The affected persons also fully expect that the necessary arrangements to compensate for loss of property are addressed before construction commences. Results are summarized broadly in Table 10. Further information is provided in Appendix 2.

C. Concerns Addressed

199. The main issues raised are addressed in the environmental management plan, as far as is reasonably practicable at this stage. Concerns with respect to rapid implementation, provision of flyovers, provision of alternative travel options, sustainability of the project, and other bus and transport services have been passed to the project team. Concerns with respect to temporary increased pollution, increases in accidents, environmental awareness of the implementing agency, and planning environmental controls have been addressed in the environmental management plan (EMP).

200. Project alignment and drainage design and the disturbance to property and business, private property, and community have been brought to the attention of the project proponent, and the relevant parties are well aware of the potential for local disturbance that can result from poorly controlled contractors. A resettlement plan has been prepared to compensate for affected persons that can reasonably be predicted at this stage. Unforeseen impacts will also be captured by the requirements to update the environmental management plan and inform ADB in response to any unpredicted impacts that arise periodically as necessary.

D. Information Disclosure and Participation

201. Concerns have been expressed that the SPO should disclose the project construction works in advance, and complaints monitoring and grievance redress mechanism (GRM, Chapter VII) will provide further opportunities for consultation and can assist in public participation. Providing information through local authority offices will provide a conduit for the improvement of the project implementation to better serve the stakeholders. Public consultation can also assist in:

(i) Harnessing cooperation from informed people to help local authorities reconfirm the extent of local permits and licenses that will be required at a later stage;
(ii) Obtaining cooperation from informed residents and groups, which will help to avoid cost and lost time in dealing with complaints;
(iii) Identifying local infrastructure projects or other local initiatives that will interface with the project corridors, with assistance from informed local authorities; and
(iv) The collection of anecdotal information on the current condition of the local

environment, including aspects of forest and wildlife conservation.

202. The environmental assessment process under the Safeguards Policy Statement requires the disclosure of the initial environmental examination (IEE) in an accessible place and language to the public during the completion of the IEE. The roads and highways department (RHD) is to provide a Bangladesh version of a summary IEE in public places along the corridor and make people aware of this through appropriate communication/media channels. This process will be concluded with the SPO providing copies of the IEE for display at the district and ward headquarters during the same period when the IEE is disclosed on the ADB website.

VIII. GRIEVANCE REDRESS MECHANISM

203. To facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project, a grievance redress mechanism is established which aims to provide a timebound and transparent mechanism to voice and resolve social and environmental concerns.

204. The project management unit (PMU) and PIUs shall make the public aware of the GRM through public awareness campaigns. The contact phone number of the respective PIUs and the PMU will serve as a hotline for complaints, and shall be publicized through the media and placed on notice boards outside their offices and at construction sites. The project information brochure will include information on the GRM and shall be widely disseminated throughout the corridor by the safeguard officers in the PMU and PIUs, with support from the NGORP and communications firm. Grievances can be filed in writing or by phone with any member of the PMU or PIU.

205. **First tier of GRM**. The PIU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The environmental officer and resettlement officer in each PIU shall be designated as the key officers for grievance redress. Resolution of complaints will be done within 7 working days. At this stage, the resettlement officer and environmental officer will inform the PMU environmental and social safeguards unit (ESSU) for additional support and guidance in grievance redress matters. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

(i) Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
(ii) Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); and
(iii) Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed off.

206. The updated register of grievances and complaints will be available to the public at the PIU office, construction sites, and other key public offices along the project corridor (offices of the *pourashavas* and union *parishads*). Should the grievance remain unresolved, it will be elevated to the second tier.

207. **Second tier of GRM**. The resettlement officer and environmental officer in each PIU will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the PMU/ESSU who will pass unresolved complaints upward to the grievance redress committee (GRC). The GRC shall be established by PMU/ESSU before commencement of siteworks. The GRC will consist of the following persons: (i) project director; (ii) representative of *pourashava* and union *parishad*; (iii) representative of the affected persons; (iv) representative of the local deputy commissioner's office (land); and (v) representative of the Department of Environment (DOE) for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person

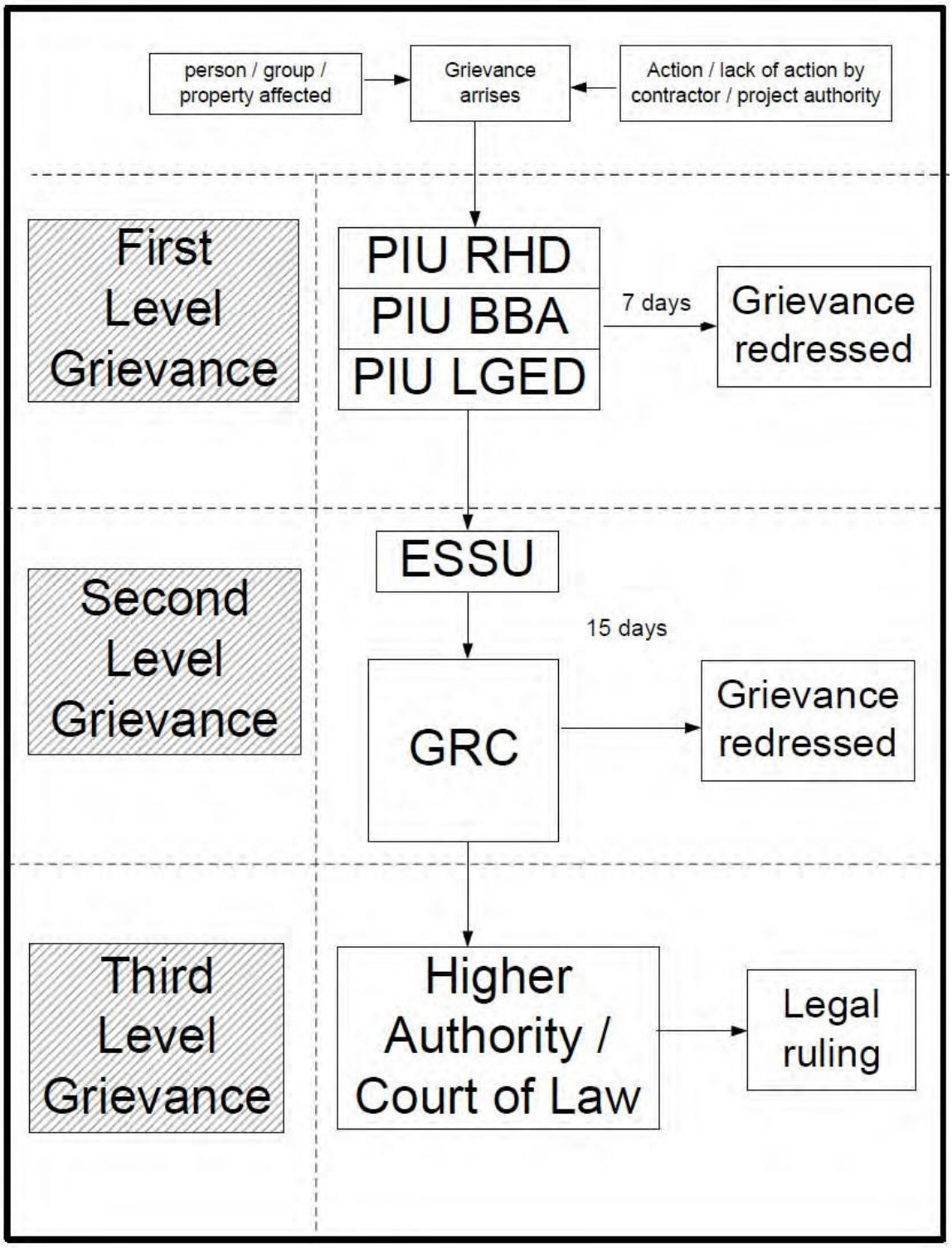
can present his or her concerns and issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's judicial or administrative remedies.

208. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues, including dust, noise, utilities, power and water supply, waste disposal, traffic interference, and public safety, as well as social issues such as land acquisition (temporary or permanent), asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them, and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

209. The PMU/ESSU officers will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

210. **Third tier of GRM**. In the event that a grievance cannot be resolved directly by the PIUs (first tier) or GRC (second tier), the affected person can seek alternative redress through the union *parishad* or ward committees or in appropriate courts. The PIUs or GRC will be kept informed by the district and municipal or national authority. The grievance redress mechanism and procedure is depicted in Figure 14 below. The monitoring reports of the EMP and the resettlement plan implementation shall include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification (I.D.) with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending).

Figure14: Grievance Redress Mechanism



BBA = Bangladesh Bridges Authority, ESSU = environmental and safety specialist, Local Government Engineering Department, PIU=project implementation unit, RHD=Roads and Highway Department.

IX. ENVIRONMENTAL MANAGEMENT PLAN

a. Implementation Arrangements

211. **Interministerial Steering Committee.** This is chaired by the Secretary of Roads Division (RD) under Ministry of Communication (MOC), and was established for the project in January 2011 to provide policy guidance and interagency coordination. The committee will provide guidance on any issues related to safeguards, particularly in delays in the land acquisition and resettlement process, or environmental management.

212. **Executing agency and implementing agencies**. The Roads, Transport and Highways Division (RTHD) of the Ministry of Road Transport and Bridges (MORTB) is the executing agency (EA) for the project and the implementing agencies (IAs) are: (i) Roads Highways Department (RHD), (ii) Bangladesh Bridge Authority (BBA), (iii) Local Government Engineering Departments (LGED), and (iv) Dhaka Bus Rapid Transit Company Limited (DBRTCL).

213. **Project management unit**. The executing agency for the project is the RD. A project management unit (PMU) has been established at RD, and has been headed by a full-time project director and supported by RD staff who has been responsible for management and coordination among the implementing agencies of the project. The PMU receive support from the project management, coordination, and capacity building (PMCCB) consultants. An environmental and social safeguard unit (ESSU) has been will be established in the PMU. The PMU/ESSU will consist of an environmental and safety officer (ESO) and a social safeguards officer (SSO) to oversee safeguards implementation. The ESO will submit an updated Environmental Management Plan for review and approval (prior to contract award), and will submit semiannual monitoring reports to ADB for review.

214. The project management unit is in place at central level and most staff have already been recruited for the project implementation unit to implement the scope of the current project and that under the additional financing. Remaining staff for DBRTCL will be recruited by 31 July 2022.

215. **Project implementing units**. There have been three implementing agencies, as follows:

(i) Roads and Highway Department (RHD) – implemented the main corridor restructuring, except the elevated section.
(ii) Bangladesh Bridges Authority (BBA) – implemented the 4.5-km elevated section, integrating the new Tongi Bridge and Abdullahpur intersection flyover.
(iii) Local Government Engineering Department (LGED) – implemented BRT depot facilities in Gazipur, and municipal infrastructures improvements (local roads, and drains). LGED has already completed construction of BRT Depot and other infrastructure development works, hence scope of works enunciated under Additional Financing will not be applicable for this executing agency.

216. A project implementation unit (PIU) has remained functional in each of these implementing agencies which was headed by a full-time project manager to take full responsibility for managing all activities of the PIU. Each PIU has been responsible for the following in relation to their respective works: (i) assisting the RHD, BBA, and LGED in implementing the project; (ii) carrying out procurement and engaging the contractors; (iii)

liaising and coordinating with the PSC, PMU, and other PIUs; and (iv) managing the contractors, and liaising with other stakeholders, on the day-to-day implementation of project activities. Each PIU has contained a deputed staff to serve as the environmental officer to oversee implementation of the EMP for their respective works, and a resettlement officer to oversee implementation of the resettlement plan. PIUs received support from engineering, procurement and construction management (EPCM) consultants, and was assisted by a nongovernment organization to implement the settlement plan (NGORP). Safeguard specialists for environment and resettlement were be part of the EPCM, including an international environmental specialist (IRS) and a national environmental specialist (NRS) to update the draft IEE during detailed design and supervise implementation of the EMP during construction. These specialists were also conduct safeguards capacity building activities within the PMU/ESSU and PIUs.

217. The Original project and the GDSUTP-AF also include four consultancy contracts: (i) project management, coordination and capacity building (PMCCB)—to support EA/IAs on procurement, capacity building and project management; (ii) engineering, procurement and construction management (EPCM)—to support the EA/IAs on preparing the detailed design, bid documents and construction supervision; (iii) operations design and business model (ODBM)—to support DBRTCL for preparing the BRT business model, fair system and BRT operational plan; and (iv) resettlement NGO to support EA/IAs on land acquisition and resettlement plan implementation.

218. A special purposes organization (SPO), Dhaka Bus Rapid Transit Company Lmited (DBRTCL), will be set up to manage and coordinate the implementation and operation of the project, and will be placed under and report directly to RD. Its board will be chaired by the Secretary of RD, and the members will include representatives of all main stakeholders of the project. The SPO will receive safeguards capacity support from the international and national environmental specialists in the EPCM consultants. After the project is completed, the PMU and PIU swill be converted into the SPO to manage, operate, and maintain the BRT.[5]

219. **Safeguards institutional capacity assessment**. A capacity assessment of the RHD and LGED on implementation of social safeguards in donor-assisted projects was carried out (see detailed capacity assessment in Section VIII. D). Both the RHD and LGED have implemented a number of projects funded by the World Bank, ADB, and other donors. There is an in-house social and environmental cell within the RHD headed by a superintending engineer supported by two officers with the rank of executive engineer (one each for the environment and the social/resettlement safeguards). For projects with resettlement impacts, an officer with the rank of subdivisional engineer is assigned responsibility for coordination of the social safeguard implementation, with support from NGOs on the implementation of the resettlement plan and income restoration activities. RHD has previously implemented resettlement plans for various projects in the roads sector. Despite this experience, RHD is still considered to have limited in-house capacity in social safeguards. This lack of in-house capacity is largely attributed to the fact that staffing of the resettlement positions consists of civil engineers with no formal training, and a lack of continuity due to the transfer of the officers either upon project completion or on promotion. LGED has similarly implemented a number of donor-funded projects, yet safeguards

[5] All three PIUs will be housed in the PMU offices and will be coordinated by the PMU management. All consultants recruited by the project will also be housed in the PMU office.

capacity needs to be strengthened, given the turnover of staff.

220. Under AF, all staff in the PMU/ESSU and PIUs will receive training half yearly basis from the EPCM safeguard specialists and Environment safeguard focal of the PMU to ensure proper implementation of EMP by the main project team.

B. Consultant Support for Environment

221. **Engineering, procurement, construction management and supervision (EPCM).** The EPCM has been engaged to carry out the detailed design, supervision, and management of the project. Environmental specialists (one international and one national) of the EPCM team revised the draft IEE based on detailed design and ensure that sound methodologies and practices were followed in the implementation of the EMP. The consultants, apart from capacity building and training on environmental safeguards-related issues of the project, advised the PMU/ESSU and the PIUs on EMP implementation, participate in meetings with the contractor, NGO-RP, and PIU, and monitor the work of the contractors in the field. The consultants have been helping the PIUs prepare quarterly progress reports submitted to the PMU/ESSU, who subsequently submits semiannual reports to ADB for review.

Table 11: Responsibilities for Environmental Management Plan (EMP) Implementation

Agency	Responsibilities
Roads Division (RD) under the Ministry of Communication (MOC), project management unit (PMU)	● Executing agency with overall responsibility for project construction and operation ● Ensure that sufficient funds are available to properly implement the EMP. ● Ensure that project, regardless of financing source, complies with the provisions of the EMP and ADB Safeguard Policy Statement 2009 (SPS). ● Ensure that project implementation complies with government environmental policies and regulations. ● For project duration, ensure that the project management and coordination consultant (PMCC) commits and retains dedicated staff environment and safety managers in the environmental and social safeguard Unit (ESSU) to oversee EMP implementation. ● Ensure that environmental protection and mitigation measures in the EMP are incorporated in the detailed designs. ● Obtain necessary location and environmental clearances certification under ECR from DOE prior to award of civil works contracts. ● Establish and implement an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. ● Confirm that bidding and contract documents include the EMP. ● Submit semiannual monitoring reports on EMP implementation to ADB.
Project implementation units (PIUs) in RHD/BBA and LGED).	● Ensure that bidding and contract documents include the EMP. ● Submit quarterly monitoring reports on EMP implementation to PMU. ● Include the EMP in the project EMP and specify requirement for preparation and implementation of method statement/site-specific EMPs (SEMPs) as described in the IEE/EMP. ● Under AF, ensure installation of effluent treatment plant (ETP) in BRT bus depot and operation of ETP during operation phase of the BRT bus service. ● Ensure that EMP provisions are strictly implemented during various project phases (design/preconstruction, construction, and operation) to mitigate environmental impacts to acceptable levels. ● Ensure that project implementation complies with ADB's Safeguards Policy Statement (SPS2009) principles and requirements. ● For project duration, commit and retain dedicated staff within each PIU as environment and safety officer (ESO) to oversee EMP implementation. ● Check that environmental protection and mitigation measures in the EMP are incorporated in the detailed designs. ● Check necessary environmental clearances and approvals from DOE prior to award of civil works contracts. ● Participate in an environmental grievance redress mechanism, as described in the IEE, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance ● Undertake monitoring of the implementation of the EMP (mitigation and monitoring measures) with assistance from EPCM. ● Report to ADB on all aspects of environmental management and monitoring at 6-month intervals, based on the results of EMP monitoring. ● With support from EPCM, prepare semiannual environmental monitoring reports for submission to ADB. ● Based on the results of EMP monitoring, identify environmental corrective actions and prepare a corrective action plan, as necessary, for submission to ADB.

	● Incorporate in to the project design the environmental protection and mitigation measures identified in the EMP for the design stage. ● Assist PMU/PIUs/ESOs to ensure that all environmental requirements and mitigation measures from the IEE and EMP are incorporated in the bidding and contracts documents. ● During detailed design phase, prepare draft method statement/SEMPs (traffic management plan, utilities, runoff control plan, waste management and spoils disposal plan, noise and dust control plan, etc.) described in the IEE/EMP. ● Prior to construction, review and approve in writing the updated SEMPs/ method Statements prepared in consultation with contractors.
Engineering, procurement, construction management and supervision consultant (EPCM)	● Update the IEE and EMP based on detailed design and construction period environmental challenges observed in the field. ● Prepare and implement safeguard enhancement plan to strengthen environmental management to offset dust pollution, improved waste management, accident prevention plan, health-safety plan and preparation and implementation of compensatory tree plantation plan. ● Implement all mitigation and monitoring measures for various project phases specified as EPCM's tasks in the EMP. ● Work within PIUs to execute any additional environmental assessment prior to project construction as required in the EMP (e.g., preparation of new or supplementary environmental assessment in case of change in alignment that will result in adverse environmental impacts that are not within the scope of the IEE prepared during loan processing, etc.). ● On behalf of PMU, prepare and submit statutory EIA and obtain environmental clearance certification prior to project construction as required in the EMP. (Also preparation of new or supplementary environmental assessment in case of change in alignment that will result in adverse environmental impacts that are not within the scope of the IEE prepared during loan processing, etc.) ● Assist PMU/ESSU and PIUs in obtaining environmental approvals and certification (e.g., LCC and ECC) under ECR from DOE prior to award of civil works contracts. ● Undertake environmental management capacity building activities for RHD/BBA and LGED PIUs/ESOs as described in the IEE and EMP. ● Engage one international (IES) and three national environment and safety specialists (ESS) to ensure proper implementation of EMP provisions. Through these specialists, the EPCM shall: (i) ensure proper and timely implementation of EPCM's tasks specified in the EMP; (ii)conduct environmental training as specified in the IEE/EMP for RHD/BBA/LGED PIUs/ESOs; (iii) conduct contractors workers' orientation on EMP provisions; (iv) undertake regular monitoring of the contractor's environmental performance, as scheduled in the EMP; (v) conduct field measurements for sediment, surface water quality, dust, and noise as required in the EMP; and (vi) prepare environmental baseline report and environmental Semiannual environmental monitoring reports, as specified in the EMP, for PIU submission to ADB.

Contractor	● Recruit qualified environmental and safety agents (ESA) to ensure compliance with environmental statutory and contractual obligations and proper implementation of the EMP. ● Implement traffic management plan with relevant authorities. ● Implement utility and telecoms reprovisioning plan in close coordination with relevant authorities. ● Prior to start of construction, update the draft SEMPs for approval by EPCM. ● Provide sufficient funding and human resources for proper and timely implementation of required mitigation measures in the EMP and segregate these sums in the bidding documents. ● Implement additional environmental mitigation measures for unexpected impacts, as necessary.
DBTCL - BRT operator	● Responsible for operation and maintenance of project corridor ● Operate ETP in BRT bus depot to ensure proper disposal of wastewater into the environment ● Ensure safe disposal of spent fuel, hazardous solid waste, if any, by engaging DOE enlisted vendor. ● Implement EMP monitoring during operation
Department of Environment	● Review and approve environmental assessment reports required by the government. ● Undertake monitoring of the project's environmental performance based on their mandate.

ADB=Asian Development Bank, DOE=Department of Environment, EMP=environmental impact assessment, ESO =environmental and safety officer, IEE= initial environmental examination, LGED=Local Government Engineering Department; PIU=project implementation unit, RHD=Road and Highways Division, SEMP=site-specific environmental management plan.

222. To facilitate environmental management plan (EMP) implementation, the contractors must be prepared during the tendering and preconstruction phase to cooperate with PIUs, ESSU, EPCM, and the local population in the mitigation of impacts. Environmental safeguard efforts provided by the contractors must be adequate, timely and appropriate to implement updated EMP under the AF phase of the BRT project. However, experience suggests that contractors may have little interest in dealing with environmental problems in the absence of performance-related criteria. Therefore, as mentioned in Chapter V, the contractor will be required (with the assistance of the EPCM) to update the site-specific EMPs (SEMPs) prepared by them during early stage of project implementation. Clearances for payments will include certification from the EPCM as to the effective implementation of the SEMPs and all other mitigation measures specified in the EMP. The completion of implementation of mitigation measures will therefore be linked to payment schedules.

C. Environmental Mitigation

223. The anticipated environmental impacts and mitigation measures discussed in the previous section are presented in Table 12. The table also shows responsibilities and time frame/schedule for implementation of mitigation measures and monitoring.

224. Table 11 shows that most mitigation activities during preconstruction are to be implemented by the EPCM, while during construction, measures shall be primarily implemented by the contractors. During operation stage, the BRT operator shall undertake environmental mitigation and monitoring requirements specified in the EMP. To ensure implementation of mitigation measures during construction, the EMP shall be included in

the tender and contract documents for civil works. Contractors' conformity with environmental contract procedures and specifications shall be regularly monitored by EPCM with assistance from PIUs/ESOs, and the results shall be reported semiannually to ADB.

Table 12: Environmental Mitigation and Environmental Performance Monitoring Plan for GDSUTP

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
DESIGN and PRECONSTRUCTION (These phases have been completed and not applicable under AF)										
1. Design update and project disclosure	Incorporate design measures in the project design to minimize environmental impacts. Compliance with Bangladesh statutory environmental assessment process. Establishment of GRM.	1. Secure the services of the design and supervision consultants to update designs to address requirements. 2. Update IEE and EMP based on detailed design and submit to ADB for review and approval. 3. Ensure EMPs are included in bidding and contract documents 4. Notify project to DOE and identify and obtain environmental permits/certificates under statutory environmental assessment process. 5. Implement plan for GRM as described in the IEE and inform local authorities 6. Based on the project EMP (included in the IEE),prepare the following draft method statements/site-specific EMPs(SEMPs) for updating by the	1 to 4 and 7: PIUs 5 and 6 (i–ix): Design and supervision consultant (EPCM)/PIU	1 to 3: Start of detailed design 4: Before start of civil works 5 and 6(i–ix): During detailed design phase	All BRT routes	Cost included in PIU and EPCM staffing.	(i) Environ-mental approval for the project obtained from DOE (ii) Response from DOE on permits (iii) Require in EPCM contract. Check during detailed design. (iv) Complete check of items 1–7.	(i) Completion of detailed design/prior to start of civil works (ii) Once during detailed design	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		contractor before construction commences, and								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		such SEMPs shall not be in conflict with any provisions of the EMP: waste management and spoil disposal plan, materials management plan, drainage management plan, runoff control plan, tree-cutting and replanting plan, traffic management plan, utilities shifting plan, noise and dust control plan, and workers and public safety plan. These SEMPs will demonstrate the manner (location, responsibilities, schedule/time frame, budget, etc.) in which the contractor will implement the mitigation measures specified in the project EMP, and other measures identified during detailed design. Further details that should be included in the above SEMPs are provided in the subsequent sections of this table and in Chapter V of the IEE. 7.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		Incorporate/undertake the following measures in the project design: (i) Land acquisition, resettlement and environmental impacts will be avoided or minimized by basing the detailed designs within the RoW as proposed in the preliminary designs. Implement resettlement plan and provide all compensation and entitlements prior to displacement. Assist vendors in shifting to alternative market sites. (ii) Potential solution spaces to ensure sufficient disposal space for cut surface spoil materials and to avoid fly-tipping will be identified in advance by the EPCM, and approved by PIU and the local community before bidding. (iii) Arrangements will be made to facilitate the timely production								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		and supply of rock and bitumen-based materials for construction and to avoid impacts due to unnecessary stockpiling near the BRT route. (iv) Extensions and improvements of drainage culverts for BRT drainage and the adjacent road will be designed to account for increase drain due to a once-in-100-years return storm event. (v) Hydrological and drainage impacts during construction will be minimized by including in the detailed design the early phasing of replacement of side drains, other infrastructure. (vi) Disruption to current facilities for water supply will be avoided and facilities retained or reprovisioned before construction works begin; provisions will be made to preserve The operation of								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		current facilities for water supply insufficient quantity, in agreement with the local community. (vii) Disruption to current power supply will be avoided and movement of power lines will be planned in advance. Power distribution circuitry will be re-provisioned before construction works begin; provisions will be made to preserve the operation of current facilities for power supply in sufficient quantity, in agreement with the local power supply company. (viii) Disruption to telecommunications will be avoided and movement of telecommunication lines planned in advance. Telecommunication lines will be reprovisioned before construction works begin; provisions will be made to preserve the operation of Current facilities for								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		Telecommunications in sufficient quantity, in agreement with the local power supply company. (ix) Disruption to current facilities for main gas supply will be avoided and facilities retained or reprovisioned before construction works begin; provisions will be made to preserve the operation of current facilities for gas supply or provide an alternative supply in sufficient quantity, in agreement with the local community. (x) Plans to minimize disturbance of vehicular traffic and pedestrians during construction will be included in the detailed designs. It will be discussed and agreed with the police and other local authorities along the project corridor. Plans to avoid or minimize disturbance of vehicular traffic and pedestrians during construction will be included in the								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		detailed design. Phasing and programming for construction will retain passing lanes along the road during construction and avoid community severance. (xi) Acquisition of agricultural land will be minimized for temporary facilities (if needed) by selecting preferred locations in detailed designs for construction yards and asphalt plants on barren or marginal land, and agreeing on terms with local community. (xi) Aim to provide enhancements under ADB policy on environmentally responsible procurement, and avoid negative impacts due to unnecessary removal of trees. Include compensatory tree planting as requested by Commissioner of Forests. (xii) Include vendor spaces within station designs.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
2. Project boundaries/ location change	EMP can control impacts and compliance required for environmental laws.	1. Design BRT and road upgrading works within RoW, to avoid schools, mosques, cemeteries, and other sensitive receptors. 2. Make the detail design of alignment to minimize loss of trees and other vegetation. 4. Detailed designs to provide for enhancement (e.g., EPCM, tree replanting) where practicable. 5. Make plans for tree replacement in coordination with local authorities and Department of Forests. 6. Update the EMP should there be additional environmental impacts identified during detailed design and for which appropriate mitigation measures have not been included. Submit updated EMP to ADB for review before start of civil works.	EPCM	Detailed design	Entire BRT route	Included in EPCM cost.	(i) Require in EPCM contract. Check during detailed design (ii) Complete check of items 1–7 on detailed design.	Once, during detailed design	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		7. Prepare a new or supplementary environmental assessment report incompliance with the ADB's Safeguard Policy Statement if there are any additional components or modifications in the project, such as change in specific location/alignment, among others, that will result in adverse environmental impacts and are not within the scope of the environmental assessment report prepared during loan processing. Submit the report to ADB for review before start of related civil works.								
3. Environmental capacity development	Develop environmental management capacity of PIU to ensure proper EMP implementation and promote environmental awareness	1. PIUs to commit and retain dedicated staff (ESO) for project duration to oversee EMP implementation 2. EPCM to train PIUs/ESOs to build their capacity on EMP implementation, i.e. monitoring and reporting using workshops and on-the-job training	1: PIU environmental officer 2 and 3:EPCM	Initiate during detailed design phase, and must be continued throughout project construction	Throughout GDSUTP	Cost included in PMU and EPCM	(i) Require in EPCM contract. Check during detailed design. (ii) Complete training and check before and during construction.	Prior to start of siteworks and throughout construction phase	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
	Among workers.	techniques and case studies. 3. Conduct workers' orientation on EMP provisions. Such orientation shall be periodically conducted by the EPCM as every new contractor is engaged.								
4a.Traffic management plan	Minimize traffic disruption and congestion.	1. Contact all relevant local authorities and local district groups. Conduct traffic impact assessments to plan traffic management if necessary. 2. Prepare a draft traffic management plan (TMP) during construction (to be updated later by the contractor) to minimize disturbance of vehicular traffic and pedestrians during construction. Access arrangements for vehicles accessing the project area will be formulated such that this will avoid community disturbance and severance, and will at least retain a	EPCM	Detailed design phase (before bidding)	Throughout all GDSUTP	Cost included in design fees	(i) Require in EPCM contract. Check during detailed design. (ii) Complete check of items 1 and 2	Once, during detailed design phase	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		passing lane along all roads used during construction. The plan will include consideration of the following (also see Appendix 5 for further guidance in TMP): i) Lane availability and minimizing interference with traffic flows past the work site; ii) establishment of acceptable working hours and constraints; iii) agreement on time scale and establishment of traffic flow/delay requirements; iv) programming issues, including the time of year and available resources; v) discussion of the EPCM/PIU's inspection/monitoring role; vi) establishment of complaints management system for the duration of the work; and								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		vii) agreement on publicity/public consultation requirements (advance signing, etc.).								
4b.Protection and reprovision of power utilities and tele-communications	Minimize interruption to power, water supply telecoms and irrigation system	1. Identify all power, gas and water supply, and telecommunication systems which will likely be interrupted by the works. 2. Contact all relevant local authorities for utilities and local district groups to plan reprovisioning of power, gas, water supply, and telecommunications. 3. Prepare a draft utilities and telecommunications reprovisioning plan (to be updated with contractor) to minimize interruption to power, gas, water supply, and telecommunications.	EPCM	Detailed design phase (before bidding)	Throughout all GDSUTP	Cost included in design fees	(i) Require in EPCM contract. (ii) Check during detailed design. (iii) Complete check of items1–3	Once, during detailed design phase	PMU/ESSU	Cost met by PMU/ESSU project staffing
4c. Plan waste and spoil disposal	Minimize waste; avoid fly-tipping and pollution.	1. Reuse of waste materials and spoil disposal locations included in bid and contract documents. 2. Prepare a draft waste management	EPCM	Detailed design phase (before bidding)	Throughout GDSUTP	Cost included in design fees	(i) Require in EPCM contract. (ii) Check during detailed	Once, during detailed design phase	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		plan and spoil disposal plan (to be updated by contractor). The plan shall cover handling, storage, treatment, transport, and disposal of solid and liquid wastes, hazardous materials, hazardous wastes, and excavation spoils. 3. The general waste section of the draft waste management plan and spoil disposal plan will include considerations of all matters related to solid and liquid waste disposal, including: i) Expected types and quantities of waste; ii) waste reduction, reuse, and recycling methods to be employed; iii) agreed reuse and recycling options and locations for disposal/endorsement from DOE and local groups; iv) methods for					design. (iii) Complete check of items1–5			

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		treatment and								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		disposal of all solid and liquid wastes; v) methods of transportation to minimize interference with normal traffic; vi) establishment of regular disposal schedule and constraints for hazardous waste; vii) program for disposal of general waste/chain of custody for hazardous waste; viii) discussions of the PIU/EPCM's inspection/monitoring role; ix) establishment of complaints management system for duration of the works; and x) agreement on publicity/public consultation requirements (advance signing etc.). 4. The draft waste management plan and spoil disposal								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		plan shall include a section on hazardous materials and waste. This will detail the mitigation measures, organizational arrangements, resources, facilities, etc. to avoid environmental as well as health and safety impacts due to use and disposal of hazardous materials/substances . 5. The spoil disposal section of the waste management plan and spoil disposal plan will include consideration of the following: i) locations and quantities of spoil arising from the construction works; ii) agreed locations for disposal/endorsement from DOE and local groups; iii) methods of transportation to minimize interference with normal traffic; iv) establishment of acceptable working hours and constraints; v) agreement on time								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		scale and program for disposal and chain of custody; vi) programming issues, including the time of year and available resources; vii) discussion of the PIU/EPCM's inspection/monitoring role; viii) establishment of complaints management system for duration of the works; and ix) agreement on publicity/public consultation requirements (advance signing, etc.).								
4d. Plan construction materials management	Avoid stockpiling of rock-based materials and runoff.	1. Designs to balance cut-and-fill where possible. 2. Prepare a draft materials management plan (to be updated by contractor). The plan shall detail the arrangements to be made to facilitate the timely production and supply of construction materials to avoid impacts due to unnecessary stockpiling outside	EPCM	Detailed design phase (before bidding)	Throughout GDSUTP	Cost included in design fees	(i) Require in EPCM contract. (ii) Check during detailed design. (iii) Complete check of items 1–3.	Once, during detailed design phase	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		the project site. As a minimum requirement, the plan shall consider the following: (i) required materials, potential sources, and estimated quantities available; (ii) impacts on identified sources and availability; (iii) excavated slope material for reuse and recycling methods to be employed; iv) endorsement from DOE and local groups for use of sources; (v) methods of transportation to minimize interference with normal traffic; (vi) constraints on regular delivery schedule to reduce stockpiling on site; (vii) program for reuse of slope excavated material; (viii) program for delivery of quarry								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		and borrow materials; (ix) discussion of the PIU/EPCM's inspection/monitoring role; and (x) agreement on publicity/public consultation requirements. 3. Prepare a draft mass haul chart for the aggregate and asphalt materials needed for the construction works.								
4e. Drainage and hydrological Impacts	To minimize hydrological impacts flooding and runoff of riverbanks	1. Designs for bridges and culverts sufficient to control flooding with appropriate drainage structures to cater to worst-case flow and rainfall from 100-year return storm, and to dissipate energy of flow to reduce runoff. 2. Design embankment and drainage to address current flooding problems (such as those experienced at Km 25–Km 27; Km38–Km39; Km 41– Km 42; Km 5–Km 51;Km 54–Km 56;Km	EPCM	Detailed design phase (before bidding)	Throughout GDSUTP	Cost included in design fees	(i) Require in EPCM contract. (ii) Check during detailed design. (iii) Complete check of items 1–4.	Once, during detailed design phase	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		61–Km 63; Km 70–Km73;Km 92–Km 96; and Km 135–Km140, etc.). Ensure that rehabilitated roads will not cause flooding of adjacent areas. 3. Designs for drainage to avoid disposal of outflow on steep slopes greater than 30% and non-vegetated areas. Protect slopes below. 4. Prepare draft drainage management plan (to be updated by contractor). The plan shall detail measures and other provisions to ensure that construction works will not cause ponding/flooding within the project site, construction camps, borrow/quarry areas, other areas used for project-related activities and adjacent areas.								
4f. Runoff control and flooding	To minimize hydrological impacts,	1. Incorporate runoff control and works stabilization measures in the	EPCM	Detailed design phase (before	Throughout GDSUTP	Cost included in design	(i) Require in EPCM contract. (ii) Check	Once, during detailed design	PMU/ESSU	Cost met by PMU/ESSU

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
	flooding damage to the works, and runoff of river banks	engineering design, such as side ditches and berms, rock lining, and slope walls, where appropriate. 2. Cut areas of works designed not to undercut or destabilize adjacent trees. 3. Temporary drainage works are to be designed based on the historical flood data and flood forecasting. 4. Ensure design includes prevention of flooding in adjacent areas during construction of bridges. 5. Incorporate in the design side drainage structures to divert the stream water at construction sites. 6. Design incorporates sufficient sizes of drains to take design flows. 7. Prepare a draft runoff control plan (to be updated by the contractor). The plan shall detail the arrangements/provisi ons to ensure that construction works		bidding)		fees	during detailed design, (ii) Complete check of implementati on of items 1–7.	phase		project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		will not cause excessive runoff and siltation of water ways adjacent to the Project site, have sufficient provisions to ensure stabilization of cut areas of the works and other runoff-prone areas, minimize hydrological impacts, flooding, and runoff of riverbanks and adjacent areas, and protect the works under construction. The plan will consider the following: i) climate and rainfall for the area and checking weather forecasts; ii) terrain and typical locations susceptible to runoff; iii) protection of the works and potential impacts to the environment; iv) runoff control methods to be employed, locations, and installation timing; v) limits to stockpiling								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		In sites near waterNA ways and irrigation channels; vi) discussion of the EPCM/PIU's inspection/monitoring role; and vii) agreement on publicity/public consultation requirements.								
4g. Tree-cutting	Minimize tree-cutting	1. Contact Commissioner of Forests office and all relevant local authorities, and local district groups to plan tree-cutting and replanting. 2. Prepare a draft tree cutting and replanting plan (to be updated by contractor) to avoid indiscriminate tree-cutting. The plan shall clearly define areas where tree removal is necessary based on project requirements, and shall have provisions for replanting to compensate for lost trees. The plan shall prohibit introduction of invasive species and shall specify that	EPCM	Detailed design phase (before bidding)	Throughout GDSUTP	Cost included in design fees.	(i) Require in EPCM contract. (ii) Check during detailed design. (iii) Complete check of items 1 and2	Once, during detailed design phase	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		new alien plant species (i.e., species not currently established in the city) shall not be used unless carried out within the existing regulatory framework for such introduction.								
4h. Noise and dust management	Minimize noise and dust	1. Reconfirm all noise and dust t sensitive receiver s which will likely be affected by construction works. 2. Contact local l district groups to plan mitigation in advance. 3. Prepare a draft noise and dust control plan (to be updated by contractor) to minimize impacts to sensitive receptors (residential areas, schools, temples, hospitals, etc.) due to construction works, sourcing and transport of construction materials, and other project-related activities.	EPCM	Detailed design phase (before bidding)	Throughout GDSUTP	Cost included in design fees	(i) Require in EPCM contract. (ii) Check during detailed design. (iii) Complete check of contractor's implementation of items 1–3.	Once, during detailed design phase	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
4i. Workers and public safety	Avoid accidents due to construction works	Prepare a draft workers and public safety plan (to be updated by contractor) to identify interfaces between the works and the public, formulate measures to ensure safety of workers and the public, and prevent accidents due to the construction works.	EPCM	Detailed design phase (before bidding)	Throughout GDSUTP	Cost included in design fees	(i) Require in EPCM contract. (ii) Complete check during detailed design.	Once, during detailed design phase	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
5. Environmentally responsible procurement	EMP Provisions are properly implemented by selected contractor	1. EMP is included in bidding and contract documents to ensure that mitigation measures are budgeted and to prepare the contractor for environmental responsibilities. 2. Specify in bid document that contractor shall engage capable and trained staff or site agents to take responsibility for the environmental management and safety issues at the working level, and to monitor the effectiveness and review mitigation measures as the project proceeds. 3. Contractors (assisted by EPCM) should submit updated specific	1 and 2:EPCM for PIUs 3: Preparation of SEMPs – contractor, approval of SEMPs-EPCM 4: Contractor	1 and 2:During bid preparation 3 and 4:Before start of civil works	Throughout GDSUTP	Included in bid cost	(i) 1 and 2:Inclusion in bid docs (ii) 3 and 4: Check compliance	During bid preparation stage and before start of siteworks	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		environmental management plans or SEMPs for approval by EPCM (i.e., management plans such as runoff control plan, noise and dust control plan, etc.). 4. Contractors should recruit qualified staff to oversee implementation of environmental and safety measures specified in the EMP.								
6. Coordinating utilities and tele-communication reprovisioning	Utilities and tele-communications remain in service during construction. Only minor/unavoidable interruptions to utilities and telecoms	1. Set up coordinating committee early in the detailed design stage. 2. Identify all potential hindrances to construction in the field. 3. Identify foresee able constraints and identify leadtime. 4. Establish preparedness of the utilities to facilitate reprovisioning. 5. Facilitate utilities and telecoms reprovisioning plan (UTRP). 6. Include the UTRP (as part of the EMP) in the bidding	1 to 10:RHD/ PIU 11 and 12:EPCM 11: Contractor	1 to 10:During detailed design and bid preparation 11and 12: Before start of civil works and periodically during construction	Throughout GDSUTP	Included in RHD and EPCM costs	(i) 1 to 10:Inclusion of UTRP in EMP in bid documents (ii)11 and 12: Security of utilities and telecoms connections	Bid preparation stage, and before start of and throughout siteworks	PMU/ESSU	Cost met by PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		documents. 7. Coordinate committee chairmanship of MOC/RHD with RDH/PIU as secretary. 8. Set monthly meetings for first 6 months of design. 9. Meet with membership implementing agency (RHD, EPCM), all utilities, police and local authorities as necessary. 10. Set additional coordinating committee meetings in construction phase if problems occur. 11. Contractors are inducted, and construction gears up through awareness workshops conducted periodically by the EPCM. 12. EPCM shares experience in the implementation of the works in case unexpected difficulties occur.								
7. Ambient air, water, and sediment	Establish baseline air, water, and	1. Collect baseline data on air quality at three locations along the alignment in the	1 to 3:EPCM 4:EPCM notifies	To be completed not later than the	1. Four throughout all GDSUTP.	Included in EPCM costs	1. Total suspended particulates (TSP)	To be completed not later than the	PMU/ESSU	Cost met by PMU/ESSU

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
quality and noise monitoring	Sediment quality and noise levels to help in assessing project impacts during implementation.	calendar month before the construction commences. 2. Collect baseline data on noise at six locations along the alignment in the calendar month before the construction commences. 3. Collect baseline water quality at Tongi Bridge in the calendar month before the construction commences. 4. Collect baseline data on sediment quality under Tongi Bridge during the early stages of detailed design to establish toxicity of sediments to facilitate discussions with DOE on identification of suitable site for disposal. To be completed no later than the calendar month before the construction commences	DOE	Calendar month before construction commences.	2. Four throughout all GDSUTP. 3. Two locations 50 m up and downstream of Tongi Bridge (Tongi Khal). 4. Two locations: at approximately where piers will be located for new Tongi Bridge flyover, and 50 m downstream of Tongi Bridge (Tongi Khal)		2. Noise levels Leq 15 mins dB(A) 3. pH, temperature, turbidity, dissolved oxygen, oil and grease, and total suspended solids (TSS) 4. As 3, plus heavy metals Cd, Cu, Hg, Pb	Calendar month before construction commences		project staffing
Seismic considerations for	Protect damage from	Designs all structures to meet Bangladesh National Building	EPCM	To be completed during		Included in EPCM	Design drawings included	Once at detailed design	PMU/ESSU	Cost met by PMU/ES

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
structures (Level 2 seismic rating)	earthquakes	Code (2006).		Detailed design of all structures		costs	Seismic compliance with BNBC, 2006	completion		SU project staffing
CONSTRUCTION STAGE (under GDSUTP-Additional Financing)										
1. Dust pollution from project activities and deterioration of air quality	Minimize dust pollution and control SPM, $PM_{2.5}$ and PM_{10} within DOE prescribed standards.	(i) Identify dust prone areas and device mitigation measures through direct visits. (ii) Operate water sprinkling/ spraying by vehicles 3 times or more as necessary. (iii) Remove loose dust from medians and both sides of road at list twice a week per spot. (iv) Establish dust control netting/ fencing at surrounding construction sites. (v) Use powdered Soiltac/Calcium Chloride Flakes solution to control dust and a soil stabilizer to ensure dust-free surface crust. (vi) Use spiral nozzles to remove airborne dust as they provide a very fine droplet size at reasonable pressures. (vii) Repair unpaved	Contractors.	Throughout project implementation	Dust prone construction sites, especially where trenches are excavated, soils/spoil dumped, damaged carriage ways.	Cost included in the contractors fees	1. Air quality monitoring 2. Site visit to observe dust condition at construction sites.	- Regular Physical Monitoring - Checklists - Effective communication system	Contractors, EPCM and PMU	Cost met by EPCM And PMU

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		/damaged parts road with asphalt as and when necessary.								
2. Avoid indiscriminate construction waste/ spoil dumping	Reduce public nuisance through ensuring proper pedestrian walkways, traffic corridor	1. Conduct meeting with contractors to clearing waste instantly after dumping. 2. Remove solid waste/construction debris from instantly/immediately. 3. Place waste bin of adequate size at construction sites for temporary dumping of construction debris which will subsequently disposed of to designated duping sites following local rules. 4. In case of piled waste which is possible source of dust should be water sprayed with dust stabilizing liquid for effective suppression.	Contractors	Throughout project implementation	Dust prone construction sites, especially where trenches are excavated, soils/spoil dumped, damaged carriage ways.	Cost included in the contractors fees	1. Air quality monitoring 2. Site visit to observe dust condition at construction sites.	- Regular Physical Monitoring - Checklists - Effective communication system	Contractors, EPCM and PMU	Cost met by EPCM And PMU

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
3. Safety precaution, including COVID-19, for workers	Ensure worker health and safety	1. Contractor to update Occupational Health Safety and Accident Prevention Plan and obtain approval from PMU. 2. Conduct toolbox talk for workers daily at sites. 3. Ensure regular health monitoring (especially extra precaution for COVID-19) and record keeping before starting works at sites. 4. Supply sufficient quantity of PPEs for employees & workers and ensure their appropriate use. 5. Conduct EHS training for workers', Contractor's representatives, Consultant, PIU & PMU once in six months. 6. Conduct hazard and risk mapping and assessment of the potential construction activities of the project. 7. Use alternatives to adopt environ-mentally and HS wise	Contractors to implement, EPCM to assist	1. Within one month from start of AF 2–10: Throughout construction phase	Entire project sites	Cost included in contracts	(i) Check implementation of items 1-15 (ii) Check compliance with Bangladesh Labor Act (2006)	- Regular Physical Monitoring - Checklists - Effective communication system	EPCM, PIU Environmental officer	Cost met by EPCM and PMU.

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		benign or less harmful construction tasks through design and technology options. 8. Establish safety measures as required by law and by good engineering practice, and provide first aid facilities that are readily accessible by workers. 9. Scheduling of regular (e.g., weekly toolbox talks) to orient the workers on health and safety issues related to their activities.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
4. Orientation for contractor, workers on environmental and social management	Contractor and workers trained to implement mitigation measures and better implementation of EMP	1. Contractors clearly separate resources applied to mitigation measures. Tenders identify named staff to supervise management's plans. 2. EPCM shall conduct training/orientation involving construction workers and PIU with regard to implementation of mitigation measures in the updated management plans/SEMPs, project EMP (i.e., those specified in the IEE) and any additional measures identified during detailed design phase. 3. Implement malaria controls and HIV-AIDS education and prevention program in line with social plans.	1: Contractor 2: EPCM 3: Contractor	1: Before start of site works 2:Within 1 month of start of site works 3: Upon deployment of workers to project site	Project site	Cost included in contract for EPCM And Contractor	Complete check of implementation of items 1–3.	1: Before start of site works 2: Within 1 month of start of construction 3: Monthly during construction	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
5. Public inconvenience and Accident prevention	Reduce public sufferings and ensure hazards free movements	1. Post safety signboards, signage, banners and stickers for awareness and precautions and maintain this activity throughout the period. 2. Provide effective safety barricade/fencing to control traffic & accidents before starting construction works at any sites. 3. Ensure proper drainage at construction sites to avoid flooding /inundation during monsoon. 4. Ensure adequate maintenance and repairing of potholes, damaged footpath, temporary pedestrian walks, etc. to reduce public inconvenience and accident prevention. 5. Implement RDH approved traffic management plan for reducing construction time impediments and sufferings and safety public.	Contractors with assistance from EPCM consultants.	Throughout project period	Entire project sites, especially at construction sites.	Cost included in contracts budget	Direct site visit and check elements of mitigation measures.	- Effective communication system - Regular visit to project construction sites - Grievance and complaint reporting	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU Project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
6. Loss of trees	Minimize impacts to flora and fauna	1. Submit Compensatory Tree Plantation Plan immediately. 2. Implement Compensatory Tree Plantation Plan by involving relevant agencies (Arboriculture department of RHD, Forest Department, etc.). 3. Monitoring and marking of vegetation that will not be removed agreed with forest authority prior to commencement of construction 4. During replanting works, new alien plant species (i.e., species not currently established in the city) shall not be used unless carried out with the existing regulatory framework for such introduction. Invasive species shall not be introduced into new environments.	1: Contractor to prepare updated TRP, EPCM to approve. 2: Contractor, District Forestry Office (DFO), EPCM3: DFO/local forestry office 4–12: Contractor	1: One month before start of site works 2–3: Before tree-cutting is implemented 4–12: Throughout construction phase	GDSUTP route	Cost included in contracts	Check implementation of items 1-12 and TRCP provisions	- Tree Plantation Plan - Photographs - Meeting minutes	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		7. As much as possible, bridge works will be scheduled in dry season to minimize adverse impacts to river water quality and other aquatic resources. 8. The contractor will not use or permit the use of wood as a fuel for the execution of any part of the works, including but not limited to the heating of bitumen and bitumen mixtures, and to the extent practicable shall ensure that fuels other than wood are used for cooking and water heating in all his camps and living accommodations. 10. Contractor shall not buy or use wood from the illegal sources (illegal logging). 11. Contractor will take all precautions necessary to ensure that damage to vegetation is avoided due to fires resulting from execution of the works. The contractor will immediately								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		suppress the occurrence of fire, and shall undertake replanting to replace damaged vegetation.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
7. Drainage and hydrological Impacts	To minimize hydrological impacts flooding and runoff of river banks	1. Review detailed designs for cross-drainage and side-drainage structures, assess and agree with PIU/EPCM if redesign is required, or if new structures would be constructed or existing ones would be repaired. 2. Before start of site works, update draft drainage management plan (DMP) prepared by EPCM during detailed design phase. Updated plan to be approved in writing by EPCM 1month prior to commencement of works. Contractor to implement provisions of DMP. 3. Implement agreed designs for bridges and culverts sufficient to control flooding as designed and to dissipate energy of flow to reduce runoff. 4 Protect lead-off streams that may become silted by construction runoff,	1: Contractor 2: Contractor to update DMP, EPCM to assist and approve. 3–8: Contractor	1 and 2:One month before start of site works 3–8: Throughout construction phase	Throughout project site, particularly at bridges, cause ways, irrigation canals, and all areas considered prone to flooding	Cost included in design	Check implementation of items 1-8 and DMP provisions	1 and 2:Before start of site works 3–8: Monthly Implementation of DMP provisions: Monthly	EPCM, PIU Environmental officer	Cost met by EPCM, PIU environ-mental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		workshops, or equipment washing yards. 5. Minimize alterations in the project corridor's surface drainage patterns as much as possible. 6. Drains to be constructed so that the outfalls of the surface runoff from the carriageway are diverted away from the service receptors 7. Ensure that storm drains and highway drainage systems are periodically cleared to maintain storm water flow during construction.								
8. Utilities	Prevent interruption of services such as electricity and water during relocation of the utilities line/connections. Repair damaged access roads.	1. Before start of siteworks, update draft utilities and telecoms reprovisioning plan (UTRP) prepared by EPCM during detailed design. Updated plan to be approved in writing by EPCM 1 month prior to commencement of works. Contractor to implement UTRP provisions. 2. Reconfirm power, water	1: Contractor to update UTRP, EPCM to assist and approve2–8: Contractor	1: One month before start of site works 2–6: Before start of construction 7 and 8: During construction	Throughout project site	Cost included in contracts	Check implementation of items 1-8 and UIRP provisions	1–6: Before construction 7 and 8:Monthly	EPCM, PIU Environmental officer	Cost met by EPCM and PIU environ-mental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		supply,								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		telecommunications, and irrigation systems likely to be interrupted by the works. 3. Contact all relevant local authorities for utilities and local village groups to plan reprovisioning of power, water supply, telecommunications, and irrigation systems. 4. Utilities shall be relocated and reconnected well ahead of commencement of construction works, and contractor shall coordinate with utility company for relocation and reconnection before work begins. 5. Affected communities shall be properly informed in advance. 6. Reconnection of utilities shall be completed at the shortest practicable time before construction commences. 7. Utilities damaged during construction shall be reported to								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		the EPCM and utility authority, and repairs arranged immediately. 8.Access roads damaged during transport of construction materials and other project-related activities shall be reinstated upon completion of construction works at Each section								
8. Materials exploitation and management of quarry and borrow areas	Minimize impacts from materials extraction, transportation, and storage.	1. Update draft materials management plan or MMP (which will also include a mass haul chart) prepared by EPCM during detailed design phase. Updated plant be approved in writing by EPCM 1 month prior to commencement of works. Contractor to agree and implement MMP provisions. 2. Balance cut-and-fill requirements to minimization impacts from extraction of aggregates. 3. Prioritize use of existing quarry sites with suitable materials, update the	1: Contractor to update MMP, EPCM to approve 2–17: Contractor	1: One month before start of site works, MMP to be updated regularly (monthly or as required by EPCM) 2–13: Throughout construction 14–17: Upon completion of materials extraction	Project site, quarry and borrow sites	Cost included in contract	Check implementation of items 1-17 and MMP provisions	1: Before construction 2 and 17: Monthly Implementation MMP provisions: Monthly	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		list of quarries and borrow pits monthly in MMP, report to PIU environmental officer, and minimize impacts on other local resources. 4. Procure materials only from DOE authorized quarries and borrow sites. 5. If the contractor shall operate the quarry site, required environmental permits shall be secured prior to operation of quarry/borrow areas. 6. Use quarry with highest ratio between extractive capacity (both in terms of quality) and loss of natural state. 7. Use quarry sites lying close to the alignment, with a high level of accessibility. 8. Do not use quarries in areas of natural woodland or near rivers which provide food and shelter for birds and other animals. 9. Borrow/quarry sites shall not be located in productive								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		land and forested								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		areas. 10. During quarry/borrow site operation, provide adequate drainage to avoid accumulation of stagnant water. 11. It is preferable to avoid or reduce the sections of quarry sites located on river bed. If it is not possible to locate quarries out of river beds, quarry sites lying on small rivers and streams shall be avoided. Alluvial terraces or alluvial deposits which lie on the river beds but are not covered by water under normal hydrological conditions are preferred. 12. Ensure borrowpits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of water bodies favorable for mosquito breeding. 13. Upon completion of extraction activities, quarry and borrow pits shall be dewatered and								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		fences shall be installed, as appropriate, to minimize health and safety risks. 14. To avoid drowning when pits become water-filled, measures such as fencing, providing floatation devices such as a life buoy tied to a rope, etc. Shall be implemented.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		EPCM/PIU, and monitored 15. Spoil disposal areas to be rehabilitated monitored, catalogued, and marked 16. Spoil will not be disposed of in rivers and streams or other natural drainage path. 17. Spoil will not be disposed of on fragile slopes, flood ways, wetland, farmland, forest, religious or other culturally sensitive areas, or areas where a livelihood is derived. 18. Surplus spoil will be used where practicable for local repair works to fill eroded gullies, depression areas, and degraded land in consultation with local community. 19. Spoils shall only be disposed of in areas approved by local authority. 20. Spoils will be disposed of in disused quarries and abandoned borrow								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		pits where practicable. 21. Disposed spoils will be spread in 15cm layers and compacted to optimum moisture content, covered with top soil, land scaped, and provided with drainage and vegetation to prevent runoff in line with best practice. 22. Spoil disposal shall not cause sedimentation and obstruction of flow of water courses, or damage to agricultural land and densely vegetated areas. 23. Under no circumstances will spoils be dumped into water courses (rivers, streams, drainage, irrigation canals, etc.). 24. The spoils disposal site shall be located at least 50 m from surface watercourses and shall be protected from runoff by avoiding formation of steep slopes and grassing.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
10. Use of hazardous substances and hazardous waste disposal	Minimize contamination due to use and storage of hazardous substances	1. Update hazardous waste section of waste management and spoil disposal plan prepared by the EPCM 1 month before construction. Updated plan to be approved in writing by EPCM 1 month prior to commencement of works. Contractor to implement WMSDP provisions. 2. Ensure that safe storage of fuel, other hazardous substances, and bulk materials are agreed by PIU environmental officer/EPCM and have necessary approval/permit from DOE and local authorities. Hydrocarbon, toxic material, and explosives will be stored in adequately protected sites consistent with national and local regulations to prevent soil and water contamination. 4. Equipment/vehicle maintenance and refueling areas will be confined to areas	1: Contractor to update WMSDP, EPCM to approve 2–17: Contractor	1:One month before start of site works 2–17: Throughout construction phase	Throughout project site, storage areas, equipment and vehicle maintenance and refueling areas	Cost included in contracts	Check implementation of items 1-17 and WMSDP provisions	1: Before construction 2 and 17: Monthly Implementation of WMSDP provisions: Monthly	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		in construction sites designed to contain spilled lubricants and fuels. Such areas shall be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency. 5. Fuel and other hazardous substances shall be stored in are as provided with a roof, impervious flooring, and bund/ containment wall to protect these from the elements and to readily contain spilled fuel/lubricant. 6. Segregate hazardous wastes (oily wastes, used batteries, fuel drums) and ensure that storage, transport, and disposal shall								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		not cause pollution and shall be undertaken consistent with national and local regulations. 7. Ensure all storage containers are in good condition with proper labeling. 8. Regularly check containers for leakage and undertake necessary repair or replacement. 9. Store hazardous materials above flood level. 10. Discharge of oil-contaminated water shall be prohibited. 11. Used oil and other toxic and hazardous materials shall be disposed of in an authorized facility offsite. 12. Adequate precautions will be taken to prevent oil/lubricant/hydrocarbon contamination of channel beds. 13. Ensure availability of spill cleanup materials (e.g., absorbent pads, etc.) specifically designed for petroleum								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		products and other hazardous substances where such materials are being stored. 14. Spillage, if any, will be immediately cleared with utmost caution to leave not races. 15. Spillage waste will be disposed of at disposal sites approved by local authorities and by EPCM. 16. All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulation. 17. The contractor shall identify named personnel in the management plan/SEMP in charge of these sites, and ensure they are properly trained to control access to these areas; entry will be allowed only under authorization.								
12.Asphalt	Avoid air	1.Locate asphalt	Contractor	1:During	Throughout	Cost	Check	1: Before	EPCM,	Cost met

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
					GDSUTP		implementation of items 1-9.			

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
plant rock crushers, bitumen usage, and soil contaminatio n	pollution, nuisances, traffic obstacles, and contaminati on.	plant, rock crushers, and bitumen supply off road and (wherever practicable) at least 500 m from nearest sensitive receivers (residential areas, schools, hospitals, etc.), and rivers, and install and maintain dust suppression equipment. 2. Bitumen should not be used as fuel. Fuel wood is not for bitumen heating. Bitumen drums must be stored in dedicated area, not scattered along GDSUTP road. 3. Bitumen will not be allowed to enter either running or dry stream beds, and nor will it be disposed of in ditches or small waste disposal sites prepared by the contractor. 4. Bitumen storage and mixing areas shall be protected against spills, and all contaminated soil must be properly handled according to applicable national and local laws and regulation. As a		Selectio n of locations for asphalt plant, rock crusher, bitumen storage 2–9: Througho ut constructi on phase		include d in contract s		establishme nt of facilities 2 and 9:Month ly	PIU Environme ntal officer	By EPCM and PIU environ-mental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		minimum, these areas must be contained, such that any spills can be immediately contained and cleaned up. Any petroleum products used in the preparation of the bitumen mixture must also be carefully managed to avoid spills and contamination of the local water table. 5. All accidental spills of bitumen or chemicals should be cleaned up immediately with the top 2 cm of any contaminated soil underneath and disposed of as chemical waste to a site approved by the local authority. 6. Prevent soil contamination by requiring contractors to instruct and train their workforce on storage and handling of materials and chemicals that can potentially cause soil contamination. 7. Recycle debris generated by dismantling of								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		existing pavement subject to the suitability of the material.								
13. Noise and dust nuisances	To minimize air impacts effectively and avoid complaints due to the air borne dust	1. Before construction starts, update the draft noise and dust control plan (NDCP) prepared by the EPCM. Include requirements for controlling noise and dusty materials at source. Updated plan to be approved in writing by EPCM 1 month prior to commencement of works. Contractor to implement NDCP provisions. 2. Restrict works to daylight hours within 500 m of residential settlements and hospitals. 3. Powered mechanical equipment and vehicle emissions to meet national TCVN standards. All construction equipment and vehicles shall have valid certifications, indicating compliance to vehicle emission	1: Contractor to update NDCP, EPCM to approve 2–16: Contractor	1:One month before start of site works 2–16: Throughout construction phase	Throughout GDSUTP	Cost included in contracts	Check implementation of items 1-16 and NDCP provisions	1: Before construction 2 and 16: Monthly and spot checks Implementation of NDCP provisions: Monthly and spot checks	EPCM, PIU Environmental officer	Cost met by EPCM and PIU environ-mental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		standards. 4. Construction equipment and vehicles will be maintained to a good standard and shall be provided with muffler silencers. Machinery causing excessive pollution will be banned from construction sites. 5. Monitor and investigate complaints; propose alternative mitigation measures. 6. Keep stock piles moist. 7. Tightly cover trucks transporting construction materials (sand, soil, cement, gravel, etc.) to avoid or minimize spills and dust emission. 8. On rainless days, undertake watering, at least twice per day, on dusty and exposed areas at construction yards, materials stock pile, construction sites, access roads, quarry areas, borrow sites, and other project areas where residential sites and other sensitive								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		receptors such as schools, hospitals, etc. are located. If works are within 15m of any sensitive receivers, the contractor shall install a dust barrier between the works at the road edge and the sensitive receivers (e.g. 2.5 m high temporary walls, etc.). 9. Mixing and crushing plants operations will be equipped with dust suppression devices such as water sprays. 10. Use chemical dust suppressant, such as Calcium Chloride Flakes to bind dust forming thin crust of soil. 11. Clean up road surfaces after work. 12. Remove loose soil from main carriage of the RoW. 13. Temporary noise barriers shall be used, as necessary, in sites where sensitive receptors are present, such as residential areas, schools, hospitals,								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		temples, etc. 14. To protect buildings and structures from vibration, nonvibrating rollers shall be used in construction sites near buildings and structures.								
		13. Structures which are damaged due to vibration caused by the project shall be repaired immediately as directed by EPCM. 14. Machinery shall be turned off when not in use. 15. Pile-driving to be scheduled for day-time if construction site is near sensitive receptors or approved by DOE, local authority, and EPCM. 16. Impose speed limits on construction vehicles to minimize dust emission along areas where sensitive receptors are located (houses, schools, hospitals, etc.).								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
14. Blasting (if required)	Perform safe blasting and prevent damage and nuisances from blasting	1. Before sites works, blasting plan to be prepared by contractor and approved by EPCM/PIU in writing. Contractor to implement blasting plan provisions. 2. All the statutory laws, regulation, rules, etc., pertaining to acquisition, transport, storage, handling, and use of explosives will be strictly followed. Blasting will be carried out as per Bangladesh statutory requirements with notification to DOE and local police. 3. No blasting will take place without condition survey of the buildings within 500 m and permission and monitoring by the EPCM. 4. People living near blasting sites will be informed of blasting times prior to the blasting. 5. Warning sirens will be sounded before blasting. 6. Presplitting shall	Contractor	1: Before site works 2–11: Throughout construction phase	Sections of project alignment where blasting will be undertaken	Cost included in contracts	Check implementation of items 1-11	1: Before construction 2 and 11:Monthly and spot checks Implementation of provisions of blasting plan: Monthly and spot checks	EPCM, PIU environmental officer	Cost met by EPCM and PIU environ-mental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		be undertaken 7. Blast blankets will be laid over the blast area to reduce flying rock. 8. Where the vibration from blasting is exceeding the maximum permissible level, or damage occurs to local property, information from the blasting shall be used to modify blasting patterns and calculate a reduced charge for future blasts. 9. Blasting will not be under taken at night. 10. Blasting shall be under careful and strict management of properly trained and licensed personnel. Workers at blasting sites will be trained prior to blast operations and provided with safety equipment and earplugs. 11. Observe proper warning and precautionary measures to ensure safety of residents, pedestrians, motorists, and structures during								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		blasting.								
15. Runoff control/run-off	Protect established works.	1. Update the draft runoff control plan (RCP) produced by the EPCM and implement excavation stabilization measures specified in the detailed designs and	1: Contractor to update ECP, EPCM to assist and approve 2–12: Contractor	1: One month before start of site works 2–12: Throughout construction phase	Throughout project site and all vulnerable slopes agreed with EPCM	Cost included in contracts	Check implementation of items 1-12 and ECP provisions	1: Before construction 2 and 12:Monthly Implementation of ECP provisions: Monthly	EPCM, PIU Environmental officer	Cost met by EPCM and PIU environ-mental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		maintained during construction to protect the works. Updated plan to be approved in writing by EPCM 1 month prior to commencement of works. Contractor to implement provisions of RCP. 2. Establish permanent surfaces immediately after completion of works in each stretch/sector. 3. Check weather forecasts and minimize work in wet weather. 4. Include and implement appropriate measures for excavation protection, i.e., shoring up as required in the detailed construction drawings. 5. Prevent runoff and protect the excavations with temporary or permanent drainage as soon as practicable after cutting. 6. Payments will be linked to the								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		Completion of the works as indicated by the installation of runoff control measures to protect the works to the satisfaction of EPCM/PIU.								
16. River protection during bridge demolition	Protect rivers and maintain river flow	In sections along and near Tongi Khal River: 1. Rocks and stones will be disposed of so as not to block rivers and streams. 2. In bridge repair and demolition, the contractor with supervision of EPCM consultant prepares and submits a bridge demolition and construction plan. 3. Put adequate emphasis that bridge structure will not be dropped in to the river, but alternative means will be used to avoid "dropping the bridge" into rivers/streams. This will be done by "sawing" appropriate sections of the bridge and using cranes to lift these sections away, or alternatively, by construction of a platform onto which	Contractor	At all times	All rivers and streams with repair and reconstruction works	Cost included in contracts	Check implementation of items 1-4	Monthly	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		the bridge could be lowered. 4. Cofferdams, silt fences, sediment barriers, or other devices will be used as appropriate based on the design to prevent migration of silt during excavation and boring operations within streams. If cofferdams are used, these will be dewatered and cleaned to prevent siltation by pumping from cofferdams to a settling basin or a containment unit. 5.Other runoff control measures such as covering open surfaces with grasses and creepers to reduce runoff will be implemented as early as possible in construction.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
17. Water quality	Prevent water quality impacts due to negligence and ensure unavoidable impacts managed effectively.	1. Store lubricants, fuels in dedicated enclosures not less than 50 m from water bodies. 2. Solid waste from construction activities and workers camps will not be thrown in rivers and other water courses (drainage, irrigation, etc.) 3. Construction storage/stock piles shall be provided	Contractor	Throughout construction phase	Throughout project site	Cost included in contracts	Check implementation of items 1-10	Monthly	EPCM, PIU Environmental officer	Cost met by EPCM and PIU environmental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		with bunds to prevent silted runoff. 4. Stock piled materials will be covered to reduce silted runoff. 5. No stockpiling or borrow sites less than 100 m from a water body. 6. Work in rivers will be scheduled during dry season, and work duration shall be as short as possible. 7. Stock pile areas and storage areas for hazardous substances shall be located away from water bodies. 9. Washing of machinery and vehicles in surface waters shall be prohibited.								
18. Water resources	Mitigate the impact of using local community water resources.	1. Assess availability of water and evaluate impact on use of local water resources to ensure that water utilization for project shall not deplete local villages' supplies. 2. Bring in project water by tanker as necessary. 3. Worker camps will be located as agreed with local community	Contractor	Throughout construction phase	Throughout project site, construction camps	Cost included in contracts	Check imple-mentation of items 1-11	Monthly	EPCM, PIU Environmental officer	Cost met by EPCM and PIU environ-mental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		authority to prevent the unplanned consumption of community-owned water resources. 4. Maintain close liaison with local communities to ensure that any potential conflicts related to common resource utilization for project purposes are resolved quickly. 5. Establish and implement guidelines to minimize the wastage of water during construction and at camp sites. 6. Avoid or minimize use of the river bed for construction materials. 7. Confine winning river materials to 20% of river width in any location, and keep away from river banks. 8. Reinstate river banks if necessary. 9. Reprovision irrigation channels affected by works 2 weeks before commencement of works to the								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		satisfaction of local community.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		10. All irrigation canals along the alignment shall be clearly marked on the ground to prevent accidental dumping of fill materials into these canals. 11. In case of accidental obstruction or damage, drainage ditches and ponds shall be cleaned or Repaired immediately.								
19. Operation of workers camps and workshops/yards	Worker facilities not to cause nuisance	1. Worker camp location and facilities located and agreed on with local communities, and facilities approved by EPCM and managed to minimize impacts. 2. Construction camps will be established in areas with adequate natural drainage. 3. Hire and train as many local workers as possible. 4. Provide adequate housing for all workers at the construction camps and establish clean canteen/eating and cooking areas. 5. Portable lavatories (or at least pit latrines	Contractor	Throughout construction phase	Throughout project site, construction camps	Cost included in contracts	Check implementation of items 1-11	Monthly	EPCM, PIU Environmental officer	Cost met by EPCM and PIU environmental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		In remote areas) shall be installed and open defecation shall be prohibited and prevented by cleaning lavatories daily, and by keeping lavatory facilities clean at all times. 6. Provide separate hygienic sanitation facilities/toilets and bathing areas with sufficient water supply for male and female workers. 7. Wastewater effluents from contractors' workshops and equipment washing yards will be passed through gravel/sand beds, and all oil/grease contaminants will be removed, discharging it in to natural streams. Oil and grease residues shall be stored in drums awaiting disposal in line with the agreed waste management plan, and consistent with national and local regulations. 8. Predictable waste water effluent discharges from construction								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		works								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		shall have the necessary permits from DOE and local authorities before the work commences. 9. Borrow pits and natural depressions with pre laid impervious liners will be used to dispose of scarified/scraped asphalt, and then covered with soil. This will check potential groundwater contamination. 10. Options for completely or partially recycling scraped scarified materials will also be taken into account. 11. Camp site will be cleaned up to the satisfaction of the local community after use. 12. Solid and liquid waste will be managed in line with the waste management plan. 13. All waste materials shall be removed and disposed of in disposal sites approved by local authorities. 14. Land used for								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		campsites shall be restored to original condition as far as practicable, and the area if required in the TCRP shall be planted with appropriate trees/shrubs as soon as practicable after it is vacated and cleaned.								
20. Sanitation and diseases	Control of infectious diseases	1. Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside to prevent proliferation of mosquitoes. 2. Temporary and permanent drainage facilities will be designed to facilitate the rapid removal of surface water from all areas and prevent the accumulation of surface water ponds. 3. Malaria controls (e.g., provision of insecticide-treated mosquito nets to workers, installation of proper drainage to avoid formation of stagnant water, etc.) and HIV-AIDS education will be Implemented in line	Contractor	Throughout construction	Throughout project site, workers camps	Cost included in contracts	Check implementation of items 1-4	Monthly	EPCM, PIU environmental officer	Cost met by EPCM and PIU environmental officer project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		with social plans for the project. 4. HIV/AIDS awareness and prevention program shall be implemented in line with social plans under the project.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		on proper use of PPE. 10. Fencing on all excavation, borrow pits, and sides of temporary trenches. 11. Workers shall be provided with appropriate personal protective equipment (PPE) such as safety shoes, hard hats, safety glasses, earplugs, gloves, etc. at no cost to the employee. 12. Where worker exposure to traffic cannot be completely eliminated, protective barriers shall be provided to shield workers from traffic vehicles. Another measure is to install channeling devices (e.g., traffic cones and barrels) to delineate the work zone. 13. Workers shall be provided with reliable supply of potable water. 14. Construction camps shall be provided with adequate drainage to avoid accumulation								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		of stagnant water. 15. Construction camps shall be provided with toilets/sanitation facilities in accordance with local regulations to prevent any hazard to public health or contamination of land, surface, or ground water. These facilities shall be well maintained to allow effective operation.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
21. Traffic conditions	Minimize disturbance of traffic and traffic congestion	1. Prior to start of siteworks, update and implement draft temporary (temporary means during construction period) traffic management plan (TTMP) prepared by EPCM during detailed design phase. Updated plan to be approved in writing by EPCM 1 month prior to commencement of works. Contractor to implement TTMP provisions. 2. Communicate to the public through local officials regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restrictions.	1: Contractor to update TTMP, EPCM to assist and approve 2–8: Contractor	1:One month before start of site works 2–8: Throughout construction phase	Entire BRT route	Cost included in contracts	Check imple-mentation of items 1-8 and RRMP provisions	1: Before construction 2 and 8:Monthly Imple-mentation of TTMP provisions: Monthly	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		3. In coordination with local traffic authorities, implement appropriate traffic diversion schemes to avoid inconvenience to road users due to project operations, ensure smooth traffic flow, and avoid or minimize accidents, traffic hold ups, and congestion. 4. In coordination with local traffic officials, schedule transport of materials to avoid congestion, and set up clear traffic signal boards and traffic advisory signs at the roads going in and out of the construction sites to minimize traffic build-up. 5. Provide safe vehicle and pedestrian access around construction areas. 6. Install bold diversion signs that would be clearly visible even at night, and provide flag persons to warn of dangerous conditions (24 hours, as necessary).								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		7. Provide sufficient lighting at night within and in the vicinity of construction sites. 8. Designate traffic officers in construction sites.								
22. Archaeo-logical and cultural artifacts	Preservation of chance finds of cultural and archaeo-logical relics identified during construction	1. Site agents instructed to keep a watching brief for relics 2. Should any potential items be located, the site EPCM will immediately be contacted and work will be temporarily stopped in that area. 3. If the site supervisor determines that the item is of potential significance, an officer from the Department of Culture and Information (DCI) will be invited to inspect the site and work will be stopped. 4. Until DCI has responded to this invitation, work will	Contractor	Throughout construction check and report on same day	All areas	Cost included in contracts	Check implementation of items 1-4	Before construction and monthly check	EPCM and PMU/ESSU	Cost met by EPCM and PMU/ESSU project staffing

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		not recommence in this location until agreement has been reached between DCI and DOR as to any required mitigation measures, which may include excavation.								
23. Enhancements	Provide environmental enhancement of the project	Contractor to reconfirm and implement enhancements (e.g., EPCM, tree replanting) identified at the detailed design stage	Contractor	Throughout construction	All areas	Cost included in contracts	Confirmed imple-mentation of required enhancements	Before construction and monthly check	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU project staffing
24. Disruption to access and business activity	Provide continued access to shops, residences, mosques, etc., during construction period.	Contractor to provide planks and continued access during construction period. Night works to be considered in areas with high-density commercial activity.	Contractor	Throughout construction	All areas	Cost included in contracts	Confirmed imple-mentation of required enhancements	Before construction and monthly check	EPCM and PMU/ESSU	Cost met by EPCM And PMU/ESSU project staffing
OPERATIONAL STAGE (GDSUTP-Additional Financing)										
1. Waste management at BRT stations and Terminal	Provide appropriate means to collect and dump solid waste at BRT stations and effluent treatment	1. Nominate third party vendor having expertise on waste collection, reuse and recycle process for BRT stations during operation period. 2. Remove solid waste/construction debris from instantly/immediately. 3. Place waste bin of	Vehicle Operating Company (VOC)/ DBRTCL	Project operation phase	All BRT stations and BRT Terminal.	VOC/ DBRTCL	Check implementation of items 1-4	- Regular Physical Monitoring - Checklists - Effective communication system	VOC/ DBRTCL	VOC/ DBRTCL

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		adequate size at suitable locations of BRT stations for temporary dumping of garbage and debrises which will subsequently disposed of to designated duping sites following local rules or reuse/recycle using appropriate means. 4. Provide adequate signs and signages for users of BRT about waste dumping and avoiding of indiscriminate littering.								
2. Use of hazardous substances and hazardous waste disposal.	Minimize contamination due to use and storage of hazardous substances and waste during operation period	1. Prepare a hazardous material management plan based on tentative assumption of type of hazmat, quantity, location of use, and users of hazmat, etc. 2. Ensure that safe storage of fuel, other hazardous substances, and bulk materials are agreed by the environment officer of DBRTCL and have necessary approval/permit from DOE and local authorities. 3. Waste batteries to	DBRTCL/ VOC	Operation Period	Throughout BRT company	DBRTCL /VOC	Check imple-mentation of items 1-7	Regular basis by the DBRTCL - Fortnightly	DBRTCL/ VOC	DBRTCL / VOC

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	Objective	Proposed Mitigation Measures	Responsible to Implement	Timing to Implement	Locations Implement	Mitigation Cost	Parameter to Monitor	Frequency and Verification	Responsible to Monitor	Monitoring Cost
		be generated from buses must disposed of/reused upon taking proper approval from the designated authority. And also prepare a battery disposal plan after life time. 4. Hydrocarbon, toxic material, and explosives will be stored in adequately protected sites consistent with national and local regulations to prevent soil and water contamination. 5. Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas shall be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency. 6. Fuel and other hazardous substances shall be stored in areas provided with a roof,								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		impervious flooring, and bund/containment wall to protect these from the elements and to readily contain spilled fuel/lubricant. 7. Segregate hazardous wastes (oily wastes, used batteries, fuel drums) and ensure that storage, transport, and disposal shall follow proper norms and in accordance with country laws.								
3. Wastewater treatment and disposal at BRT Bus Depot	Protect natural environment from pollution and save aquatic lives	1. Adopt water conservation approach to save groundwater as much as possible. 2. Segregate high polluted wastewater from the less polluted effluent through proper wastewater management planning. 3. Construct Effluent Treatment Plant (ETP) for treating wastewater using robust treatment mechanism. 4. Considering wastewater volume and pollution load, physico-chemical ETP could be	DBRTCL	Operation Period	BRT Bus Depot	DBRTCL /AFD	Check imple-mentation of items 1-6	Weekly by the DBRTCL during construction of ETP and daily monitoring of ETP performance during operation of ETP	DBRTCL/ AFD	AFD

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency and Verification**	**Responsible to Monitor**	**Monitoring Cost**
		feasible in BRT Bus Depot. For knowledge-based decision technical assessment could be undertaken before designing of the ETP. 5. Measure pollution characteristics of incoming and outgoing effluent for understanding treatment capacity of of ETP. 6. Ensure adequate budge to meet the cost of construction of ETP and it's operation and maintenance.								

		Impact mitigation					Performance and Impact Monitoring			
Environmental Concern	**Objective**	**Proposed Mitigation Measures**	**Responsible to Implement**	**Timing to Implement**	**Locations Implement**	**Mitigation Cost**	**Parameter to Monitor**	**Frequency And Verification**	**Responsible to Monitor**	**Monitoring Cost**
4. Tree survival	Ensure survival of planted trees.	Monitor survival of replanted trees (also transplanted/compensatory planting trees) and replant, as necessary.	BRT operator and District Forestry Office (DFO)	During operation	Throughout entire BRT route	Included in operation and maintenance cost	First 3 years of operation	Semiannual for first 3 years of operation	BRT operator and DFO	Cost met by for PMU/ESSU staffing and CCOF staffing
5.Vendors	Ensure vendors impacted by project are given commercial space in stations or other locations.	Ensure commercial licenses are fairly given and vendors previously selling goods at stations are included in station commercial spaces, with preference to women.	BRT operator	During operation	All stations	Included in operation and maintenance cost	First 3 years of operation	Semiannual for first 3 years of operation	BRT operator	Vendors

ADB = Asian Development Bank, AIDS = acquired immune deficiency syndrome, BRT = bus rapid transit, Cd = cadmium, cm= centimeters, Cu = copper, DOE =Department of Environment, EMP=environmental impact assessment, EPCM=engineering, procurement, construction management and supervision consultant, GDSTUCP = Greater Dhaka Sustainable Urban Transport Project, GRM = grievance redress mechanism, Hg = mercury, HIV = human immune-deficiency virus, IEE = initial environmental examination, m = meters, Pb = lead, PIU = project implementation unit, RHD = Road and Highways Department, ROW = right of way, SEMP = site-specific environmental management pl

D. Environmental Monitoring

1. Compliance Monitoring

220. Table 12 above also shows the program for monitoring the compliance on various provisions of the environmental management plan (EMP) during preconstruction, construction, and operation. The engineering, procurement, construction management and supervision consultant (EPCM) needs to implement a number of measures during detailed design phase (e.g., incorporation of environmental design measures into the detailed design, preparation of draft method statements/site-specific environmental management plan or SEMPs, etc.) and this will be confirmed by EPCM/project implementation unit (PIUs) to ADB. During construction, most of the mitigation measures shall be implemented by the contractors, and their environmental performance, in terms of implementation of such measures, shall be monitored by EPCM. The timing or frequency of monitoring is also specified in Table12. During operation, EMP implementation shall be the responsibility of the BRT operator.

(i) Design Stage

221. The project management units (PMU)/PIUs shall ensure that EMP measures for the design stage are incorporated in the detailed design. The bidding documents for EPCM candidate consultants will also include the EMP. The effective incorporation of the EMP in the civil works contracts shall also be ensured be by PIUs with assistance from EPCM and this, along with implementation of EMP provisions, shall be audited by ADB as part of the loan conditions.

222. Prior to implementation of the project, the IEE and EMP will be updated and amended, as necessary, by EPCM after the detailed designs are complete and contracting arrangements are known. Such updating shall be based on reconfirmation and any additional information on the assumptions made at this feasibility stage on location scale and expected conditions of the project. For example, in this case, if there is additional land required (although not confirmed yet), the designs may be amended and the environmental significance reviewed. Although no major additional impacts would be anticipated based on the information provided to date, the performance and evaluation schedules to be implemented during project construction can be reviewed and updated, and costs estimates can be revised if necessary.

(ii) Preconstruction Stage

223. Implementation of construction of the project will need to comply with environmental requirements and clearance that have been obtained from the Department of Environment (DOE) at a divisional level for any statutory environmental assessment, or any indication that no further assessment is required. EPCM will also need to confirm that the contractors and their suppliers have complied with all statutory requirements for permits from DOE and provincial authorities. EPCM shall also check that the contractors have all the necessary valid licenses and permits for use of powered mechanical equipment if necessary and the use of local water supplies (and to construct or operate plant such as for cement batching or asphalt/bitumen if required) in line with all environmental regulations and environmental clearance certification conditions from divisional authorities. (N.B. Existing local suppliers of cement and bitumen with will be preferred if practicable.)

(iii) Construction Stage

224. The updated SEMPs/method statement prepared by contractors, with assistance from the EPCM, will be reviewed and approved by PIUs before any construction activity is initiated to take account of any subsequent changes and fine-tune the draft SEMP prepared by EPCM. For AF, EPCM environmental specialist with the assistance of PMU and contractors shall update EMP particularly to address critical environmental issues that have posed serious health and safety related concerns on employees, workers, pedestrians and community people of the BRT project corridor. EPCM environmental specialist has prepared the Environment Safeguard Enhancement Plan which is attached as (Appendix – 8) and later incorporated in the updated EMP for implementation by the contractors during AF period. For smooth implementation of updated EMP, contractors shall revise the approved SEMP and submit to PMU for approval within one month of submission of the updated EMP. The EPCM shall undertake regular monitoring of the contractor's implementation of mitigation measures specified in the EMP.

(iv) Operational Stage

225. BRT operator shall implement the EMP mitigation and monitoring requirements during operation, such as waste management, road safety Issues, monitoring of run off control measures, survival of planted trees, etc. Accidents along BRT road shall also be monitored as basis for implementation of mitigation measures to improve road safety.

2. Environmental Effects Monitoring

226. As shown in Table 14, EPCM shall undertake baseline environmental monitoring for air quality, noise, and surface water quality. One-time sampling shall be conducted prior to start of site works at the specified locations. During construction, EPCM shall undertake quarterly monitoring of surface water quality and semiannual monitoring of air quality and noise in the same locations sampled during preconstruction. Additional sampling shall be carried out and additional parameters analyzed (as necessary) to validate complaints and/or investigate pollution events caused by the project.

E. Reporting

227. The PMU shall submit the following environmental monitoring reports to ADB:

228. **Baseline monitoring report**. The results of baseline data collection carried out by EPCM on air quality, noise, and surface water quality (as specified in the EMP) shall be submitted to ADB prior to commencement of civil works.

229. **Semiannual environmental monitoring reports**. Semiannual environmental monitoring reports shall cover the status of EMP implementation in terms of required mitigation measures for different project phases, results of environmental effects monitoring (air quality, noise, and surface water quality), necessary remedial actions to effectively address negative environmental impacts due to project implementation, status of environmental capacity building activities, as well as documentation of complaints received and corresponding action/resolution. The environmental monitoring reports will be submitted to ADB semiannually during construction period.

230. **Environmental costs**. As part of good engineering practice in the project, there have been several measures as spoil management, safety, signage, dust prevention, noise mitigation, etc., the costs for which will be included in the design of the project. The IEE costs include monitoring costs during construction and capacity building costs on environmental management, which are absorbed into EPCM or contractors' work packages.

The costs for training proposed include the costs incurred towards the site visits, travel to the training program by the participants, printing of training materials, and other logistic arrangements. The costs involved towards preparation of training material and imparting of training are covered in the EPCM fees. The budget for the environmental management costs for the project is presented in Table 13 below. The government counterpart funding will require covering the costs for environmental permitting and tree planting, and are included as a separate line item under the total project costs.

Table13: Summary of Estimated Costs for EMP Implementation during Construction Period

Item	Estimated Total Cost (US$)	Costs Covered By
Environmental specialists in EPCM (2Nos.) for 1 year - 24 person month@$3,000/month	72,000	EPCM
Environmental management capacity building program/training to be undertaken by EPCM	10,000	EPCM
Environmental impact monitoring (allow $3,000/quarter)	12,000	Contractor
Mitigation measures (included in project costs)	To be determined during detailed design as part of project design costs	Contractor
Environmental permitting**	3,000	PMU
Tree planting	72,000	PMU
ETP Construction Cost (estimated based on a discharge flow of 5 Million Litee per Day capacity physico-chemical ETP)	160,000	BRTCL / AFD
Total	329,000	

EPCM=Engineering, procurement, construction management and supervision consultant.
*includes design and construction phases.
**N.B. Permits for environmental clearance certificate under ECR required from DOE.

Table14: Environmental Effects Monitoring Plan for GDSUTP

Environmental Aspect	Parameters	Location	Means of Monitoring	Frequency	Responsibility
PRECONSTRUCTION					
1. Ambient surface water quality	1. pH, temperature, turbidity, dissolved oxygen, oil and grease, and total suspended solids (TSS) 2. For any rivers/streams close to construction/workers' camps, the following additional parameters shall also be analyzed: biological oxygen demand – 5 days (BOD5), coliform, and fecal coliform.	1. At Tongi Khal/Turag River Bridge at Km 4, establish sampling points where bridge construction, repairs, and replacement will be undertaken. Samples shall be collected near river bottom and at mid-depth. 2. Establish sampling points on river/stream sections that are close to construction camps (i.e., rivers that will most likely receive runoff/discharge from construction/workers' camps).	Analytical methods outlined in ECR 1997 At river crossings, collect water samples 50 m before (upstream) and 50m after (downstream) the bridge at mid-width and mid-depth. Submit baseline monitoring report to ADB at the end of the detailed design period. (For monitoring report content, see Chapter V, Sec.A.7 of the IEE.)	Once, during the month prior to construction	EPCM
2.Sediment quality	1. Heavy metals, Cu, Cd, Hg, Pb, pH, temperature, dissolved oxygen, oil and grease, and total suspended solids (TSS), Keldhjal Nitrogen (total) and total organic matter	At Tongi Khal/Turag River at Km 4, establish sampling points at major river crossing where bridge construction, repairs and replacement will be undertaken.	Analytical methods outlined in ECR 1997 At Tongi Khal/Turag River at Km 4, collect sediment samples at proposed pier locations, excavation locations (under bridge), and 50 m after (downstream) the bridges at positions where construction/dredging will disturb sediments. Submit baseline monitoring report to ADB at the end of the detailed design period (For monitoring report content, see Chapter V of the IEE).	Once, during the month prior to construction	EPCM

Environmental Aspect	Parameters	Location	Means of Monitoring	Frequency	Responsibility
3. Ambient air quality and noise	Total suspended particulate (TSP)	At each district, undertake field sampling at representative sensitive receptors (SR). That is, one sampling station shall be established and sampled for each SR type as follows: (i) residential area, (ii) school, (iii) temple, and (iv) hospital/health center per district	Analytical method outlined in ECR 1997 Submit baseline monitoring report to ADB at the end of the detailed design period. (For sampling and monitoring report requirements, see Chapter V, Sec. A.7 of the IEE.)	Once, during the month prior to construction	EPCM
4.Noise	Noise levels dB(A) covering different periods specified in ECR 1997	Same stations established for ambient air quality	Analytical method outlined in ECR 1997 Submit baseline monitoring report to at the end of the detailed design period. (For sampling and monitoring report requirements, see Chapter V, Sec. A.7 of the IEE.)	Once, during the month prior to construction	EPCM
CONSTRUCTION					
1. Ambient surface water quality	1. pH, temperature, turbidity, dissolved oxygen, oil and grease, and total suspended solids (TSS) 2. For rivers/streams close to construction/workers' camps, the following additional parameters shall also be analyzed: biological oxygen demand – 5 days (BOD5), coliform, and fecal coliform. 3. Other relevant parameters to be analyzed	1. Same stations sampled during preconstruction phase. 2. Other locations to validate complaints or during pollution events (e.g., fuel spill, etc.)	Analytical methods outlined in ECR 1997 At Tongi Khal/Turag River at Km 4, collect water samples 50 m before (upstream) and 50 m after (downstream) the bridges at mid-width and mid-depth. Include results of environmental effects monitoring in the semiannual EMP implementation monitoring report to be submitted by PIU to ADB.	Quarterly after works commence as well as in response to complaints and during pollution events	EPCM

Environmental Aspect	Parameters	Location	Means of Monitoring	Frequency	Responsibility
	to validate complaints and pollution events As necessary				
2 Ambient air quality and noise	Total suspended particulate (TSP)	1. Same stations sampled during preconstruction phase. 2. Other locations to validate complaints	Analytical method outlined in ECR 1997 Include results of environmental effects monitoring in the semiannual EMP implementation monitoring report to be submitted by PIU to ADB.	Semiannual and in response to complaints	EPCM
3.Noise	Noise levels dB(A) covering different periods specified in ECR 1997	1. Same stations sampled during preconstruction phase. 2. Other locations to validate complaints	Analytical method outlined in ECR 1997 Include results of environmental effects monitoring in the semiannual EMP implementation monitoring report to be submitted by PIU to ADB.	Semiannual and in response to complaints	EPCM

ADB=Asian Development Bank, ECR=environmental conservation rules, EMP=environmental impact assessment, EPCM=engineering, procurement, construction management and supervision consultant, IEE= initial environmental examination, PIU =project implementation unit

F. Capacity Building

231. In Bangladesh, the environmental assessment process is established, but environmental awareness and capability for implementation of EMP in infrastructure projects of both the executing agency (MOC) and the implementing agencies (Roads and Highways Department (RHD)/Bangladesh Bridges Authority (BBA)/local government engineering department (LGED) are still developing. As of March 2011, the project implementation unit (PIU) of RHD had some officers in the environmental and social circle department (ESC) that are delegated environmental duties. The delegated officers have responsibility to bring environmental issues to the notice of senior management. Typically, the delegated officers have been moved to different departments due to promotions and operational needs after about every 3 years, and they move on to other engineering departments in RHD. The status quo is that ESC engineering officers are delegated to check environmental assessments prepared by consultants, but they do not check the adequacy of the EMP. The IEEs and EMP are referred to the DOE in the Ministry of Environment and Forests (MOEF) for approval. The ESC in RHD is not directly involved with project implementation, but has more administrative responsibility to ensure environmental compliance and a general role to increase environmental awareness for RHD. It is therefore not clear if RHD/ESC or BBA or LGED has the capacity to check the adequacy of the SEMPs to be developed for this project. The PMU for this project will also be supported by and environmental and social safeguards unit (ESSU).Environmental responsibilities in PMU are sufficient to warrant dedicated staff, and in future this approach can be broadened and continued by the ESSU. In the long term, it is recommended that the ESSU be strengthened into a more robust environmental management unit for the BRT with permanent dedicated staff trained in environmental engineering and environmental management. The ESSU could be developed to improve overall environmental capacity in the PMU. The developed ESSU could work with various PIUs as required and respond to growing national and international environmental concerns that will face the SPO in medium and long term.

232. The most significant challenge for environmental management on this project is the lack of human and financial resources and necessary infrastructure in each PIU. There is an interest in ESC in RHD to establish a separate safeguards office to respond to growing national and international environmental concerns. In consultation, ESC indicated that a first step will be to recruit an environmental officer and a resettlement officer for the GDSUTP under the PIU. The resettlement officers and environmental officers in the PIUs will each be graduates with backgrounds and experience in the social sciences and environmental management. This approach should also be repeated in BBA and LGED's PIU so that each PIU can monitor the environmental management of the project and liaise with the ESSU.

233. The requisite environmental officer staff in each PIU should be delegated prior to the commencement of the tendering for the detailed design activities in order to work full-time with EPCM, to ensure the inclusion of environmental requirements can be translated into contractual works for completion and also to respond to unexpected circumstances. The EPCM environmental specialists can then train environmental officers in PIUs ~~on~~ the job, ‖and there can also be benefits available to ESC if training sessions are broadened to include ESC. Environmental officers can fall back on assistance from EPCM as they develop experience.

234. Considering the number of government agencies that need to be involved in the EMP implementation, training workshops should be conducted by the EPCM 2 weeks before works

commences, and refresher courses should be set up every month for the first 3 months as the construction gears up. Training workshops should be conducted periodically by the EPCM as every new contractor is engaged and every 6 months or twice each year, for the second and third year, to share experience in the implementation of the works and the monitoring report on the implementation of the EMP, to share lessons learned in the implementation, and to decide on remedial actions, if unexpected environmental impacts occur. The environmental officer in PIU and ESC officers can take over this role as they develop capability.

235. The table below shows the indicative terms of reference for the environmental management capacity building activity to be conducted by EPCM for PIU environmental officer staff tasked to oversee EMP implementation.

Table15: Sample Training Program for Environmental Management Capacity Building of PMU/PIUs

Program	Description	Participants	Form of Training	Duration	Trainer/ Agency
Introduction and sensitization to environment issues	Sensitization on environmental concerns Environmental impacts of BRT system environmental regulations of GoB ADB environmental regulations Coordination between departments for implementation of environmental issues	RHD BBA and LGED engineers /management team, officials responsible for implementing project, and other PIU /EPCM staff as interested	Workshop	One day workshop preconstruction	EPCM Environmental specialist (international)
Preproject training on hazards, health, safety, and environmental issues pertaining to the project	Sensitization and training for engineering and management professionals, to be involved in on site execution and operation of the proposed facilities	RHD BBA and LGED engineers/manage ment team	Workshops, site visits	3 days, pre-construction	Tailor made training prog. By Industrial safety board of Ban.(ISBB), engineering staff college, etc. (international)
EMP implementation	Implementation of environment EMP Identification of environment impacts Monitoring and reporting for EMP Public interactions and consultations Coordination for consents and with various departments Monitoring formats filling and review of impacts	RHD BBA and LGED/engineers, officials responsible for implementing project, and other PIU/EPCM staff as interested	Lectures and field visit	2-day session Construction stage	EPCM Environmental Specialist (International)

Training on environmental management, OHS systems, emergency and risk response systems	Guidance for conformance to environmental management systems	RHD BBA and LGED/engineers, officials responsible for implementing project, and other PIU/EPCM staff as interested	Lectures	4-day program, lectures, site visits	Tailor made training programs by ISBB, Engineering staff college, etc.

ADB=Asian Development Bank, BBA=Bangladesh Bridges Authority, BRT=bus rapid transit, EMP=Environmental Management Plan, EPCM = Engineering, Procurement, Construction Management and Supervision Consultant, LGED=Local Government Engineering Division, PIU = Project Implementation Unit.

X. CONCLUSIONS AND RECOMMENDATIONS

236. This initial environmental examination (IEE) concludes that the environmental impacts will be manageable if the mitigation measures are implemented thoroughly. The EMP is based on the type, extent, and duration of the identified environmental impacts. The EMP has been prepared with close reference to best practices and in line with the Safeguards Policy Statement (SPS).

237. This IEE study was carried out when the BRT was at the preliminary stage of design during TA 7415 (BAN). Essentially secondary data was used to assess the environmental impacts in a comprehensive manner. Public consultation and route reconnaissance were carried out in order to complete the environmental assessments and recommend suitable mitigation measures. The potential environmental impacts were assessed in a comprehensive manner. The IEE report assesses the potential environmental impacts associated with the BRT, and suitable mitigation measures have been recommended. The EMP was be reviewed by the EPCM at the detailed design stage and included in bidding documents. In the event that any design details for the locations or scope of the BRT are changed, the IEE and EMP shall be reviewed and revised accordingly and submitted to ADB for acceptance.

21. The original plan of implementation of GDSUTP project scheduled to be commenced in 2013 and completed by 2017. The construction of BRT project has experienced many unexpected hindrances and hence the project happened to be delayed by 4-5 years from the first planned schedule. New completion time is June 2022 and to cope with the financial inflation and increase of construction materials, an Additional Financing (AF) has been approved by ADB mainly to meet cost overrun of the BRT project. As far as design is concerned, pavement design of the existing road is changed for both C-01 and C-02 from single layer overlay, that was assumed adequate during the design, to full reconstruction with new Polymer Modified Bitumen (PMB) wearing course and bitumen binder base course after widening, due to poor condition of the existing pavement and to serve high volume of heavy trucks. PMB also possesses less temperature sensitivity than plain bitumen PMB, hence durable against high variability under climate change condition. Other design changes included: large amount of drainage facilities to be added during the implementation, change of concrete type for C-01, increased maintenance works of existing roads, and change of girder type for C-01 under the AF. Adequate drainage facilities will reduce chance of inundation and flooding even during high monsoon.

238. Considering these changes in construction, there will be minimum changes in environmental impact significance. Still, PMU of BRT-AF considered importance to update IEE report and the EMP recognizing the fact that the approved IEE is 8-9 years old, and few important adaptive changes with regards to environmental impact management observed during construction phase. Particular focus has given to update IEE based on revised design of the project description, COVID-19 health and safety in section on Anticipated Environmental Impacts and Mitigation Measures. In addition, BRT operational period issue of using battery-operated bus that may generate hazardous waste is also discussed in the operation phase subsection of environmental impact Section. Corresponding environmental impacts/concerns are accommodated in the construction and operation parts of the EMP. Update IEE report also provided an updated BOQ for environmental management for cosntruciton and operation periods, so that GDSUTP-AF project authority may mobilize

necessary resources for implementation of environmental impact mitigation measures.

239. The BRT offers a robust option for the enhancement of the existing road-based transportation network. Several actions are required during the detailed design stage to minimize impacts to acceptable levels. The negative environmental impacts from the BRT will mostly take place during the construction stage. The construction impacts should be very predictable and manageable, and with appropriate mitigation few residual impacts are likely. Additional human and financial resources will be required to improve environmental capability, and to progress and achieve necessary statutory compliance and environmental clearance certification for the BRT or associated activities that also require environmental assessment and environmental permits under the environmental laws of Bangladesh.

240. The responsibilities for the implementation of mitigation measures and the parties responsible will be clearly defined in contracts and agreements, and the implementation by various parties will be monitored by PIUs with assistance from EPCM.

241. Whereas most anticipated environmental impacts related to the BRT will take place during the construction phase, there are no significant cumulative adverse impacts during operation that are identifiable at this stage. The implementation of the environmental mitigation measures during the construction period shall be the responsibility of the contractors, and these requirements will be included in contracts and shall be closely monitored by the PMU and PIUs, assisted by EPCM. RHD will maintain the adjacent roads and the BRT operator shall undertake the appropriate operational mitigation measures for maintenance during the lifetime of the GDSUTP BRT.

242. Whereas the implementation of the environmental mitigation measures during the construction period will be assigned to the contractors, experience suggests that contractors may have little impetus or interest to deal with environmental problems in the absence of performance-linked criteria. Therefore, the required environmental mitigation must be clearly described in the contract documents at the bidding stage, and environmental performance and the completion of mitigation should be linked to payment schedules in the contracts.

243. Contractor environmental awareness training will be undertaken by the EPCM, and this can also be broadened to assist PIUs to develop environmental awareness at all levels. It will require sustained effort over several years to achieve proactive management of environmental responsibilities by the BRT operator. GDSUTP and other previous ADB projects have also included provisions to consolidate environmental capability, and overtime environmental improvements can accrue in line with good sustainable practice and ADB guidelines. The environmental officers in the PIUs will be supported in the short term by the EPCM, who will be able to liaise with PIUs and ESSU and decide how better to utilize the available staff resources to support environmental management. This capability can be used to extend environmental awareness for the contractors in short duration. In the medium to long term RHD, BBA and LGED can be strengthened to support their developing environmental management responsibilities and dovetail their efforts with the environmental initiatives and requirements from DOE. At the completion of the BRT construction, the environmental officers in PMU/ESSU, environmental officers in PIUs, or national environmental specialists in EPCM could be retained by the BRT operator, and the ongoing environmental obligations of the BRT operator could be more easily taken up by experienced staff for future BRT lines and more ambitious projects.

243. Government land will be transferred for the stations near the airport and the Gazipur Depot. The construction of the main BRT is restricted to the existing road corridor, and as far as can be ascertained at this stage, there will be some small areas of land required where the road geometry needs to be improved and encroachers in the right of way (RoW) will need to be removed, but at this stage there is not likely to be any significant additional land required to complete the construction. The resettlement planning workstream has prepared and established policies and procedures for payment of compensation to affected people for lost or damage assets. The scope of land acquisition impacts, where they occur, will be limited to the areas of the road where the geometry needs to be adjusted, and in areas where there will become displacement of mainly shopkeepers and vendors and other affected people that will experience losses. The resettlement plan will be implemented and monitored to ensure impacts to vendors and land acquisition are mitigated as per ADB's safeguards policy.

244. Environmental impact and compliance monitoring activities will focus on compliance with conditions of licenses from DOE and EMP provisions, recording implementation of mitigation measures, recording environmental parameters, reviewing contract or environmental performance, and proposing remedial actions to address unexpected impacts and complaints.

245. The EMP prepared for the project (Chapter VIII) will be used as basis for an environmental compliance program in a regular program of environmental monitoring and auditing. In addition, any conditions included as part of the environmental compliance certificate from the government (MOEF/DOE) will also be included as a basis for environmental monitoring and compliance. Therefore, monitoring of (i) the implementation of mitigation measures and (ii) the implementation of the conditions of environmental compliance will be carried out regularly as scheduled in the EMP, and results will be reported semiannually to ADB. In the future, the operational performance specifications for the BRT will be set by the central transportation authority that will be responsible for all mass transit in Dhaka.

246. The IEE report is prepared based on the preliminary designs for the Greater Dhaka Sustainable Urban Transport Project (GDSUTP) bus rapid transit (BRT) and road upgrading proposals along the specified route. At the implementation stage, RHD/PIU, assisted by EPCM, will make arrangements to monitor the schedules of mitigation measures and conduct of environmental effects monitoring activities specified in the EMP. With these measures in place, environmental impacts of the project should be manageable and will not result in any residual impacts which are above accepted environmental standards. No further or additional impact assessment is considered necessary at this stage.

APPENDIX1: SELECTED PHOTOGRAPHS

Photograph1 Potential location for station and terminal area near Airport KM0+000 (elevated)

Photograph 4 Km4+300 looking south towards Tongi Bridge (eight-lane flyover at bridge, BRT elevated 2+2)

Photograph2 Km 2+000 looking north (at grade BRT 2+2)

Photograph 5: Km5+200 Tongi Station Road looking north (BRT elevated 2+2)

Photograph3
At Km3=000 looking north (eight-lane flyover)

Photograph6 Km7+800 Dewra Station and U-turn (BRT elevated 2+2 and U-turn elevated, BRT ramps down

Appendix1

north (BRT 1+1 at grade)

Photograph 7
Km8+600 looking north
(BRT at grade 1+1)

Photograph 8
Km9+000 to Km9+300 (flyover) looking
north (BRT 1+1 and 2+2 road on flyover)

Photograph9
Km9+300 to Km9+500 looking

Photograph10
Km14+700 looking north to proposed Tangail Rd (BRT at grade and BRT 1+1and 2+2 road on flyover)

Photograph11
Km16+300 looking north to Chowrasta flyovers (BRT 1+1 and road on flyover)

Photograph12
Km19+600 looking east towards Gazipur Bazaar (BRT at grade 1+1)

APPENDIX 2: RESULTS OF PUBLIC CONSULTATION

Summary of Information Disclosure, Consultation, and Participation
B1–Information Provided to Authorities in Dhaka District, Utilities, Transport, Provincial and Public Officials (January–February 2011)

Reference	Information Provided
1	As consultants for the ADB Project Greater Dhaka Sustainable Transport Corridor from Airport to Gazipur, we are collecting information from interested parties.
2	The main part of the project is the Bus Rapid Transit (BRT). Do you know about the BRT Project? Let me clarify
3	The project will go from Airport to Gazipur along Mymensingh Road (16km) and turn at Joydevpur towards Gazipur, about 20km long in total.
4	There will be central bus only lanes that are separated from the other traffic by barriers so buses can move faster from station to station.
	There will be bus stations in the central reservation connected to the roadside by footbridges/underpasses. There will be traffic flyovers at major road interchanges.
5	The BRT project will mainly be with in the current right of way (RoW along Mymemsingh Rd/Gazipur Rd) designated by the Roads and Highways Department.
6	The project will be detailed designed later in 2011/12, and contractors will be selected in 2012.
7	Construction will be for several months in each location, but is targeted for completion in late 2014 or 2015.

B2–Questions Posed to Authorities in Dhaka City, Utilities, Transport, Provincial, and Public Officials

(Jan–Feb 2011)

QUESTIONNAIRE 1

Name	Engr. Serajul Karim Talukder, Engr. Mozammel Haque, Engr. Nuruzzaman
Province/District	Dhaka
Workplace/Home	Environmental and Social Cell, Roads and Highways Department
Position	Superintending engineer, executive engineer, executive engineer respectively
Location	Not applicable
Time/Date	13 January 2011

Questions asked during the public consultation to get people's reactions and comments on the proposed project activities.

Reference	Questions	Response/Comments
1	What are your general comments and observations regarding the project construction and works?/Agree/disagree/comment	We fully agree to this venture in mass transit.
2	What are your general comments and observations regarding the project location?	We will be happy to have BRT, and hopefully it will be hassle-free and convenient for us.

Reference	Questions	Response/Comments
	Do you have a comment on the design of the bus routes and stations?	
3	How will BRT contribute to the local commerce/development?	Fast and reliable transportation for local commuters
4	Will BRT cause any local problems?	No

Reference	Questions	Response/Comments
5	What are your comments on the effects on local traffic due to construction traffic and access for the project lorries/trucks?	Temporary dislocation of the traffic will happen at the time of construction of the project and create noise and disturbances. We have to accept these for the future prospect of the project.
6	Are there any trees, gardens, or cemeteries with religious, cultural, or heritage significance nearby? If so, where? What is the distance to the centerline of the project from the properties (approximately in meters)?	Not known
7	Do you as a local representative/official/resident/worker have any Specific observation on the environmental changes and impacts that will take place?	Applicable during construction period, but don't live in project area.
8	Will construction and operation of the project affect your working life?	Should affect it during construction period
9	Are there any special protected buildings within 50 m of the road (military, police or special protected building, pump house, substations, etc.)?	Not known
10	Does your department have enough capability to support the project with processing of licenses and permits?	Environmental and Social Cell of RHD is responsible for overview of the project feasibility report covering the environment, social resettlement part. The cell itself does not undertake study but reviews the mass departmental official of the government. The cell has developed a manual for the preparation of the environmental parameter identification and will guide the RHD field engineers to prepare the progress report encompassing the environmental monitoring plan of the project. Responsible for awareness building and training on environment, social and resettlement for the project preparation and implementation. In-house capacity to discharge the function is inadequate; more manpower and training will be required. All the topmost responsibilities go to engineers, but they are not much interested; as such it should be combined with persons from other natural science disciplines.
11	In your opinion, what environmental problems should we pay attention to?	Air quality would be main concern, but hopefully it should improve. Proper maintenance of the buses so that they have less harmful exhaust. Less noisy buses and keep the area dust-free.
12	Do you have any suggestions to reduce such environmental impacts?	Same as for question no.11
13	Do you have any other suggestions or ideas?	Try to find ways to make best use of the existing railway between Narayangonj and Joydevpur. The fare in the train is comparatively cheaper than bus.
14	Do you have any questions?	No

QUESTIONNAIRE2

Name	Mr. Abdul Karim, Mr. Akber Hossain, Mr. Faizuddin Morol, Abdus Salam Bepari
Province/District	Dhaka
Workplace/Home	Gazipur Pourashava
Position	Mayor, executive engineer, member, Gazipur Pourashava
Location	Gazipur Pourashava
Time/Date	14 February 2011

Questions asked during the public consultation to get people's reactions and comments on the proposed project activities

Reference	Questions	Response/Comments
1	What are your general comments and observations regarding the project construction and works? /Agree/disagree/comment	I fully agree to this venture in mass transit.
2	What are your general comments and observations regarding the project location? Do you have a comment on the design of the bus routes and stations?	We will be happy to have BRT and hopefully it will be hassle-free and convenient for us.
3	How will BRT contribute to the local commerce/development?	Fast and reliable transportation for local commuters
4	Will BRT cause any local problems?	No
5	What are your comments on the effects on local traffic due to construction traffic and access for the project lorries/trucks?	Temporary dislocation of the traffic will happen at the time of construction of the project and create noise and disturbances. We have to accept these for the future prospect of the project.
6	Are there any trees, gardens, or cemeteries with religious, cultural, or heritage significance nearby? If so, where? What is the distance to the centerline of the project from the properties (approximately in meters)?	Not known to me
7	Do you as a local representative/official/resident/worker have any specific observation on the environmental changes and impacts that will take place?	Not applicable, as I don't live in project area
8	Will construction and operation of the project affect your working life?	Should affect during construction period
9	Are there any special protected buildings within 50 m of the road (military, police or special protected building, pump house, substations, etc.)?	Not known
10	Does your department have enough capability to support the project with processing of licenses and permits?	If a portion of the road is taken away for the BRT, it will develop further traffic congestion in the area. Sufficient space should be left for the mixed bus traffic and NMT to avoid any clash of interest with present bus owners and the workers. At the moment about 500 buses are plying the route, but facilities are insufficient. The bus terminal constructed by ADB funding is so small that it can accommodate only 40 buses. The bus terminal is being constructed by the Gazipur Pourashava and leased out to the bus owner and bus workers association, and they always demand

Reference	Questions	Response/Comments
		better facilities for the convenience of the passengers. Present owners should be consulted and their interest should be taken into consideration in implementing the BRT. However, with good management, BRT can be of much help for the commuters, as it is expected to be faster and smoother.
11	In your opinion, what environmental problems should we pay attention to?	Air quality would be main concern, but hopefully it should improve. Proper maintenance of the buses so that they have less harmful exhaust. Less noisy buses and keep the area dust-free.
12	Do you have any suggestions to reduce such environmental impacts?	Same as for questionno.11
13	Do you have any other suggestions or ideas?	Try to find out the ways to make best use of the existing railway between Narayangonj and Joydevpur. The fare in the train is comparatively cheaper than bus.
14	Do you have any questions?	Yes
	Is it possible to have a new bus terminal for the present operator?	This will be raised with team for consideration. We are not sure about it yet.
	Can you construct flyover all through Gazipur Bazaar to Chowrasta?	Flyover will be constructed at Chowrasta intersection.

QUESTIONNAIRE 3

Name	Mr. Salehuddin, Mr. Anisur Rahman
Province/District	Dhaka
Workplace/Home	Nagar Bhavan,DCC, Dhaka
Position	Additional executive director, director for CASE studies
Location	Not applicable
Time/Date	9 January 2011

Questions asked during the public consultation to get people's reactions and comments on the proposed project activities

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Reference	Questions	Response/Comments
1	What are your general comments and observations regarding the project construction and works? /Agree /disagree/comment	We fully agree to this venture in mass transit.
2	What are your general comments and observations regarding the project location? Do you have a comment on the design of the bus routes and stations?	We will be happy to have BRT and hopefully it will be hassle-free and convenient for us.
3	How will BRT contribute to the local commerce/development?	Fast and reliable transportation for local commuters
4	Will BRT cause any local problems?	Construction phase
5	What are your comments on the effects on local traffic Due to construction traffic and access for the project lorries/trucks?	Temporary dislocation of the traffic will happen at the time of construction of the project and create noise and disturbances. We have to accept these for the future prospects of the project.
6	Are there any trees, gardens, or cemeteries with religious, cultural, or heritage significance nearby? If so, where? What is the distance to the centerline of the project from the properties (approximately in meters)?	Not known to me
7	Do you as a local representative/official/resident/worke r have any specific observation on the environmental changes and impacts that will take place?	Applicable to construction phase, but I don't live in project area
8	Will construction and operation of the project affect your working life?	Should affect during construction period
9	Are there any special protected buildings within 50 m of the road (military, police or special protected building, pumphouse, substations, etc.)?	Not known
10	Does your department have enough capability to support the project with processing of licenses and permits?	DTCB is the apex body of the transportation policy planning in Dhaka city. They are reviewing any transportation project within the city. DTCB is not an implementation authority but has the responsibility of management planning of the transportation. This is a coordination body for all stakeholders for transportation. DTCB plans to open one
		environmental and social management cell of its own. They will prepare operational standards a for the transportation sector, as well as rule and regulations.

Reference	Questions	Response/Comments
11	In your opinion, what environmental problems should we pay attention to?	Air quality would be main concern, but hopefully it should improve. Proper maintenance of the buses so that they have less harmful exhaust. Less noisy buses, and keep the area dust-free.
12	Do you have any suggestions to reduce such environmental impacts?	Same as for question no.11
13	Do you have any other suggestions or ideas?	Try to make best use of the existing railway between Narayangonj and Joydevpur. The fare in the train comparatively cheaper than bus.
14	Do you have any questions?	No

QUESTIONNAIRE 4

Name:	Mr. Md. Shajahan Engr. Dr. Mustofa Kamal
Province/District	Dhaka
Workplace/Home	Department of Environment, Government of Bangladesh
Position	Director (Admin), Director (AQMP)
Location	Not applicable
Time/Date	12 January 2011

Questions asked during the public consultation to get people's reactions and comments on the proposed project activities

Reference	Questions	Response/Comments
1	What are your general comments and observations regarding the project construction and works? /Agree/disagree/comment	We fully agree to this venture in mass transit.
2	What are your general comments and observations regarding the project location? Do you have a comment on the design of the bus routes and stations?	We will be happy to have BRT, and hopefully it will be hassle-free and convenient for us.
3	How will BRT contribute to the local commerce/development?	Fast and reliable transportation for local commuters
4	Will BRT cause any local problems?	No
5	What are your comments on the effects on local traffic due to construction traffic and access for the project lorries/trucks?	Temporary dislocation of the traffic will happen at the time of construction of the project and create noise and disturbances. We have to accept these for the future prospects of the project.
6	Are there any trees, gardens, or cemeteries with religious, cultural, or heritage significance nearby? If so, where? What is the distance to the centerline of the project from the properties (approximately in meters)?	Not known to me
7	Do you as a local representative/official/resident/worker have any specific observation on the environmental changes and impacts that will take place?	Construction. Not applicable, as I don't live in project area.
8	Will construction and operation of the project affect your working life?	Should affect during construction period
9	Are there any special protected buildings within 50m of the road (military, police or	Not known

Reference	Questions	Response/Comments
	special protected building, pumphouse, substations.)?	
10	Does your department have enough capability to support the project with processing of licenses and permits?	DOE is regulatory body for environment clearance of the project. There is categorization of the project, like red, yellow, green, etc. (ECR). Government has drafted Environmental Conservation Act (ECA) and environment conservation rules (ECR) on the recommendation of the DOE and empowered them as regulatory body in the country. Based on feasibility study of the project, IEE or EIA information is prepared. Baseline condition of the project, identifying possible impact, mitigation measures, and EMP are all to be reviewed to obtain clearance of the project authority. DOE has continuous monitoring station (CMS) and satellite air monitoring station (SAMS) for air quality. DOE has well-equipped lab for testing and publishing data as done in Annual Report 2006. In the clearance process, there must be an objection certificate from local authority, emergency plan, safety plan, and most importantly, public consultation.
11	In your opinion, what environmental problems should we pay attention to?	Air quality would be main concern but hopefully it should improve. Proper maintenance of the buses so that they have less harmful exhaust. Less noisy buses and keep the area dust-free.
12	Do you have any suggestions to reduce such environmental impacts?	Please refer above as I said in question no.11
13	Do you have any other suggestion so ride as?	Try to find out the ways to make best use of the existing railway between Narayangonj and Joydevpur. The fare in the train is comparatively cheaper than bus.
14	Do you have any questions?	
	Can you change the design to make it an elevated BRT to have more accommodation on the same road area?	There will be several flyovers and elevated sections at important intersections.

QUESTIONNAIRE 5

Name	Mr. Tariqul Islam, Zaheer Iqbal
Province/District	Dhaka
Workplace/Home	Department of Forest, Government of Bangladesh
Position	Assistant conservator of forest, divisional forest officer
Location	Not applicable
Time/Date	12 January2011

Questions asked during the public consultation to get people's reactions and comments on the proposed project activities

Reference	Questions	Response/Comments
1	What are your general comments and observations Regarding the project construction and works? / Agree/disagree/comment	I fully agree to this project.
2	What are your general comments and observations regarding the project location? Do you have a comment on the design of the bus routes and stations?	We will be happy to have BRT and hopefully it will be hassle-free and convenient for us.
3	How will BRT contribute to the local commerce/development?	Fast and reliable transportation for local commuters
4	Will BRT cause any local problems?	No
5	What are your comments on the effects on local traffic due to construction traffic and access for the project lorries/trucks?	Temporary dislocation of the traffic will happen at the time of construction of the project and create noise and disturbances. We have to accept these for the future prospects of the project.
6	Are there any trees, gardens, or cemeteries with religious, cultural, or heritage significance nearby? If so, where? What is the distance to the center line of the project from the properties (approximately in meters)?	Not known to me
7	Do you as a local representative/official/resident/worker have any specific observation on the environmental changes and impacts that will take place?	Not applicable as I don't live in project area.
8	Will construction and operation of the project affect your working life?	Should affect during construction period
9	Are there any special protected buildings within 50m of the road (military, police or special protected building, pump house, substations, etc.)?	Not known
10	Does your department have enough capability to support the project with processing of licenses and permits?	For clearing the trees for construction purpose, the Forest Transit Rules will apply. The owner of the trees, if it be RHD, will have to go on joint inspection of the standing tree or forest and identify the trees to be cleared. Though sale proceeds will belong to the owner of the tree, joint inspection and Permission from forest authority to cut is mandatory for the owner. There serve forest (Bhawal NP) is

Reference	Questions	Response/Comments
		about 10 km north from Joydevpur and is not affected in any way. A number of trees need to be cleared during construction, and implementation personnel will take care of it. Persons interested in plantation can obtain slope of embankment, borrow pits, and abandoned land to create social forestry, and forest produce can beshared with government.
11	In your opinion, what environmental problems should we pay attention to?	Air quality would be main concern but hopefully it should improve. Proper maintenance of the buses so that they have less harmful exhaust. Less noisy buses and keep the area dust-free.
12	Do you have any suggestions to reduce such environmental impacts?	As above,no.11
13	Do you have any other suggestions or ideas?	Try to find out the ways to make best use of the existing railway between Narayangonj and Joydevpur. The fare in the train comparatively cheaper than bus.
14	Do you have any questions?	No

QUESTIONNAIRE 6

Name	Mr. Abdul Quasem
Province/District	Dhaka
Workplace/Home	Bangladesh Railway (BR), Railway Bhavan, Abdul Ghani Road, Dhaka
Position	Additional director general
Location	Not applicable
Time/Date	28 February 2011

Questions asked during the public consultation to get people's reactions and comments on the proposed project activities

Reference	Questions	Response/Comments
1	What are your general comments and observations regarding the project construction and works? /Agree/disagree/comment	I fully agree to this venture in mass transit.
2	What are your general comments and observations regarding the project location? Do you have a comment on the design of the bus routes and stations?	We will be happy to have BRT and hopefully it will be hassle-free and convenient for us.
3	How will BRT contribute to the local commerce/development?	Fast and reliable transportation for local commuters
4	Will BRT cause any local problems?	No
5	What are your comments on the effects on local traffic due to construction traffic and access for the project lorries/trucks?	Temporary dislocation of the traffic will happen at the time of construction of the project and create noise and disturbances. We have to accept these for the future prospects of the project.
6	Are there any trees, gardens, or cemeteries with religious, cultural, or heritage significance nearby? If so, where? What is the distance to the centerline of the project from the properties (approximately in meters)?	Not known to me
7	Do you as a local representative/official/resident/worker have any specific observation on the environmental changes and impacts that will take place?	Not applicable, as I don't live in project area.
8	Will construction and operation of the project affect your working life?	Should affect during construction period
9	Are there any special protected buildings within 50m of the road (military, police or special protected building, pumphouse, substations, etc.)?	Not known
10	Does your department have enough capability to support the project with processing of licenses and permits?	BRT is not involved in commuting the passengers in and around Dhaka City, but BRT is likely to help and ease the pressure of commuters. Railway carries part of commuters between Gazipur and Narayangonj only with very limited service. The train can't have the desired speed because of number of level crossings. Several accidents have occurred at the level crossings, and train needs to slow down at the crossings. There are about 40 level crossings between Gazipur and Narayangonj. The number of crossings is increasing due to development of cross roads by LGED.

11	In your opinion, what environmental problems should we pay attention to?	Air quality would be main concern but hopefully it should improve. Proper maintenance of the buses so that they have less harmful exhaust. Less noisy buses and keep the area dust-free.
12	Do you have any suggestions to reduce such environmental impacts?	As in question no.11
13	Do you have any other suggestions or ideas?	Try to find out the ways to make best use of the existing railway between Narayangonj and Joydevpur.The fare in the train comparatively cheaper than bus.
14	Do you have any questions?	No

B3–Questions Posed to General Public in the Vicinity of the Project Corridor (February–March2011)

TA7415-BAN: Preparing the Greater Dhaka Sustainable Urban Transport Project
(Summary Sheet–Survey was conducted among 397 respondents)

ENVIRONMENT MODULE

EM1. What is the distance to the project from the property?

	Number of Responses	Maximum	Minimum	Median	Average
Distance(m)	362	4000.00	1.50	280.00	290.41

EM2.What is the distance to the center line of the project from the property?

	Number of Responses	Maximum	Minimum	Median	Average
Distance(m)	342	1500.00	3.50	300.00	288.64

EM3. What are your comments on the effects on local traffic due to construction traffic and access for the project lorries/trucks?

	Number of Responses	Percentage			
(1) Nonimpact	87	21.91%			
(2)Will create problem	159	40.05%			
(3)May create problem	6	1.51%			
(4) Traffic jam will in crease	57	14.36%			
(5)Temporary Impact	24	6.05%			
(6)No comments	64	16.12%			

EM4. Are there any trees, gardens, or cemeteries with religious, cultural, or heritage significance nearby? If so, where?

	Number of Responses	Percentage			
(1)Yes	132	33.25%			
(a)Northside	37	32.17%			
(b)Southside	16	13.91%			
(c)Eastside	34	29.57%			
(d)West side	22	19.13%			
(e)Beside house	4	3.48%			
(f) At 200m distance	2	1.74%			
(2) No	265	66.75%			

EM5. Are there any graves or other religious structures, temples, or shrines with religious, cultural, or heritage significance nearby?

	Number of Responses	Percentage			
(1)Yes	295	74.31%			
(a)Northside	49	24.62%			
(b)Southside	31	15.58%			

(c)Eastside	52	26.13%			
(d)West side	59	29.65%			
(e)Beside house	3	1.51%			
(f)At100mdistance	1	0.50%			
(g)At200mdistance	3	1.51%			
(h)At500mdistance	1	0.50%			
(2)No	102	25.69%			

EM6. Do you as a local resident/worker have any specific observation on the environmental changes and impacts that will take place?

	Number of Responses	**Percentage**			
(1)Yes	180	45.34%			
(2)No	217	54.66%			

EM7. Will construction and operation of the project affect your working life?

	Number of Responses	**Percentage**			
(1)Yes	156	39.29%			
(2)No	241	60.71%			

EM8. Will construction and operation of the project affect your homelife?

	Number of Responses	**Percentage**			
(1)Yes	162	40.81%			
(2)No	235	59.19%			

EM9. What is your idea on the overall environmental impact due to the construction and operation?

	Number of Responses	**Percentage**			
(1)Travel time will be reduced	32	8.06%			
(2)Transportation mode will be easier	91	22.92%			
(3)No significant impact	5	1.26%			
(4)Quality of environment will be better	40	10.08%			
(5)Life standard will be better	39	9.82%			
(6)Temporary impact/possibility of accidents	12	3.02%			
(7)Environmental pollution will increase	22	5.54%			
(8)Mode rate impact	21	5.29%			
(9)Implementing agency to be more aware of impacts	3	0.76%			
(10)There will be no traffic jams, or they will be reduced	3	0.76%			
(11) No impact	1	0.25%			
(12)Don't know	128	32.24%			

EM10. Do you have suggestions to control the overall environmental impact due to project construction and operation?					
	Number of Responses	**Percentage**			
(1)Day-to-day life will be easier	23	5.79%			
(2) Travel time will be reduced, transportation mode will be easier	23	5.79%			
(3)Needs proper planning	21	5.29%			
(4)People will benefit more financially	7	1.76%			
(5)Environment impacted	15	3.78%			
(6)Project should be completed as early as possible	40	10.08%			
(7)Temporary loss	17	4.28%			
(8)Implementing agency to be more environmentally aware	57	14.36%			
(9)Construction work should be conducted on holidays	1	0.25%			
(10)Environment friendly project	44	11.08%			
(11)Corruption should be restricted	5	1.26%			
(12) Construction work should be conducted at night to avoid traffic	17	4.28%			
(13)Number of accidents will lessen	4	1.01%			
(14)Environment will be impacted	12	3.02%			
(15)Don't know	113	28.46%			
EM11. Do you have any questions for the interviewing consultant?					
	Number of Responses	**Percentage**			
(1)Yes	69	17.38%			
(a)How the road will be constructed?	24	35.29%			
(b)There should be less cost but better service	18	26.47%			
(c)What will the road look like?	16	23.53%			
(d)Project should be completed as early as possible	10	14.71%			
(e)What is the condition of the bus (new/comfortable / reconditioned)?	1	1.47%			
(2) No	328	82.62%			
EM12. Do you support the project overall?					
	Number of Responses	**Percentage**			
(1)Yes	394	99.24%			
(2)No	1	0.25%			
(3)Don't know	2	0.50%			
EM13. If answer 12 is YES: What (if anything) would cause you NOT to support the project?					
	Number of Responses	**Percentage**			
(1)There should be provision for flyovers/alternatives	34	8.63%			

(2) If other transportation systems will not be sustainable with BRT	4	1.02%			
(3)Project is not sustainable (respondents have doubts)	26	6.60%			
(4)Scarcity of bus in service	4	1.02%			
(5)How much the general public will benefit	6	1.52%			
(6)Long-term implementation of project	1	0.25%			
(7)Less willingness of government	1	0.25%			
(8)Poor quality of service	1	0.25%			
(9)Nothing	316	80.20%			
(10)If not helpful	1	0.25%			

EM14.If answer to 12 is NO: What (if anything) would lead you to SUPPORT the project?

	Number of Responses	**Percentage**			
(1)It is Better to Complete the project as early as Possible	1	100%			

APPENDIX 3: SENSITIVE RECEPTORS ALONG THE PROJECT CORRIDOR

Chainage	Type	Name/Address	Number of Stories	Remarks
1+240	School	Scholastica, Road-8, Sector-1	7	No physical impact on structures
5+360		Munnu Textile Mills High School, Tongi	1	No physical impact on structures
6+310		Kaderia High School, Cherag Ali	1	No physical impact on structures
8+850		Gazipura Ideal School, Tongi	1	No physical impact on structures
11+460		Khaleq Rashid Edu care School, Board Bazar, Gazipur	3	Boundary wall will be Impacted
12+000		Star lit School, National University, Gazipur	2	No physical impact on structures
11+390		Holy Model School, Board Bazar, Gazipur	2	Boundary wall will be Impacted
2+550	College	Uttara Model College	5	No physical impact on structures
3+630		Fashion Design and Textile Technology	4	No physical impact on structures
7+050		Tongi Govt. College	4	Boundary wall will be Impacted
16+670		Gazipur National Law College, Noljani, Gazipur	2	Boundary wall will be Impacted
8+450	Madrassa	Tamirul Millat Madrassa	2	No physical impact on structures
8+850		Darul Ulum Ahammad Ali Madrassa,Tongi	1	No physical impact on structures
14+700		Khalikiha Darul Ulum Madrassa, Boson Sarak,Gazipur	3	No physical impact on structures
12+150		Madrassa Teacher Training Institute, Gazipur	5	No physical impact on structures
2+550	University	Asian University	5	No physical impact on structures
3+000		People University, SR Tower, Sector-7, Uttara	7	No physical impact on structures
3+230		Queens University, Road-7D, Sector-7,Uttara	6	No physical impact on structures
3+630		Uttara Town University College	5	No physical impact on structures
11+560		Islamic University of Technology, Board		Boundary wall will be
Chainage	**Type**	**Name/Address**	**Number of Stories**	**Remarks**
to12+125		Bazar, Gazipur		Impacted
		National University, Gazipur		Boundary wall will be Impacted
		Open University, Gazipur		Boundary wall will be Impacted
6+700		Darul Ihsan University	5	No physical impact on structures
3+060		Uttara University	6	No physical impact on structures
2+940		Uttara University	7	No physical impact on structures

6+700		Training Center	Gazipur Medical Training Institute, / Cherag Ali, Gazipur	5	No physical impact on structures
0+840		Clinic	Jahanara Clinic Pvt. Ltd.	4	No physical impact on structures
13+160			Mother and Child Clinic, Shikder Marker, Gazipur	6	No physical impact on structures
16+450			Shaol Health Center, Chowrasta	4	No physical impact on structures
7+120			Surjer Hasi Clinic, College Gate,Tongi	5	No physical impact on structures
4+940			Popular Dental Clinic, Station Road, Tongi	3	No physical impact on structures
4+530			Meri Stops Clinic, Bata Gate, Tongi	4	No physical impact on structures
1+140		Hospital	Uttara Central Hospital, Road-7, Sector-1, Uttara	4	No physical impact on structures
7+530			Prime General Hospital, Tongi	4	No physical impact on structures
14+730			N. S. General Hospital, Boson Sarak, Gazipur	4	No physical impact on structures
16+980			Desh Eye Hospital, Noljani, Gazipur	3	No physical impact on structures
16+100			Doctor's Foundation Hospital, Chowrasta	3	No physical impact on structures
9+560			TMCC Hospital,Targas,Gazipur	4	No physical impact on structures
2+510		Hospital/ Diagnostics	RMC Hospital/Diagnostic, Uttara	5	No physical impact on structures
Chainage		**Type**	**Name/Address**	**Number of Stories**	**Remarks**
0+750		Mosque	A Proposed Mosque in Uttara, Sector-1	3	No physical impact on structures
4+350			Ashraf Jamjam Jame Mosque,Tongi	1	No physical impact on structures
5+540			Munnu Shahi Jame Mosque, Millgate,Tongi	2	No physical impact on structures
5+710			Baitun Nur Jame Mosque, Millgate, Tongi	1	No physical impact on structures
6+060			Jame Mosque, Dhaka Metal Works, Tongi	1	No physical impact on structures
6+400			Kaderia Mosque, Cherag Ali	1	No physical impact on Structures
8+850			Baitun Jame Mosque, Tongi	1	No physical impact on structures
11+310			Alhaz Meher Ali Wak'f Jame Mosque, Board Bazar	5	Boundary wall will be Impacted
14+670			Baitul Ahad Jame Mosque, Boson Sarak	2	No physical impact on structures
17+410			Darus Salat Jame Mosque, Noljani, Gazipur		No physical impact on structures
18+590			Tin Sarak Jame Mosjid, Infront of Arong Milk, Tin Sarak, Lakhimpura Joydevpur, Gazipur	1	Boundary wall will be Impacted
20+160			Puratan Bus Stand Jame Mosque	1	No physical impact on structures
19+660			West Chandana Jame Mosque, Joydevpur		No physical impact on structures

16+240			Chandana Chowrasta Mosque		No physical impact on structures
15+530			Shawon Neatware Mosque, Vogra, Chandana	3	No physical impact on structures
12+970			Hazir Pukur Mosque, Choydana, Hazir Pukur, Gazipur	2	No physical impact on structures
10+760			Chata Mosque, Board Bazar, Gazipur	1	No physical impact on structures
9+200			Shahadat Filling Station Mosque, Kunia, Gazipur	1	No physical impact on structures
7+360			Hossain Market Jame Mosque, Tongi, Gazipur	3	No physical impact on structures
6+520			Cherag Ali Kacha Bazar Mosque, Tongi	1	No physical impact on structures
5+710			Millgate Mosque	2	No physical impact on structures
5+150			Hospital Mosque, Station Road	2	No physical impact on structures
3+960			Tongi Bazar Mosque	2	No physical impact on structures
3+430			Mazar Mosque, Abdullapur Bus Station	1	No physical impact on structures
20+150		Temple	Sri Sri Indreshwar Shiv Mondir	1	Boundary wall will be Impacted
12+550		Church	CDC, Sign Board, Gazipur	5	No physical impact on structures
4+500			Baptist Church, Bata Gate, Tongi	2	No physical impact on structures
6+420		Shrine	Abdul Wahab Shahen Shah Mazar, Cherag Ali	1	No physical impact on structures
4+280			Tazim Shah Rowja Sharif, Tongi	1	No physical impact on structures
3+440			Doyal Baba Mollahji Mazar, Abdullapur Bus Station	1	No physical impact on structures

N.B.L= left side of chainage: i.e. Westside Km0+000 to Km16+300 northside Km16+300 to Km20+200. R= right side of chainage i.e. east side Km0+000 to Km 16+300 south side Km16+300 to Km20+200. FoB=Footover bridge.

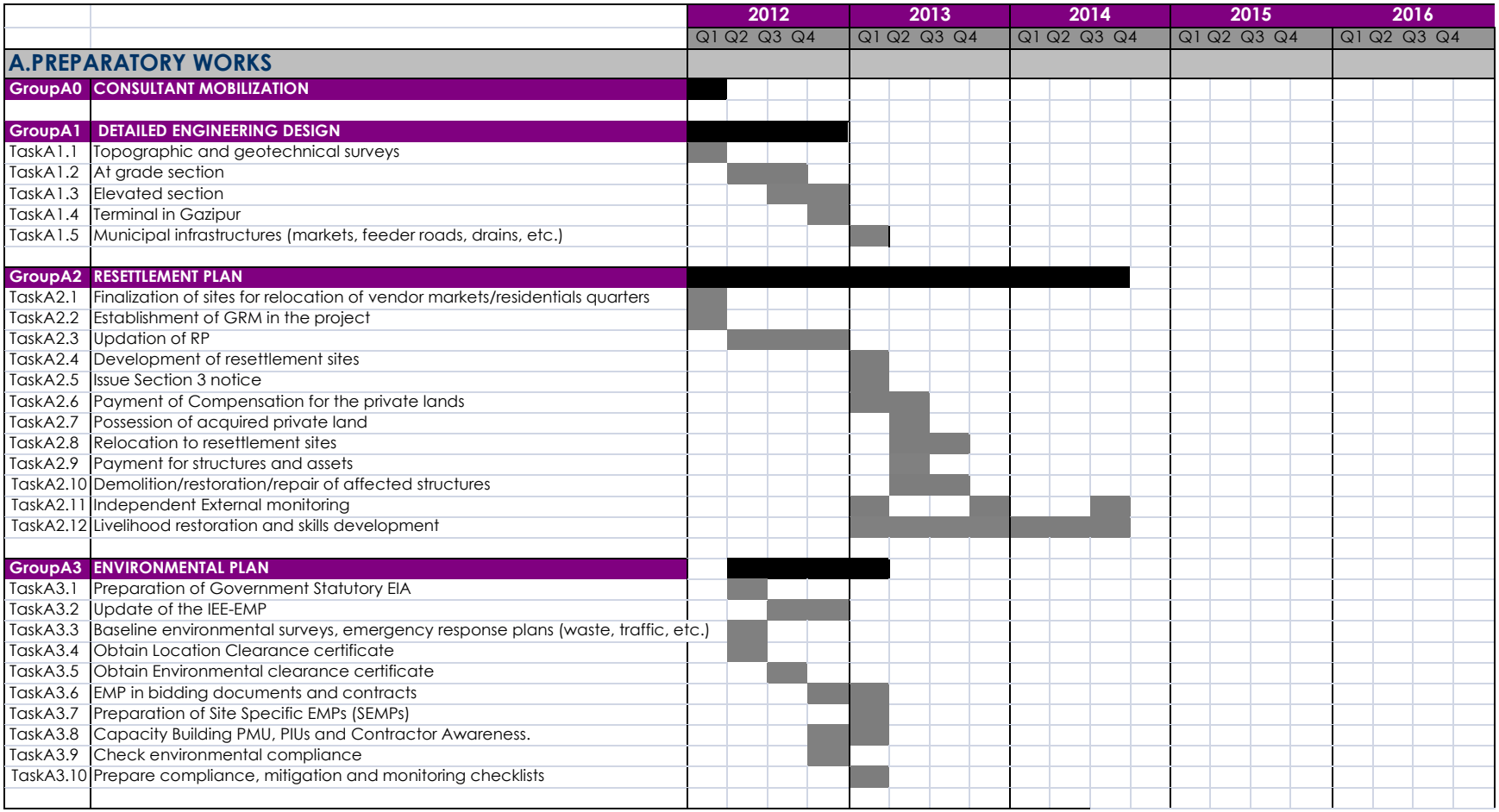
Map References Indicate Location by Chainage in the Following Table

StartCH	EndCH	MapNo.
0	200	101
200	400	100
400	600	99
600	800	98
800	1,000	97
1,000	1,200	96
1,200	1,400	95
1,400	1,600	94
1,600	1,800	93
1,800	2,000	92
2,000	2,200	91
2,200	2,400	90
2,400	2,600	89
2,600	2,800	88
2,800	3,000	87
3,000	3,200	86
3,200	3,400	85
3,400	3,600	84
3,600	3,800	83
3,800	4,000	82
4,000	4,200	81
4,200	4,400	80
4,400	4,600	79
4,600	4,800	78
4,800	5,000	77
5,000	5,200	76
5,200	5,400	75
5,400	5,600	74
5,600	5,800	73
5,800	6,000	72
6,000	6,200	71
6,200	6,400	70
6,400	6,600	69
6,600	6,800	68
6,800	7,000	67

StartCH	EndCH	MapNo.
7,000	7,200	66
7,200	7,400	65
7,400	7,600	64
7,600	7,800	63
7,800	8,000	62
8,000	8,200	61
8,200	8,400	60
8,400	8,600	59
8,600	8,800	58
8,800	9,000	57
9,000	9,200	56
9,200	9,400	55
9,400	9,600	54
9,600	9,800	53
9,800	10,000	52
10,000	10,200	51
10,200	10,400	50
10,400	10,600	49
10,600	10,800	48
10,800	11,000	47
11,000	11,200	46
11,200	11,400	45
11,400	11,600	44
11,600	11,800	43
11,800	12,000	42
12,000	12,200	41
12,200	12,400	40
12,400	12,600	39
12,600	12,800	38
12,800	13,000	37
13,000	13,200	36
13,200	13,400	35
13,400	13,600	34
13,600	13,800	33
13,800	14,000	32
14,000	14,200	31
14,200	14,400	30
14,400	14,600	29
14,600	14,800	28
14,800	15,000	27
15,000	15,200	26

StartCH	EndCH	MapNo.
15,200	15,400	25
15,400	15,600	24
15,600	15,800	23
15,800	16,000	22
16,000	16,200	21
16,200	16,400	20
16,400	16,600	19
16,600	16,800	18
16,800	17,000	17
17,000	17,200	16
17,200	17,400	15
17,400	17,600	14
17,600	17,800	13
17,800	18,000	12
18,000	18,200	11
18,200	18,400	10
18,400	18,600	9
18,600	18,800	8
18,800	19,000	7
19,000	19,200	6
19,200	19,400	5
19,400	19,600	4
19,600	19,800	3
19,800	20,000	2
20,000	20,200	1

APPENDIX 4: PROJECT IMPLEMENTATION SCHEDULE



APPENDIX 5: TRAFFIC MANAGEMENT PLANNING

A. Principles for Traffic Management Planning (TMP)

1. One of the prime objective of this TMP is to ensure the safety of all the road users along the work zone and to address the following issues:

(i) The safety of pedestrians, bicyclists, and motorists traveling through the construction zone;
(ii) Protection of work crews from hazards associated with moving traffic;
(iii) Mitigation of adverse impact on the road capacity and delays to the road-users;
(iv) Maintenance of access to adjoining properties; and
(v) Addressing issues that may delay the project works.

B. Operating Policies for TMP

2. Figure 1 illustrates the operating policy for TMP.

C. Analyze the Impact Due to Street Closure

3. Apart from the capacity analysis, a final decision to divert the traffic should involve the following steps:

(i) approval from the relevant local authorities and local community to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, Department of Roads, etc. regarding the mitigation measures necessary at the detours where the road is diverted during the constructions;
(iii) determination of the maximum number of days allowed for road closure and incorporation of such provisions in to the contract documents;
(iv) determination if additional traffic control or temporary improvements are needed along the detour route;
(v) considering how access will be provided to the worksite;
(vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
(vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

4. If full road closure of certain streets within the area is not feasible due to inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends, with the construction commencing from Friday night up to Sunday morning prior to the morning peak period.

D. Public Awareness and Notifications

5. There will be travel delays during the construction, as is the case for most construction projects, albeit on a reduced scale if the utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as result of street

closures to accommodate the works.

Figure A 51: Policy Steps for the TMP

6. The awareness campaign and prior notification for the public will be a continuous activity which the project will pursue to compensate for the above delays and minimize public claims as a result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to digest the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through the print, TV, and radio media. In addition, the project, in collaboration with a utility management coordinator, will also seek the assistance of the local authorities to post the public notice regarding street closure and traffic diversions in the future.

7. The utility management coordinator will also conduct an awareness campaign to educate the public about the following issues:

(i) Traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
(ii) Defensive driving behavior along the work zones; and
(iii) To inform about reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to employ a road safety education specialist to design an appropriate program for road safety and conduct the awareness programs.

9. The campaign will cater to all types of target groups, i.e. children, adults, drivers. Therefore, these campaigns will be conducted in schools, civic centers, and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and also be available at the PIU, office of both the contractor and consultant, and the contractor's site office. The text of the brochure should be concise to be effective with lot of graphics. It will detail the following aspects:

(i) Why the brochure was prepared along with a brief description of the project;
(ii) Advice the public to expect the unexpected;
(iii) educating reader about the various traffic control devices and safety measures adopted at the work zones;
(iv) educating reader about the safe road user behavior to emulate at the work zones;
(v) how to stay informed or where to inquire about road safety issues at the work zones (website; name, telephone, mobile number of the contact person; SMS service or traffic information on FM Radio); and
(vi) office hours.

E. Install Traffic Control Devices at the Work Zones and Traffic Diversion Routes

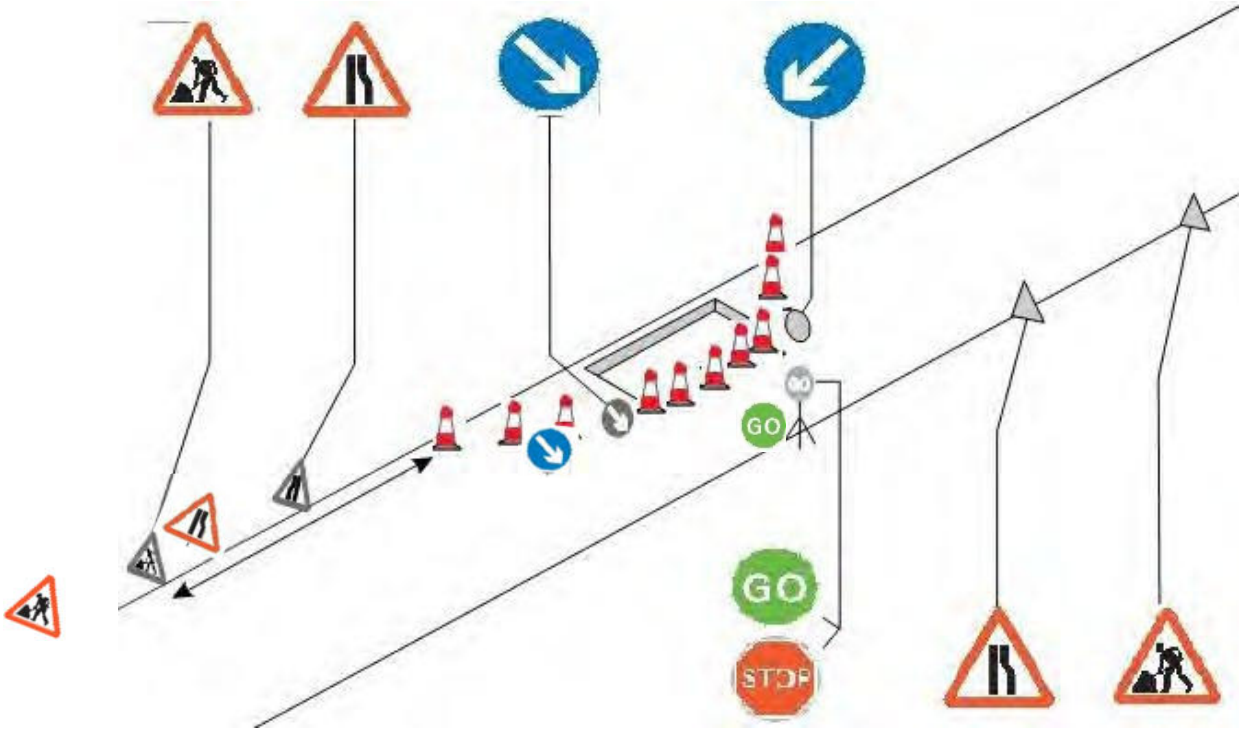
10. The purpose of installing traffic control devices at the work zones is to delineate these are as to warn, inform, and direct road users about a hazard ahead, and to protect the former as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones.

11. Procedures for installing traffic control devices at any work zone vary depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. At the area, the work area will take place both at the minor streets and the major streets. As such, the traffic volumes and road geometry vary, with the latter qualifying for more elaborate settings. However, regardless of where the constructions take place, all the work zones should be cordoned off and traffic should shift away at least with traffic cones, barricades, and temporary signs (temporary STOP and GO). The works will closely follow any guidelines outlined by the Roads and Highway Department and other literature available in this respect.

12. Figure A52 illustrates a typical setup for installing traffic control devices at the work zone

of the area.

Figure A52: Basic Layout for Delineation of a Work Zone (Small Area)



13. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (later a land longitudinal) and the transition space required for delineation, as applicable. For the BRT works, enough clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, adequate space is necessary to install the temporary traffic signs and cones. Figure AE3 clarifies that the "ROAD NARROWS" warning sign is only necessary at the works zone, where high traffic speeds are likely during off peak hours and nighttime. All the temporary traffic signs should be reflectorized, especially for the works to be conducted during the nighttime.

14. All the traffic diversions should be properly delineated through proper "DIVERSION AHEAD" and "ROADWORK AHEAD" signs. In addition, the "B46" temporary warning sign for sharp bends used at temporary diversions should be in place after the start of the taper of the traffic cones. Flashing beacons should be installed at the entry to the work zone, as well as traffic diversion for night constructions or if backfilling of the trenches does not take place after the completion of a dayshift.

Figure AE3: Basic Layout for Delineation of a Work Zone (Small Area)

15. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion effected as a result of full street-closure at certain areas during the works. For BRT works, personnel are necessary at the entry to the diversion from both directions. These personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during nighttime.

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions. In light of the ongoing load-shedding problem in Nepal, it is practical to use solar-powered LED lights, which are energy efficient, wherever feasible.

APPENDIX 6: INTERNATIONAL CONVENTIONS RELATING TO BANGLADESH

	International Conventions, Protocols, and Treaties	Signed	Status and Date
1	International Plant Protection Convention (Rome, 1951)		1 September 1978
2	International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954) (amended October 1969)		28 December 1981 (entry into force)
3	Plant Protection Agreement for the South East Asia and Pacific Region (as amended 1956)		4 December 1974 (AC) (entry into force)
4	Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water (Moscow, 1963)	13 March 1985	
6	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (Brussels,1969)		4 February 1982 (entry into force)
7	Convention on Wetlands of International Importance especially as Waterflow Habitat (Ramsar,1971) ("Ramsar Convention")		20 April 1992 (ratified)
8	Convention on Prohibition of Development, Production and Stockpiling of Bacteriological (Biological) and Toxic Weapons, and Their Destruction (London, Moscow, Washington,1972)		13 March 1985
9	Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris,1972)		3 August 1983 (accepted) 3 November 1983 (ratified)
10	Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington, 1973)("CITES Convention")	20 November 1981	18February1982
11	United Nations Convention on the Law of the Sea (Montego Bay, 1982)		10 December 1982
12	Vienna Convention for the Protection of the Ozone Layer (Vienna,1985)		2 August 1990 (AC) 31October1990 (entry into force)
13	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987)		2 August 1990 (AC), 31 October 1990 (entry into force)
13a	Protocol on (London,1990)		18 March 1994 (AC), 16 June 1994 (entry into force)
13b	Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, Copenhagen,1992		27 November 2000 (AT), 26 February 2001 (entry into force)
13c	Protocol on Montreal,1997		27 July 2001 (accepted) 26 October 2001 (entry into force)
14	Convention on Early Notification of a Nuclear Accident (Vienna,1986)		7 February 1988 (entry into force), 7January 1988 (ratified)
15	Convention on Assistance in the Case of a Nuclear Accident of Radiological Emergency (Vienna,1986)		07 January 1988 (ratified) 07 February 1988 (entry into force)
16	Agreement on the Network of Aquaculture Centers in Asia and the Pacific (Bangkok,1988)		15 May 1990 (ratified)

	International Conventions, Protocols, and Treaties	Signed	Status and Date
17	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel,1989)		1 April 1993 (AC)
18	International Convention on Oil Pollution Preparedness, Response and Cooperation (London,1990)	30 November 1990	In the process of ratification
19	United Nations Framework Convention on Climate Change (New York, 1992)	9 June 1992	15 April 1994
20	Convention on Biological Diversity, (Rio De Janeiro,1992)	5 June 1992	3 May 1994
21	International Convention to Combat Desertification (Paris 1994)	14 October 1994	26 January 1996 (ratification), 26 December 1996 (entry into force)
22	Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (Geneva, 1976)		3 October 1979 (AC), (entry into force)
23	Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (New York, 1994)	28 July 1996	
24	Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (New York,1995)	4 December 1995	
25	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Paris,1993)	14 January 1993	
26	United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (Paris,1994)	14 October 1994	26 January 1996
27	Convention on Nuclear Safety (Vienna,1994)	21 September 1995	21 September 1995 (AT)
28	Cartagena Protocol on Biosafety to the Convention on Biological Diversity	24 May 2000	5 May 2004 (AC)
29	Convention on Persistent Organic Pollutants, Stockholm	23 May 2001	12 March 2007
30	Kyoto Protocol to the United Nations Framework Convention on Climate Change		21 August 2001 (AC), 11 December 1997 (AD)

Source: Department of Environment:
N.B.#DOE terminology AC=Ratification/Accession, AD=Adopted, AT=Accepted.

APPENDIX 7: ENVIRONMENTAL CRITERIA– EVIRONMENTAL CONSERVATION RULES 1997

SCHEDULE – 4

Standards for Sound

[See Rule 12]

Sl. No.	Category of areas	Standards determined at dBa unit	
		Day	Night
a.	Silent zone	45	35
b.	Residential area	50	40
c.	Mixed area	60	50
	(mainly residential area, and also simultaneously used for commercial and industrial purposes)		
d.	Commercial area	70	60
e.	Industrial area	75	70

Notes:

1. The time from 6 a.m. to 9 p.m. is counted as daytime.

2. The time from 9 p.m. to 6 a.m. is counted as night time.

3. Area up to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.

SCHEDULE – 5

Standards for Sound originating from Motor Vehicles or Mechanized Vessels
[See Rule 12]

Category of Vehicles	Unit	Standards	Remarks
*Motor Vehicles (all types)	dBa	85	As measured at a distance of 7.5 meters from exhaust pipe.
		100	As measured at a distance of 0.5 meter from exhaust pipe.
Mechanized Vessels	dBa	85	As measured at a distance of 7.5 meters from the vessel which is not in motion, not loaded and is at two thirds of its maximum rotating speed.
		100	As measured at a distance of 0.5 meter from the vessel which is in the same condition as above.

* At the time of taking measurement, the motor vehicle shall not be in motion and its engine conditions shall be as follows:-

(a) Diesel engine – maximum rotating speed.

(b) Gasoline engine –at two thirds of its maximum rotating speed and without any load.

(c) Motorcycle – If maximum rotating speed is above 5000 rpm; two-thirds of the speed, and if maximum rotating speed is less than 5000 rpm, three-fourth of the speed.

SCHEDULE – 6

Standards for Emission from Motor Vehicles

[See Rule 12]

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit (HSU)	65
Carbon Monoxide	gm/k.m. percent area	24 04
Hydrocarbon	gm/k.m. ppm	02 180
Oxides of Nitrogen	gm/k.m. ppm	02 600

* As measured at two thirds of maximum rotating speed.

APPENDIX8: COMPARISON OF FUEL CONSUMPTION AND EMISSIONS

		Number buses	Seating	Distance km	CNG km/m3	Trips/day/bus	Total Trips BRT Service provided		Fuel Cons m3/d	Trips/d	1 Pax	Fuel/pax/km m3
Case 1	BRT	50	70	20	2.63	25	1250	25000	9505.703422	87500	0.108636611	0.005431831
Case 2	Large Buses	50	50	20	3.92	6	300	6000	1530.612245	15000	0.102040816	0.005102041
Case 2	Mini Buses	50	30	20	5.23	6	300	6000	1147.227533	30000	0.038240918	0.001912046

Vehicle Type	km/ m3	Km service@	Fuel consumed m3/day	Passengers $	Fuel / Pax	Fuel / Pax km **	Factor *		Fuel consumed compared to BRT
BRT	2.63	25000	9505.703422	87500	0.108636611	0.005431831	1.0	0.005431831	
Large Bus	3.92	6000	1530.612245	15000	0.102040816	0.005102041	5.8	0.029761905	5.479166667
Mini Bus	5.23	6000	1147.227533	9000	0.127469726	0.006373486	9.7	0.06196445	11.40765527

\# Fuel Consumed by 50 bus fleet

@ Km service provided by 50 bus fleet

$ Passengers carried by 50 busses in a day

** Fuel consumed per passenge km travelled

* Factor = number of busses to make equivalent of BRT bus trips in a day

Large buses would consume 5.5 times the amount of CNG fuel to provide the same service

Mini buses would consume 11.4 times the amount of CNG fuel to provide the same service

Vehicle Type	Passengers $	Relative Consump	Fuel consumed	Fuel consumed compared to BRT	Fuel for equivale trips (m3) ***	Kg CO2 for fuel released ###	Kg emission CO2 saved / day
BRT	87500	0.0054	9505	1.0	9505	31644	
Large Bus	87500	0.0148	3061	5.8	17753.8	59106	27462
Mini Bus	87500	0.0309	2294	9.7	22251.8	74081	42437

***Assume gas density methane 1.189kg/m3

Assume 2.8kg Co2/kg fuelgas density methane 1.189kg/m3 http://encyclopedia.airliquide.com/Encyclopedia.asp?GasID=41