Environmental Monitoring Report

Project No. 42169-013
Semi-Annual Report
December 2017

2862/63/64-BAN (SF): Greater Dhaka Sustainable Urban Transport Project

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

SMEC
Member of the Surbana Jurong Group

In Association with: SYSTRA SA, France
Brisbane City Enterprises, Australia
ACE Consultants, Bangladesh

Greater Dhaka Sustainable Urban Transport Project

ADB Loan No's 2862/2863/2864-BAN

Bus Rapid Transit (BRT), Airport-Gazipur

Package 2, Engineering, Procurement and Construction Management (EPCM)

SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT No.3: JULY - DECEMBER 2017




EXECUTIVE SUMMARY

Project Scope

The Bus Rapid Transit (BRT) Airport-Gazipur, EPCM Package 2 of the Greater Dhaka Sustainable Urban Transport Project (GDSUTP), being funded by ADB is a priority project under the Bangladesh Government's Strategic Transport Plan approved in 2008.

The Project will contribute to developing a sustainable urban transport system (UTS), within the Dhaka North City Corporation (DNCC) and Gazipur City Corporation (GCC) areas which forms part of North Greater Dhaka, through the delivery of a 20-km bus rapid transit (BRT) corridor. This pilot project provides a solution for integrated urban mobility and will have a demonstration effect, as no modern mass transit system exists in Bangladesh.

Project Status

The detailed designs of the various components commenced in 2013 and were progressively completed by the end of 2015. The five major Contract Packages are:

C01: Upgrading and widening of pavement with provision of BRT lanes and construction of flyovers and BRT stations including access to stations (Km 0+000 to Km 2+600 and Km 7+100 to Km 20+200);
C02: Upgrading and widening of pavement, construction of elevated BRT lanes including Tongi Bridge and BRT stations (Km 2+600 to Km 7+100);
C03: Construction of Pavement, Drains, Pedestrian Facilities and Local markets on Both Sides of the BRT Corridor.
C04: Construction and Completion of BRT Bus Depot at Gazipur.
C05: Supply and Installation of Energy Efficient Highway Lighting along the BRT corridor including the provision of Solar Panels at Bus Stations

The At-Grade Section Contract (C01) was signed on 01 December 2016 with the Contractor, China Gezhouba Group Co. Ltd (CGGC). The Notice to Commence for the Works was issued on 13 Apr 2017 following the Ground-Breaking Ceremony presided over by the Minister of Road Transport and Bridges and attended by Local Representatives on 31 Mar 2017 at the site of the U-Turn Flyover at Km 8+500.

The Contractor commenced mobilisation involving survey works and made submissions of the Draft Construction Programme, Traffic Management Plan, Environmental Management System and other methodologies for review and approval. Initial activities on site involved the establishment of the Contractor's own plant yard, preparation for construction of the Engineer's Office building, clearing of the area for the Gazipur Terminal Station and for the drainage near the U-turn Flyover at Ch 8+200 and the preparation for subsoil investigations and pilot piles for the Gazipur Interchange. The progress achieved on the various activities up to the end of 31 December 2017 is summarised in Table I.5.

The Contractor conducted the Baseline Monitoring of Environmental Parameters in August 2017 and the first Environmental Sampling as per the EMP of EIA report on November 2017. A Draft Environmental Management System (EMS), Site Safety Manual, Site Personnel Health and Epidemic Prevention Program were submitted along with plans to survey and measure the trees of Ch 0+000 to Ch 0+260. The consultant already reviewed the draft documents and requested the comments to be addressed in a final version without delay.

Overall Progress of the Project at 31st December 2017 was assessed as 0.48% against a revised target of 4.5% indicating a lag of 4.02%. The achieved progress of the Contractor was based on the completed quantities of physical works executed under the above Items.

The Elevated Section Contract (C02) was awarded to Jiangsu Provincial Transportation Engineering Group Co. Ltd (JTEG) on 13 Sep 2017. The Contract was signed on 19 Oct 2017 on receipt of the Performance Guarantee and following the Pre-Award Meeting held on 17 Oct 2017. The Notice to commence was issued on 15 Dec 2017.

The Local Roads and Markets Contract (C03) was awarded to Weihai International Economic & Technical Cooperative Co. Ltd (WIETC), China on 13 Sep 2017. The Contract was signed on 28 Sep 2017 on receipt of the Performance Guarantee and following the Pre-Award Meeting held on 27 Sep 2017. The Notice to commence was issued on 10 Dec 2017.

The Bus Depot Contract (C04), the first to be awarded signed on 08 February 2016 with the Contractor SEL-UDC commencing site activities on 23 February 2016 after the site was formally handed over by the Employer LGED. The progress achieved on the various activities up to the end of 31 December 2017 is summarised in Table I.6. Overall Progress of the Project at 31st December 2017 was assessed as 45.23% against a revised target of 89.82% indicating a lag of 44.59%. The achieved progress of the Contractor was based on the completed quantities of physical works executed under the above Items. Progress has been constrained by slow mobilisation and with many activities then unable to proceed due to the wet conditions during July to September 2017.

Activities continued in several areas including the drainage system, embankment works in the main depot parking area and on the access road involving the preparation of subgrade layers and subbase works. Concrete works continued for the Admin & Maintenance Building, the Boundary Wall and the BTCL Complaints Centre, Main Entry Gate & Guardhouse, the Electrical Sub-Station and the Drainage System including the manufacture of pipes and their installation with approx. 1,249 m^3 of concrete supplied and placed.

Environmental Monitoring

The implementation status of the mitigation measures to be addressed during the construction stage of the Project is shown in the tables below for comparison with the designed mitigation measures stated in the EMP. In summary the mitigation measures during this stage involve ensuring that the Contractor develops and presents his various method statements, plans, etc. accordingly for review and approval before commencing the works, that relevant actions required to be implemented by the Contractor in the execution of the works are addressed and that the measures have all been addressed effectively.

The Baseline Monitoring Sampling and first environmental monitoring of Environmental Parameters (air quality, noise & vibration level, surface water and groundwater quality, soil quality) on the At-Grade Section (C01) Contract was carried out from 27 to 30 August 2017 and subsequently at the end of November 2017 as required and the results have been analysed and included in the main report.

The routine sampling of Environmental Parameters (air quality, noise & vibration level, surface water and groundwater quality, soil quality) on the Bus Depot Contract (C04) was carried out in early December 2017 as required and the results have been analysed and included in the main report. No information was provided regarding fisheries resources and wildlife. However, in the construction site, there is only a small ditch. The data from other environmental quality sampling showed that the construction work appeared to have very few longer-term impacts on the biophysical environment.

Compliance with Safeguards Requirements

At Grade Section including Flyovers (C01)

The Contractor for C01 has fully complied with Environmental monitoring and mitigation program as per the EMP of the EIA. The baseline environmental monitoring and the first environmental quality monitoring have been conducted during the monitoring period. The Contractor submitted the draft Environmental Management System (EMS) after incorporating the comments from the Consultant. The Contractor has been notified several times to submit the final HSMP, Site Safety Manual, Site Personnel Health and Epidemic Prevention Program for approval from consultant. The Contractor yet not deployed their Environmental Management Officers (EMOs) despite repeated reminders regarding the issue.

Mitigation measures regarding surface water, ground water, air quality, noise and dust pollution were fully complied. Results of the noise level monitoring during day and night time and the ambient air quality monitoring along the project corridor shows that the values were higher than the national standard. The reason for this high ambient noise reading may be a result of the high traffic volume and the large number of industrial and commercial activities along the project influenced area and not construction activities.

Elevated Section including Tongi Bridge (C02)

Since C02 started on 15 December 2017 and they have not yet started any major works thus there was no scope for environmental monitoring. The Contractor has yet not submitted their Environmental Management System (EMS)/Construction Environmental Management Plan (CEMP) for approval from Consultant. The Contractor has also not yet complied with the Baseline Monitoring of Environmental Parameters and not yet deployed the Environmental Management Officers (EMOs).

Local Roads and Kitchen Markets (C03)

Since C03 started on 10 December 2017 and they have not yet started any major works thus there was no scope for environmental monitoring. However, the Contractor has submitted their Draft Environmental Protection Plan, and the HIV-AIDS Awareness Program for approval from Consultant. The Contractor has not yet complied with the Baseline Monitoring of Environmental Parameters.

Gazipur Bus Depot (C04)

The Contractor for C04 has fully complied with Environmental monitoring and mitigation program for filling up of water logged area, fisheries, occupational health and safety and community health and safety issues. Mitigation measures regarding surface water, ground water, air quality, and noise and dust pollution were partially complied. The latest result of the noise level monitored during day time at the construction site (49.01 dBA) was within the ambient standard (Leq 55 dBA) whereas the noise level was higher than the standard during the previous period monitoring. Soil quality sampling was conducted during this monitoring period for the first time. There is a risk of contamination of soils at the camp and work sites due to accidental spillage of noxious chemical, petroleum derivatives and bituminous material. Therefore, mitigation and monitoring measures for preventing soil pollution were stressed to the Contractor.

Conclusions

There have been no key Environmental Safeguard issues identified to date at Gazipur Bus Depot (C04) site and the At-Grade Section Contract (C01) site. The C01 Contractor has mobilised staff, prepared the required management plans as per EMP implementation and initiated the environmental quality monitoring. The C01 Contractor has submitted his Environmental Management System, Safety Manuals and Health Programme which have been reviewed by the Consultant environmental specialist and returned for correction and further improvements. The monthly environmental monitoring report up to August 2017 also submitted by the contractor for approval from Consultant.

The relevant Environmental Safeguards identified through the EIA and the IEE have been addressed in the EMPs that have been included in the bidding documents for each of the civil works contracts with both their implementation and monitoring to proceed once the major activities will be start.

It is expected however that there will be a requirement for extensive awareness training workshops to be carried out once these major activities have

Further Action Required

The next semi-annual Environmental Monitoring Report will cover the period from January to June 2018 during which all the Civil Works Contracts will have commenced and the procedures for implementation of the EMPs on each contract will have been established with updated base line information recorded. The focus of this report will be to identify if the Contractors have adequately understood their Environmental obligations as set out in the EMP and other relevant provisions of their Contracts, have been able to submit their EMPs and other related documents and have initiated the relevant procedures on site to ensure compliance with these requirements.

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
ADF	Asian Development Fund
AFD	*Agence Française de Développment* (French Development Agency)
AP	Affected Person
BBA	Bangladesh Bridge Authority
BIWTA	Bangladesh Inland Water Transport Authority
BOQ	Bill of Quantities
BR	Bangladesh Railway
BRM	Bangladesh Resident Mission (of the ADB)
BRT	Bus Rapid Transit
BUET	Bangladesh University of Engineering & Technology
CAR	Contractor's All Risk
CBR	California Bearing Ratio
CCDB	Christian Commission for Development Bangladesh
CGGC	China Gezhouba Group Co. Ltd – Contractor for At-Grade Section Contract C04
CPM	Contractor's Plant and Machinery
DESCO	Dhaka Electric Supply Company
DOE	Department of Environment
DPHE	Department of Public Health and Engineering
DU	University of Dhaka
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPCM	Engineering, Procurement and Construction Management
EOT	Extension of Time
EP	Entitled Person
FOB	Foot Over Bridge
GCC	General Conditions of Contract
GDSUTP	Greater Dhaka Sustainable Urban Transport Project
GEF	Global Environmental Facility
GOB	Government of Bangladesh
IEE	Initial Environmental Examination
IPC	Interim Payment Certificate
ITP	Inspection and Testing Plan
LA	Land Acquisition
LGED	Local Government Engineering Department
MoRTB	Ministry of Road Transport and Bridges
MPR	Monthly Progress Report
NGO	Non-Government Organisation
NMT	Non-Motorised Transport
NTC	Notice to Commence
OCR	Ordinary Capital Resources
OFC	Optical Fibre Cable
ODBM	Operational Design and Business Model

PCC	Particular Conditions of Contract
PMCCB	Project Management, Coordination and Capacity Building
PMU	Project Management Unit
PPTA	Project Preparation Technical Assistance
PSC	Prestressed Concrete
REB	Rural Electrification Board
RHD	Road and Highways Department
ROW	Right of Way
RTHD	Road Transport and Highways Division
SEL-UDC	SEL-UDC Joint Venture - Contractor for Gazipur Bus Depot Contract C01
SMEC	SMEC International Pty Ltd & Associates
SPO	Special Project Organisation
TOR	Terms of Reference
VO	Variation Order
WB	World Bank

I. INTRODUCTION

A. REPORT PURPOSE AND RATIONALE

1. As defined in the Initial Environmental Examination (IEE)[1] the Bus Rapid Transit (BRT) Corridor from Airport to Gazipur is the component of the Greater Dhaka Sustainable Urban Transport Corridor Project under ADB Loan for which an environmental assessment was completed. As part of the borrower's commitment, Semi-Annual Environmental Monitoring reports (EMR) are to be prepared in order to report on the Contractors' progress with implementing the requirements of the Environmental Management Plan (EMP), as well as the borrower's responses to non-compliance issues.

2. The purpose of this third EMR is to document the environmental management activities and compliance with the approved EMP of this Project and provides details of project activities during the period from July to December 2017. This report is prepared in accordance with the environmental monitoring program as part of the EMP. As the third EMR, it will only cover the construction phase as the compliance with the EMP for the design, bidding, and construction preparation stages was addressed in the previous report. In line with targets aimed at reducing the negative environmental impacts of the Project and in accordance with all the relevant specifications and standards of the Government of Bangladesh (GOB), as well as the policies of the Asian Development Bank (ADB), this report will emphasize: (i) progress made in implementing the EMP, (ii) implementation of mitigation measures, (iii) environmental compliance and (iv) problems that have occurred and corrective actions taken.

3. This report is prepared by SMEC International and Associates (SMEC) as the project implementation consultant for the Engineering, Procurement and Construction Management (EPCM) Component (Package 2) of the Project.

Sector Objective

4. Dhaka is the most densely populated city in the world with limited inhabitable land due to the city's topography, limited infrastructure and low levels of public services that result in tremendous congestion and constrain the ability of the urban transport system to provide mobility for all people. With the growing middle class, the registration of private cars and other motorised vehicles has been rapidly increasing and with an annual growth rate of about 8% there could be up to half a million cars in 2025, significantly impacting the increase of Greenhouse Gas (GHG) emissions from the transport sector. To ensure a sustainable future for Dhaka, public transport focused on people's mobility needs and accessibility has to be improved and given priority over simple road projects.

5. At the Government's request the 6 main corridors in Greater Dhaka's fringes were analysed with the north corridor recommended as the one with the best potential to organize urban development and support a mass-transit infrastructure. A Bus Rapid Transit (BRT) system was also recommended as the best mass-transit mode for the selected corridor, with 20% of its length located within the Dhaka North City Corporation (DNCC) and 80% located within the Gazipur City Corporation (GCC).

6. The GCC with an estimated population of 1 million is a garment hub with around 300 garment factories in the immediate vicinity of the corridor employing approximately 1 million workers adding to the floating population. With rapid motorisation the situation in road-based traffic collisions deteriorates, mostly affecting pedestrians who represent up to 50% of road accident fatalities in the GCC streets. The safety issues become even more acute when looked at from a gender perspective where 80% of the workers are women and a large portion of them commute on foot.

[1] Asian Development Bank. 2012. INITIAL ENVIRONMENTAL EXAMINATION. Supplementary Appendix of the Report and Recommendation of the President to the Board of Directors (RRP) for the GDSUTP.

7. Public transport in Greater Dhaka is inadequate and of poor quality with an estimated total of over 5000 large and mini buses operated by 45 companies, mostly private, running through the selected corridor. The bus fleet is in poor condition, there are few equipped stops, information on itinerary or connections is not provided, the ticketing system is not developed and the operators aggressively compete for passengers worsening congestion and impairing safety.

8. The Project complies with Dhaka's urban transport sector priorities by following some of the recommendations of the Strategic Transport Plan approved by the Government in 2008. The corridor selected will connect with the BRT corridor to be undertaken by the World Bank from the airport terminal south to Dhaka, ultimately providing a 40 km mass-transit corridor from Gazipur to Dhaka city centre and will be integrated with the MRT system routes also being implemented through JICA support.

Project Inception

9. The Government of Bangladesh (GOB) has requested a loan in the amount of US$ 100 million from ADB's Ordinary Capital Resources (OCR), a loan in various currencies in Special Drawing Rights (SDR) equivalent in value to US$ 45 million for ADB's Special Funds, and a loan in various currencies in Special Drawing Rights (SDR) equivalent in value to US$ 15 million from ADB's Hard Special Funds to help finance the Greater Dhaka Sustainable Urban Transport Project.

10. The Project is also co-financed by the *Agence Française de Développement* (AFD) with an additional loan of US$ 45 million and the Global Environmental Fund (GEF) with a grant not exceeding US$ 4.6 million. Both AFD and GEF's co-financing are being administered by ADB with the closing date of the loans and the grant being 31 Dec 2019 for AFD and 30 Jun 2020 for ADB.

Project Objective

11. The Project will improve the quality of life within the Gazipur City Corporation (GCC), which forms part of Greater Dhaka, through the delivery of a more efficient and sustainable Urban Transport System (UTS), including a 20 kilometre Bus Rapid Transit (BRT) corridor.

12. The ADB loans in the amount of US$160 million, or 62.7% of the total project investment cost of US$ 255 million will be used to finance:

i) The large civil works packages for the BRT corridor restructuring, vehicles and equipment;
ii) Consulting services including surveys and capacity building;
iii) Compensation fund for private bus operators and fleet scrapping program;
iv) SPO's recurrent administrative costs during the 4-year construction period;
v) Advocacy; and
vi) Interest charges during implementation.

13. The GOB financing of US$ 45 million or about 17.6% of the total project cost will be used for land acquisition and resettlement, taxes and duties and a small part of the civil works and recurrent administration costs.

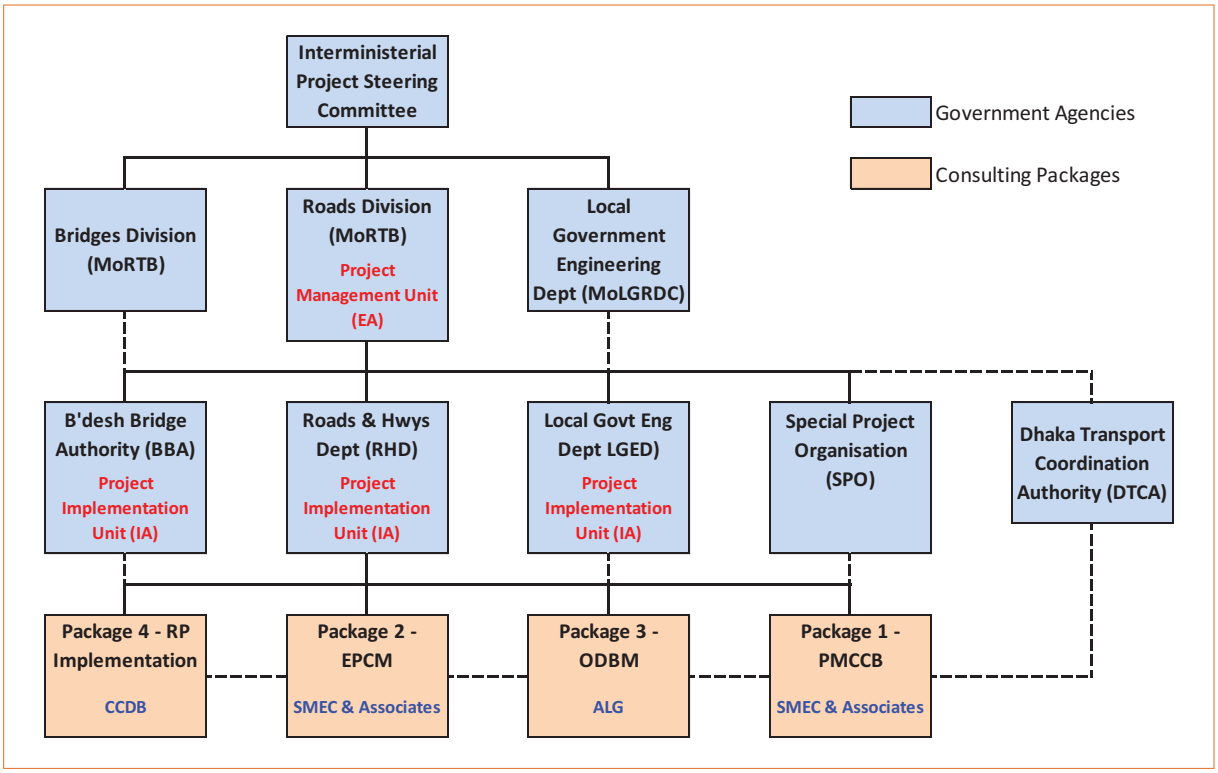
14. Consulting services to be provided under the Project are:

- Package 1 Project Management, Coordination and Capacity Building (PMCCB)
- Package 2 Engineering, Procurement and Construction Management (EPCM)
- Package 3 Operations Design and Business Model (ODBM)
- Package 4 Resettlement Plan Implementation (RPI)

Project Implementation

15. The Project Organisation established to ensure the requirements of all stakeholders are adequately addressed is shown in the following diagram.

Figure I.1: Project Organisation Chart



16. The Executing Agency (EA) for the Project is the Road Transport and Highways Division of the Ministry of Road Transport and Bridges (MoRTB) and the Implementing Agencies (IA) for the various components of the Project are as follows:

i) The Roads and Highways Department (RHD) will implement the main corridor restructuring, excluding the elevated section;
ii) The Bangladesh Bridge Authority (BBA) will implement the elevated section (also including the at-grade area beneath, integrating the new Tongi Bridge over the Turag River and the Abdullahpur intersection flyover; and
iii) The Local Government Engineering Department (LGED) will implement the BRT Bus Depot at Gazipur, improvements in Local Roads and Local Markets and Highway Lighting.

17. A Project Management Unit (PMU) established within the RHD and headed by its Project Coordinator will oversee the operations of the individual Project Implementation Units (PIU) established within each of the IAs and which are responsible for their respective component. The PIUs will each be headed by a Project Director with the EPCM consultancy services being overseen by the Project Director from the RHD PIU who will coordinate with the other Project Directors.

18. An International Tender was called for Consultancy Services Package 2 for the Engineering, Procurement and Construction Management (EPCM) of the BRT Project. SMEC International Pty Ltd, Australia in association with Systra SA, France, Brisbane City Enterprises Pty Ltd (BCE), Australia and ACE

Consultants Ltd (Bangladesh) was the successful tenderer and a consultancy contract was signed on 13 May 2013.

19. During the design stage the Consultant's team included an International and National Environmental Specialist who provided inputs for the preparation of the Environmental Impact Assessment (EIA) to seek Government Clearance for the project and updating the Initial Environmental Examination (IEE) for ADB clearance.

B. PROJECT LOCATION AND COMPONENTS

Project Location

20. The proposed BRT corridor will follow National Highway 3 (N3) starting at the proposed airport terminal station and continue north for nearly 16 km to the Joydevpur Chowrasta roundabout. From this point the alignment will proceed east for 4 km to the Gazipur Terminal station just south of the Gazipur bazaar. From the airport station on the southern end to about Km 3 the level is generally at grade (ground level). The section from Km 2+600 to Km 7+100 will be elevated over the Sonargaon Jonopoth Road, Ashulia Road and Station Road Intersections and the Turag River. There are also 6 flyovers for the BRT over major intersections.

21. The corridor from the Airport Station to the Gazipur Station is administratively located in 2 districts: Dhaka North City Corporation and the Gazipur City Corporation. The rainy season in this area starts between April and July and ends between September and November. The route passes through low, flat and alluvial land, much of which is reclaimed and crosses the Turag River. Land use in the corridor is primarily commercial, institutional, and industrial thereby making it a major employment zone.

Project Components

22. The scope of the BRT Airport-Gazipur and the major project activities are summarised 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 footover 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

viii) High Capacity Drainage system along the restructured corridor

ix) 113 access feeder roads improved in favour of NMT for a distance of 100 metres from the corridor totalling 49 km;

x) Highway lighting with 1000 energy efficient lights along the corridor with power provided using solar panels located at each of the station buildings.

xi) Improvements to 8 local markets, local drainage and Local Roads

xii) Installation of BRT priority traffic lights and closed-circuit cameras (CCTV) at main junctions

xiii) Environmental Safeguards

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

23. The implementation of the civil works under the responsibility of each of the designated IAs is formalised through a number of Contract packages as shown in Table 1.

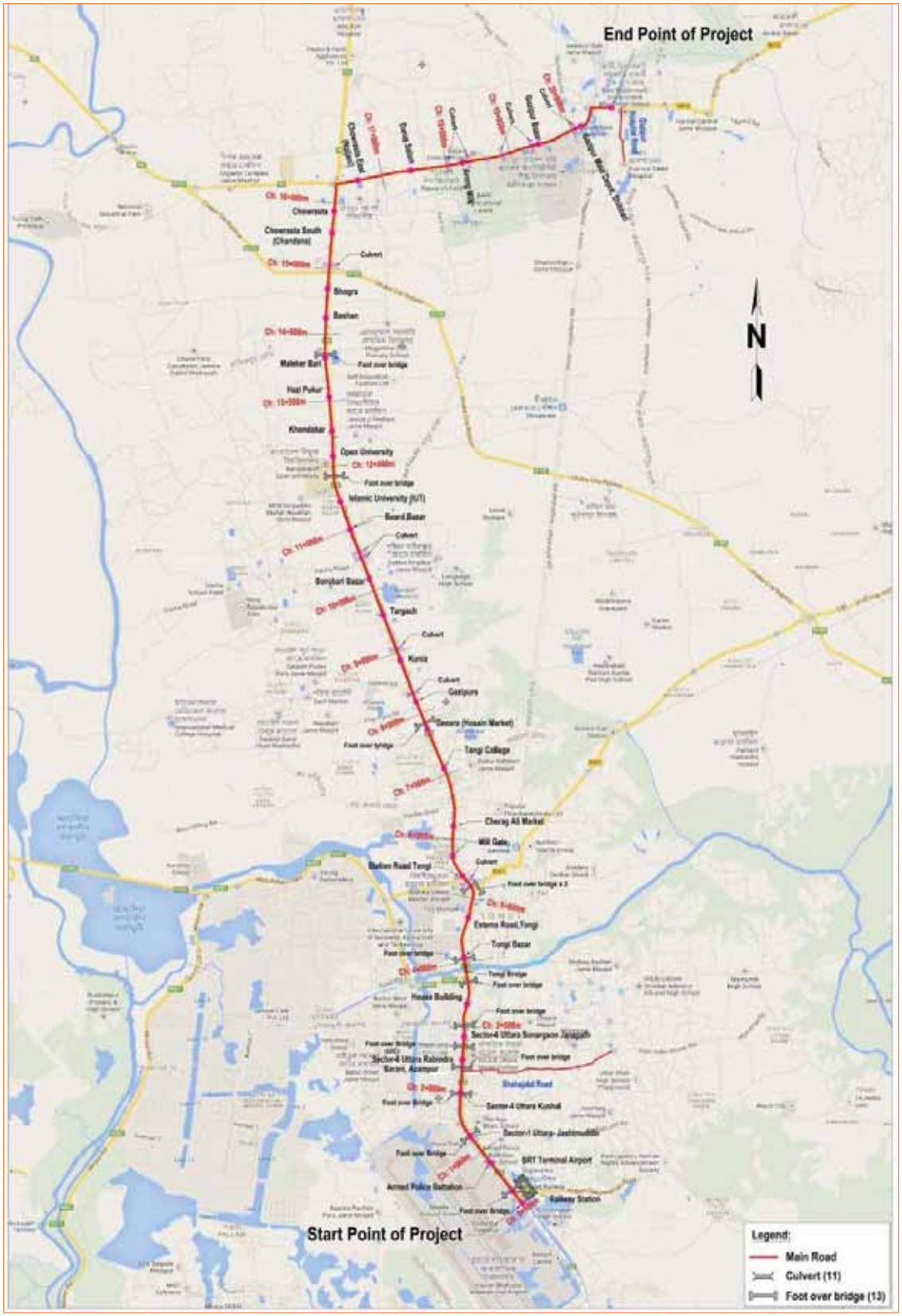
Table I.1: Contract Packages

Package No.	Component	Implementing Agency	Contract Period
C01	Upgrading and Widening of Pavement with provision of BRT Lanes and Construction of Flyovers and BRT stations including access to Stations.	RHD	30 months
C02	Upgrading and Widening of Pavement, Construction of Elevated BRT Lanes including Tongi Bridge and BRT Stations.	BBA	30 months
C03	Construction of Pavement, Drains, Pedestrian facilities and Local Markets on Both Sides of BRT Corridor.	LGED	18 months
C04	Construction and Completion of BRT Bus Depot at Gazipur.	LGED	18 months
C05	Supply and Installation of Energy Efficient Highway Lighting along the BRT corridor including the provision of Solar Panels at Bus Stations.	LGED	12 months

24. The overall physical construction period of the Project is estimated as 52 months based on the Contract Completion Date of the last of the Contracts (C02) being 18 June 2020.

25. A Location Map of the site showing the key features of the Project is presented in Figure 2.

Figure 2: Project Location Map



C. ENVIRONMENTAL CLASSIFICATION AND RESPONSIBILITIES

Environmental Category

26. The potential impacts of this project are expected to be site-specific, low-scale adverse and mostly reversible. The Project therefore is classified as category B in accordance with the Safeguard Policy Statement (SPS), 2009 of the Asian Development Bank (ADB). Accordingly, an Initial Environmental Examination (IEE) is sufficient to meet the environmental requirements as no significant impacts are envisioned. An IEE conducted in 2012 and approved by ADB was updated in 2015/16 by SMEC Consultant and is broadly consistent with the recommendations of that study. The IEE examined the environmental impacts of the project comprehensively, presented an in-depth analysis of the impacts, and proposes mitigation measures with more details than the IEE conducted in 2012.

27. However, the project is classified as a Red Category project under the Government of Bangladesh regulations requiring the preparation of a full Environmental Impact Assessment (EIA) that was subsequently prepared to enable the Environmental Clearance Certificate (ECC) to be issued as required under the Environmental Conservation Rules (ECR 1997) of Department of Environment (DoE).

Environmental Clearances

28. The initial environmental clearance certificate for the project, valid for one year, was obtained from the DOE on 22nd May 2016 which was valid up to 01 May 2017, according to their memo DOE/Clearance/5252/2013/175 following submission of the Environmental Impact Assessment to the DOE in December 2015 and a presentation made to the Environment Report Committee on 28th Jan 2016. The renewal of the Environmental Clearance Certificate was issued on 16th May 2017 which is valid up to 01 May 2018. As per their memo 22.02.0000.131.72.007.17/Renewal-01 the ECC needs to be renewed again no later than 01 May 2018.

Institutional Setup and Responsibilities

29. The Project Organisation Chart and Implementation arrangements are described in Figure I.1 of this Report. The Contractors engaged for each Contract Package will each be represented by a Contractor's Representative in Dhaka. The EPCM Consultant is SMEC and Associates represented by the Team Leader who will be delegated some of the authority of "The Engineer" under the Contracts. The responsibilities of each organisation during the various Phases of the Project are shown in Table I.2 below.

Table I.2: Environmental Responsibility Matrix

Phase	Agency	Contact	Responsibility	Deliverables
Design/ Pre-construction	Executing Agency: (RHD)	Chief Engineer		
	Implementing Agencies: (RHD, BBA, LGED)	Project Director	Preparation of EIA, EMP. Incorporation of EMP clauses into bidding documents. Reporting to ADB.	IEE, EIA, EMP, Bidding Documents
	EPCM Consultant: SMEC & Associates	Design Team Leader		
Construction	Executing Agency: (RHD)	Chief Engineer		
	Implementing Agencies: (RHD, BBA, LGED)	Project Director	Monitoring of EMP Implementation, Audit and Reporting to ADB.	Monthly, Quarterly Reports. Bi-annual Reports to ADB.
	EPCM Consultant: SMEC & Associates	Construction Team Leader		

Phase	Agency	Contact	Responsibility	Deliverables
	Contractor:	Contractor's Representative(s)	Implementation of Mitigative Measures and internal monitoring & reporting	Monthly and bi-annual Reports
	INGO: CCDB	CCDB Team Leader	Execution of RP	Monthly Reports
	NGO: tbn	Team Leader – tbn	Delivery of HIV/AIDS Awareness Program	Monthly Reports
	Independent 3rd Party RP monitor: tbn	tbn	Monitoring of execution & Compliance of RP	Inception Report, Bi-Annual Report, Final Report.
Operation / Post Construction	BRT Operator: (SPO)	Managing Director	Operation and Maintenance of BRT Corridor. Implementation of EMP Monitoring during Operation.	Annual Reports, Annual Accounts.

Key Findings in IEE Report

30. The conclusions and recommendations of the updated IEE of 2015/16 pertinent to this Environmental Monitoring report are as follows:

> *"596. This initial environmental examination (IEE) concludes that the project is expected to have impacts on water quality, air quality and noise & vibration level, loss of trees, waste/spoil disposal, hydrology/drainage, soil contamination, traffic congestion, occupational health and safety, community health and safety, socio-economic environment of PAPs and Risk of high impact accidents.*
>
> *597. The probable negative impacts are expected to be faced mostly during the construction phase. On the other hand, impacts on air quality and noise level of the project are expected to significantly decrease during the operation phase which are, at present, above the DoE specified levels. Other beneficial impacts are availability of temporary employment opportunities during construction.*
>
> *598. However, most of the impacts that are significant and adverse can be mitigated with the proposed mitigation measures with no residual impacts on the environment.*
>
> *599. Therefore, the EMP of IEE/EIA provides the specific guidelines which have been put in place to prevent or mitigate these effects. The implementing agencies (RHD, BBA and LGED) are committed to implementing these measures and have fully endorsed the IEE which is the basis for the EMP. They will also ensure that the work is carried out in an environmentally acceptable manner and the monitoring and reporting are completed in a compliant and timely fashion, acceptable to both DoE and ADB.*

D. CHANGE IN PROJECT SCOPE

31. The original scope of the project envisaged in the feasibility study and as presented in the TOR for the EPCM Consultancy Services and the revised scope as presented in the Design Report and subsequently approved for incorporation in the Bidding Documents for the various contract packages are compared in Table I.3.

Table I.3: Comparison of Original and Revised Project Scope.

Item	Original Scope	Revised Scope
1	Four dedicated BRT lanes (2+2) for the full length of the At-grade BRT corridor.	Two dedicated BRT lanes (1+1) for the length of the corridor with passing lanes at each Bus Station
2.	Two mixed traffic lanes in each direction (2+2) for full length of corridor.	Two mixed traffic lanes in each direction (2+2) for full length of corridor.
3.	Four dedicated BRT lanes (2+2) for the 4.5 km elevated section (Km 3+500 – Km 8+000)	Two dedicated BRT lanes (1+1) for the 4.5 km elevated section (Km 2+600 – Km 7+100) with passing lanes at each elevated Bus Station.
4.	Four dedicated BRT lanes (2+2) and four mixed traffic lanes (2+2) on the Tongi Bridge.	Four dedicated BRT lanes (2+2) and minimum four mixed traffic (2+2) lanes on the Tongi Bridge for through and turning traffic.
5.	On-ramp for traffic from Ashulia to Gazipur (W-N) at Tongi Bridge	On-ramp for traffic from Ashulia to Gazipur (W-N) at Tongi Bridge
6.	No provision for traffic from Gazipur to Ashulia (N-W) at Tongi Bridge.	Off-ramp for traffic from Gazipur to Ashulia (N-W) at Tongi Bridge with U-turn provision under elevated section.
7.	No provision for NMT or pedestrians on the Tongi Bridge.	Two lanes provided (1+1) for NMT and pedestrians on the Tongi bridge
8.	Separate Flyover at Sonargaon Road before the start of Elevated Section.	Elevated section extended to incorporate Flyover at Sonargaon Road to avoid "roller-coaster" effect.
9.	Bus Stations at either side of Turag River.	One Bus Station provided at Abdullahpur where demand has been identified.
10.	31 Stations and 2 Terminals	23 Station and 2 Terminals
11.	Underpass access to Bus Stations	Access to At-grade Bus Stations by Pedestrian Foot Overbridges (14 no.) and at-grade (4 no.). Access to Elevated Bus Station at-grade to central median area (7 no.)
12.	Bus Depot provided adjacent to Gazipur Terminal Station.	Bus Depot not provided at Gazipur Terminal, but in BTCL land near Km 17+450.
13.	Airport Terminal located between the existing ROW and the Airport Railway Station on elevated level with elevated approach from ROW.	Airport Terminal located at-grade in central median area between two flyovers provided for through traffic at the Airport Intersection.

32. These changes were evaluated and agreed after extensive consultations with the Client and EPCM consultant including discussions with the operational design and business model (ODBM) consultant using information provided from the Operational Plan for the BRT.

33. Revised Costs and Estimates were prepared with quantities included in the BOQs for the Bidding Documents.

34. A Request for additional financing of US$129.94 million was made to the ADB on 6th April 2016.

Revised DPP

The cost for the implementation of the EMP was included in the Contract and the proposed Revised Development Project Proforma/Proposal (RDPP).

E. PROJECT STATUS

Project Status at 31 December 2017

Design

35. The following activities were carried out during the Design Stage enabling the detailed design of four of the contract packages incorporating the various components of the Project to be completed in 2015.

- Topographic Surveys, Geotechnical Investigations
- Traffic Counts and Surveys
- Axle Load Surveys
- Pavement Condition Surveys
- Hydrological Investigations
- Bridge Condition Surveys
- Land Acquisition Plans
- Utility Surveys and Relocation Requirements
- Resettlement Plan
- Baseline Environmental and Social Surveys
- EIA and IEE preparation
- Stakeholders Meetings, Public Consultations, Design Framework and Final Design Workshops

Procurement

36. Based on the completed designs, tender documents were prepared and issued to contractors and the status of the Procurement process up to the end of December 2017 is summarised in Table I.4.

Table I.4: Status of Procurement of Contract Packages at 31 December 2017

Component	C01	C02	C03	C04	C05
	At Grade Section and Flyovers	Elevated Section incl Tongi Bridge	Local Roads and Markets	Gazipur Bus Depot	Highway Lighting
Implementing Agency	**RHD**	**BBA**	**LGED**	**LGED**	**LGED**
Bid Documents Approved	18 Nov 15	15 May 16	07 Apr 16	03 Oct 14	
Invitation to Bid	19 Nov 15	19 May 16	10 Apr 16	25 Feb 15	
Prebid Meeting	08 Dec 15	14 Jun 16	03 May 16	30 Mar 15	
Bid Closing	18 Jan 16	04 Aug 16	05 Jun 16	30 Apr 15	
Financial Opening	18 Jul 16	29 Mar 17	14 Feb 17	27 Sep 15	
Letter of Acceptance	10 Nov 16	13 Sep 17	13 Sep 17	25 Jan 16	
Contract Award	01 Dec 16	19 Oct 17	28 Sep 17	08 Feb 16	
Engineer's Estimate (BDT Mill)	9,149.923	12,878.624	1,196.901	300.243	
Agreed Contract Price (BDT Mill)	8,553.750	9,351.298	1,583.183	325.572	
Notice to Commence	13 Apr 17	15 Dec 17	10 Dec 17	23 Feb 16	
Contract Time for Completion	30 months	30 months	18 months	18 months	
Original Completion Date	17 Oct 19	18 Jun 20	01 Jun 19	21 Aug 17	

Component	C01	C02	C03	C04	C05
	At Grade Section and Flyovers	Elevated Section incl Tongi Bridge	Local Roads and Markets	Gazipur Bus Depot	Highway Lighting
Extension of Time				154 days	
Current Completion Date				22 Jan 18	

Construction

a) Construction of At-grade section including 6 Flyovers. – C01

37. The At-Grade Section Contract (C01) was signed on 01 December 2016 with the Contractor, China Gezhouba Group Co. Ltd (CGGC). The Notice to Commence for the Works was issued on 13 Apr 2017 following the Ground-Breaking Ceremony presided over by the Minister of Road Transport and Bridges and attended by Local Representatives on 31 Mar 2017 at the site of the U-Turn Flyover at Km 8+500.

38. The Contractor commenced mobilisation involving survey works and made submissions of the Draft Construction Programme, Traffic Management Plan, Environmental Management System and other methodologies for review and approval. Initial activities on site involved the establishment of the Contractor's own plant yard, preparation for construction of the Engineer's Office building, clearing of the area for the Gazipur Terminal Station and for the drainage near the U-turn Flyover at Ch 8+200 and the preparation for subsoil investigations and pilot piles for the Gazipur Interchange. The progress achieved on the various activities up to the end of 31 December 2017 is summarised in Table I.5.

Table I.5: Summary of Progress Status – C01

Notice to Commence:	13 Apr 2017	Contract Period:	917 days
Elapsed Time	263 days	Completion Status (Time)	28.7%

No.	Activity	Physical Status At 31 Dec 2017
1	Pavement Widening and Rehabilitation	0.0%
2	Drainage System and Culverts	0.21%
3	Bus Lanes	0.0%
4	Airport Flyovers	0.0%
5	Jasimuddin Flyover	0.0%
6	U-turn Flyover #1	0.03%
7	U-turn Flyover #2	0.03%
8	Vogra Flyover	0.0%
9	Joydepur Chowratsta Interchange	0.21%
10	Airport Terminal Station	0.0%
11	Gazipur Terminal Station	0.0%
12	Bus Stations	0.0%
13	Pedestrian Foot Over Bridges	0.0%
14	Medians, Kerbs, Footpaths, Kerbing & Grassing	0.0%

39. Overall Progress of the Project at 31st December 2017 was assessed as 0.48% against a revised target of 4.5% indicating a lag of 4.02%. The achieved progress of the Contractor was based on the completed quantities of physical works executed under the above Items.

b) Construction of Elevated BRT Lanes including Tongi Bridge and BRT Stations. – C02

40. The Elevated Section Contract (C02) was awarded to Jiangsu Provincial Transportation Engineering Group Co. Ltd (JTEG) on 13 Sep 2017.

41. The Contract was signed on 19 Oct 2017 on receipt of the Performance Guarantee and following the Pre-Award Meeting held on 17 Oct 2017. The Notice to commence was issued on 15 Dec 2017.

c) Construction of Pavement, Drains, Pedestrian facilities and Local Markets on Both Sides of BRT Corridor. – C03

42. The Local Roads and Markets Contract (C03) was awarded to Weihai International Economic & Technical Cooperative Co. Ltd (WIETC), China on 13 Sep 2017.

43. The Contract was signed on 28 Sep 2017 on receipt of the Performance Guarantee and following the Pre-Award Meeting held on 27 Sep 2017. The Notice to commence was issued on 10 Dec 2017.

d) Construction of Bus Depot at Gazipur – C04

44. The Bus Depot Contract (C04) was signed on 08 February 2016 with the Contractor SEL-UDC commencing site activities on 23 February 2016 after the site was formally handed over by the Employer LGED. The progress achieved on the various activities up to the end of 31 December 2017 is summarised in Table I.6.

Table I.6: Summary of Progress Status – C04

Notice to Commence:	23 Feb 2016	**Contract Period:**	700 days
Elapsed Time	677 days	**Completion Status (Time)**	96.7%

No.	Activity	Physical Status	
		At 30 Jun 2017	At 31 Dec2017
1	Site Earthworks and Drain Relocation	93.7%	97.9%
2	Boundary Wall	25.4%	43.1%
3	Main Entry Gate and Guard House	28.3%	48.9%
4	Administration and Maintenance Building	33.6%	45.7%
5	Bus Parking Area and Footpaths	9.3%	12.8%
6	Fuel Filling Station and Storage Tanks	---	0.0%
7	Bus Washing Area	---	5.9%
8	Effluent Treatment Plant	2.0%	9.8%
9	Electrical Room and Substation	26.3%	38.5%
10	Waste Materials Building	73.1%	75.4%
11	Drainage System	21.1%	75.2%
12	Access Road to Depot	36.0%	43.8%
13	Water Reservoir and Fire System	3.5%	48.3%
14	BTCL Complaints Centre and Guard House	50.4%	64.7%

45. Overall Progress of the Project at 31st December 2017 was assessed as 45.23% against a revised target of 89.82% indicating a lag of 44.59%. The achieved progress of the Contractor was based on the completed quantities of physical works executed under the above Items.

46. Progress has been constrained by slow mobilisation and with many activities then unable to proceed due to the wet conditions during July to September 2017.

47. Activities continued in several areas including drainage system, embankment works in the main depot parking area and on the access road involving the preparation of subgrade layers and subbase works. Concrete works continued for the Admin & Maintenance Building, the Boundary Wall and the BTCL Complaints Centre, Main Entry Gate & Guardhouse, the Electrical Sub-Station and the Drainage System including the manufacture of pipes and their installation with approx. 1,249 m^3 of concrete supplied and placed during the period.

F. Environmental Mitigation and Monitoring Requirements

Environmental Management Plan

48. In the both the EIA and the IEE separate EMPs were prepared for the At-grade section, the Elevated section, the Bus Depot and the Local Roads components. The recommendations of the EMPs were incorporated into the detailed design and the tender documents and have then became a part of the civil works contracts.

49. The EMP for all the Contracts was included in the Bidding Documents and was subsequently included Contract Documents.

50. The Construction Contracts also contain a number of specific environmental and occupational health and safety clauses that the Contractors must also comply with (given that they have signed the contract which included these clauses).

Environmental Management System

51. In Section 1 of the Technical Specifications for each of the Contracts the Contractors are required to prepare an Environmental Management System (EMS), that will set out the means by which the Environmental Management provisions will be supervised, monitored and audited to ensure compliance with the principles and objectives of the Environmental Management Plan (EMP) at all times.

Sampling Program

52. The extent of the impacts of environmental pollution related to surface water, ground water, soil quality, air quality, noise measurement and vibration level will be determined in quantitative terms by sampling a range of related parameters. Based on these results the mitigative measures provided for in the EMP can be adjusted accordingly. The field sampling work has been specified for the construction and operating period.

53. The sampling program for the At Grade Section and Flyovers, Elevated Section including Tongi Bridge, Local Roads and Kitchen Markets and the Bus Depot is presented in Appendix 6 and is summarised in Table I.7, I.8 and I.9 respectively in below

Table I.7: Sampling Program Summary for At Grade Section and Flyovers*

Sl.	Impact	Construction		Operating Period		Parameter
		Frequency	Dur'n	Frequency	Dur'n	
1	Air Quality	Twice/yr	2.5 yrs	Twice/yr	3 yrs	H_2S, SOx, NOx, CO, O_3, O_2, CO_2, TVOC, SPM, PM_{10}, Humidity, Wind direction,

Sl.	Impact	Construction		Operating Period		Parameter
		Frequency	Dur'n	Frequency	Dur'n	
						Wind speed, Temperature
2	Dust	Regularly		---	---	Dust Control
3	Noise Level	Twice/yr	2.5 yrs	Twice/yr	3 yrs	dB(A)
4	Vibration Level	Twice/yr	2.5 yrs	Twice/yr	3 yrs	Acceleration, velocity and displacement
5	Surface Water	Quarterly	2.5 yrs	Twice/yr	3 yrs	Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P and Oil & Grease
6	Ground Water	Twice/yr	2.5 yrs	Twice/yr	3 yrs	Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P
7	Traffic Safety	-------	-------	Full Operation Period		Accident number
8	Soil Pollution	Twice/yr	2.5 yrs	Once/yr	---	pH, As, Pb, Hg, Cd, Cr, Zn
9	Soil Erosion	Monthly		---	---	Visual Check
10	Drainage Congestion	Weekly during monsoon		---	---	Regular Inspection. Visual check of plan and actual implementation.
11	Wildlife	Quarterly		Quarterly	---	Wildlife habitat and movement
12	Fisheries	Annually		End of first year of operation	---	Impact of Fish productivity, breeding and spawning.
13	Waste Management	Weekly		---	---	Storage, transportation, disposal, handling of hazardous waste.
14	Health & Safety	Regularly		---	---	Food and accommodation, Water supply and effluent, First Aid Kit.

* The sampling follows the methodology provided in the Bangladesh national standard methods for monitoring pollutants. Other associated standards are national environmental quality standards and pollutant emission standards.

Table I.8: Sampling Program Summary for Elevated Section including Tongi Bridge*

Sl.	Impact	Construction		Operating Period		Parameter
		Frequency	Dur'n	Frequency	Dur'n	
1	Air Quality	Twice/yr	2.5 yrs	Once/yr	3 yrs	H_2S, SOx, NOx, CO, O_3, O_2, CO_2, TVOC, SPM, PM_{10}, Humidity, Wind direction, Wind speed, Temperature
2	Dust	Regularly		---	---	Dust Control
3	Noise Level	Twice/yr	2.5 yrs	Once/yr	3 yrs	dB(A)
4	Vibration Level	Twice/yr	2.5 yrs	Twice/yr	3 yrs	Acceleration, velocity and displacement
5	Surface Water	Quarterly	2.5 yrs	Once/yr	3 yrs	Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P and Oil & Grease.
6	Ground Water	Twice/yr	2.5 yrs	Once/yr	3 yrs	Temperature, Turbidity, pH, TDS, EC,

Sl.	Impact	Construction		Operating Period		Parameter
		Frequency	Dur'n	Frequency	Dur'n	
						TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P
7	Riverbed Material	Twice/yr	2.5 yrs			As, Pb, Cd, Cr, Hg, Fe, pH
8	Traffic Safety	-------	-------	Full Operation Period		Accident number
9	Soil Erosion	Monthly		---	---	Visual Check
10	Drainage Congestion	Weekly during monsoon		---	---	Regular Inspection. Visual check of plan and actual implementation.
11	Wildlife	Quarterly		Quarterly	---	Wildlife habitat and movement
12	Fisheries	Annually		At the beginning and end of first year of operation	---	Impact of Fish productivity, breeding and spawning.
13	Waste Management	Weekly		---	---	Storage, transportation, disposal, handling of hazardous waste.
14	Health & Safety	Regularly		---	---	Food and accommodation, Water supply and effluent, First Aid Kit.

* The sampling follows the methodology provided in the Bangladesh national standard methods for monitoring pollutants. Other associated standards are national environmental quality standards and pollutant emission standards.

Table I.9: Sampling Program Summary for Bus Depot, Local Roads and Kitchen Markets*

Sl.	Impact	Construction		Operating Period		Parameter
		Frequency	Dur'n	Frequency	Dur'n	
1	Air Quality	Twice	1.5 yrs	Monthly		H_2S, SOx, NOx, CO, O_3, O_2, CO_2, TVOC, SPM, PM_{10}, Humidity, Wind direction, Wind speed, Temperature
2	Dust	Regularly		---	---	Dust Control
3	Noise Level	Twice/yr	1.5 yrs	Monthly	---	dB(A)
4	Vibration Level	Twice/yr	1.5 yrs	Twice/yr	3 yrs	Acceleration, velocity and displacement
5	Surface Water	Twice/yr	1.5 yrs	Twice/yr	3 yrs	Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P
6	Ground Water	Twice/yr	1.5 yrs	Twice/yr	3 yrs	Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P
7	Soil Pollution	Twice/yr	1.5 yrs	---	---	pH, As, Pb, Hg, Cd, Cr, Zn
8	Soil Erosion	Once during rainy season		---	---	Visual Check
9	Drainage Congestion	Weekly during monsoon		---	---	Regular Inspection. Visual check of plan and actual implementation.
10	Wildlife	Quarterly			---	Wildlife habitat and movement

Sl.	Impact	Construction		Operating Period		Parameter
		Frequency	Dur'n	Frequency	Dur'n	
11	Fisheries	Annually			---	Impact of Fish productivity, breeding and spawning.
12	Waste Management	Weekly		---	---	Storage, transportation, disposal, handling of hazardous waste.
13	Health & Safety	Regularly		---	---	Food and accommodation, Water supply and effluent, First Aid Kit.

* The sampling follows the methodology provided in the Bangladesh national standard methods for monitoring pollutants. Other associated standards are national environmental quality standards and pollutant emission standards.

EMP Related Activities

54. The Donor Missions related to the Project and the EMP related issues are summarized as:

ADB Consultation Mission on 18 July and 09 November 2017. During the mission site inspections were carried out by the Social and Environmental Safeguards Teams of the proposed work sites and of works in progress on the At Grade Section & Flyovers, and Gazipur Bus Depot. Discussions on various issues were held at the meetings with ADB and the Client prior to site visit.

II. ENVIRONMENTAL MONITORING

A. PRE-CONSTRUCTION STAGE

55. The implementation status of the mitigation measures to be addressed during the pre-construction stage of the project is shown in the table below for comparison with the designed mitigation measures stated in the EMP. In summary the mitigation measures during this stage involved ensuring that the contract documentation addressed all relevant actions subsequently required to be implemented by the Contractor in the execution of the works and that the Contractor developed and presented his various method statements, plans, etc. accordingly for review and approval before commencing the works. These measures have all been addressed effectively and further monitoring and reporting is not required as the Contract is now into the Construction Stage.

Table II.1 Mitigation Measures Implemented in At Grade Section including Flyovers Construction Site

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
IMPLEMENTATION PHASE: PRE-CONSTRUCTION			
Provision of Early Training	Awareness and Training on environmental protection aspects relevant to good construction practices may avoid construction period impacts.	EPCM Consultant and RHD to provide training as part of the overall awareness and training programs to be delivered before construction begin.	
Climate Change	Changes in climate and long-term impacts on the environment.	Consider potential impacts from extreme climate change scenario in designing bridge and culverts.	Complied
Topography	• Change in topography due to construction-related structures such as bridges, flyovers, stations etc.; and • Visual changes to topography.	• Tree planting for street beautification as per the Tree Cutting and Replantation Plan (TCRP) developed by RHD.	Contractor assures the future afforestation as compensation
Land Acquisition	• Acquisition of 2.25 ha land; • Resettlement of Affected Persons (APs).	• All efforts have been made in BRT design to reduce land acquisition; • Careful alignment and route selection by the design team to minimize resettlement; • Developing proper and adequate compensation package for affected persons; • Prior to site works, payment of compensation to affected people based on the Resettlement Plan.	Complied
Loss of Structures (Dwellings, Commercial Buildings and Industrial Structures)	A total 2,482 of structures will be affected through strip-taking along the project corridor where widening is required.	• Compensation for the loss of land, house, trees, structures, crops, wage/income to be included in the Resettlement Plan. • In case of relocation provision of similar or better living conditions for project affected persons (PAPs).	
Construction activities near Educational Institutions, Religious and, Culturally Sensitive Structures	• Educational, religious, and cultural institutions in the project area will be directly and indirectly affected from the project activities. • The monument "Jagroto Chowrongi' will have to be relocated or protected.	• The project implementation should take in to consideration construction of the alignment or making provision of allocating financial resources for rehabilitation of the Madrassa, Mosque and the educational institution. • Provision should be made for two rows of trees between RoW of the alignment and the sensitive	

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		structures, and suitable noise barriers to absorb the noise. • The sculpture should be dismantled with care and installed in an appropriate location selected by DC, Gazipur or protected during construction.	
Damage to Public Utilities	Utility lines will have to be moved disrupting services	• Provision in the design and budget for the relocation of the existing utility infrastructures, wherever required; • All public utilities (e.g. water/gas pipes, power/telephone lines, mobile tower likely to be affected by the proposed project road expansion will be relocated before the actual commencement of the construction work. • Informing all hospitals, schools, places of worship, and affected communities well in advance; • Utilities will only be removed and relocated with proper agency approvals and permission; • If utilities are damaged during construction, it will be reported to the Consultants and utility authority and repairs will be arranged immediately at the contractor's expense. • Reconnection of utilities will be completed at the shortest practicable time before construction commences.	Complied
[2]Tree Cutting	• Around 4728 trees including 230 large, 1909 medium, 1904 small trees and 685 saplings will be cut along the RoW and within the bus depot site for site preparation.	• Minimize the tree cutting by selecting road widening option based on technical • Trees should not be cut prior the permission from Forest Department. • Afforestation will be done at the ratio of 1 (cut):2(new planting). • A total of 9456 sapling trees will be planted as per TCRP developed by RHD. • For social forestry, afforestation ratio will be as per the consultation with tree owner. • Indigenous trees most suited to the tract will be planted; • An awareness campaign targeted on the neighborhood affected persons will be carried to popularize tree planting and saplings should be provided to interested parties;	Contractor assures the future afforestation as compensation

[2] Size of the trees refer here to circumference of the trees which are: Large=5' and Above; Medium= 2'7''-5'; Small= 7''-2'7''; Saplings= <6''

Table II.1 Mitigation Measures Implemented in Bus Depot Construction Site

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
IMPLEMENTATION PHASE: PRE-CONSTRUCTION			
Provision of Early Training	Awareness and Training on environmental protection aspects relevant to good construction practices may avoid construction period impacts.	EPCM Consultant and LGED to provide training as part of the overall awareness and training programs to be delivered before construction begin.	
[3]Tree Cutting	• Around 586 trees including 6 large, 57 medium, 260 small and 263 saplings will be cut down within bus depot site due to site preparation and construction activities resulting in potential ecological and economic loss.	• Prohibit cutting of trees for firewood and for use in project. Gas cylinders to be used for fuel at the camp for cooking purposes. Cutting of trees/bushes for fuel not to be allowed. • Invasive species will not be introduced into new environment. • When construction work is completed, trees and understory vegetation must be planted, in order to help the cleared areas in an effort to attract some wildlife such as birds. Plant at least two trees for every one tree cut.	Contractor assures the future afforestation as compensation
Loss of Structures and Public Utility	• The house within proposed bus depot site will be relocated. • Inconvenience caused by disruption of public utility (Power/ Telephone lines).	• The householders will be included in the RAP for compensation and relocation; • Provision in the design and budget for the relocation of the existing utility infrastructures wherever required.	Complied

B. CONSTRUCTION STAGE

56. The implementation status of the mitigation measures to be addressed during the construction stage of the project is shown in the tables below for comparison with the designed mitigation measures stated in the EMP. In summary the mitigation measures during this stage involve ensuring that the Contractor develops and presents his various method statements, plans, etc. accordingly for review and approval before commencing the works, that relevant actions required to be implemented by the Contractor in the execution of the works are addressed and that the measures have all been addressed effectively.

57. Those activities related to the Implementation/Operations stage of the Project, whilst included in the table are not applicable at this stage.

[3] Size of the trees refer here to circumference of the trees which are: Large=5' and Above; Medium= 2'7''-5'; Small= 7''-2'7''; Saplings= <6''

At Grade Section including Flyovers (C01)

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
IMPLEMENTATION PHASE: CONSTRUCTION STAGE			
Changes to Hydrologic Regime	• Temporary drainage blockage, especially at bridge, culverts, service areas, and construction sites. •	• Provision of drains of sufficient sizes to take design flows. • Wastes and dredged spoils should not be disposed near any water body. All waste depending on its characteristics, should be disposed of in a controlled and following local requirements. • Minimize alterations in the surface drainage pattern as much as possible.	Fully complied
Drainage changes	• Drainage congestion due to waste/sediment disposal and construction of road corridor.	• Regular cleaning of channels to avoid choking. • Adequate cross drainage structures will be provided to easily drain off water to canals and other lowland areas; • Ensure that storm water drains and highway drainage systems are periodically cleared to maintain storm water flows during construction. • All irrigation canals along the alignment will be clearly marked on the ground to prevent accidental dumping of fill materials into these canals.	Partially complied
Soil Erosion and Siltation	• Soil erosion due to construction activities, earthworks, cut and fill operations and from stockpiles. • Erosion and subsequent deposition in the adjacent land.	• Adopt good construction practices. • Adjusting construction schedule for bridge during non-monsoon season. • Turfing of road shoulders to protect slopes. • Earth stockpiles to be provided with gentle slopes. • Ensuring vegetation on road embankments and road cuttings with fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization. • Using stone pitching or riprap at appropriate places especially around overpasses, bridge, culverts.	Fully complied
Soil Compaction and Contamination	• Compaction of soil due to movement of vehicles and equipment • Contamination of soil due to leakage/spillage of oil, bituminous and non-bituminous debris	• Construction vehicles, machinery, and equipment to be stationed in the designated RoW to avoid compaction. • Haulage routes to be designated along fallow and consolidated soil areas to reduce compaction of arable land. • Fuel storage and filling to be undertaken in areas with concrete surfacing and bunds and interceptor traps • Oil interceptors to be provided at	Fully complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		wash down and refuelling sites • Oil and grease spill and oil-soaked materials will be sold off to authorized recyclers.	
Riverbed Sediment	• Disturbance of riverbed sediments due to dredging activities; • Contamination of bottom sediments by accidental spilling of bituminous materials and other petro-chemicals.	• Prevent construction debris from entering drainage or irrigation canals; • Construction work close to river to be minimized especially during monsoon season; • Conduct regular riverbed sediment quality monitoring according to the determined sampling schedule. • Train construction workers on safe handling of petro-chemicals to prevent spillage or leakage to the river or other water bodies; • Restrict disposal of any construction waste into the river or nearby water bodies;	Fully complied
Topsoil removal	• Removal of top soil for construction outside the RoW. • Compaction of topsoil. • Loss of top soil by wind and water erosion. • Covering of top soil by project works.	• The stockpile slope to be no steeper than 2 (H):1 (V) to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Use stripped topsoil to cover all disturbed areas and along the proposed tree plantation sites. • Rip ground surface prior to the spreading of topsoil, • Limit equipment and vehicular movements to within the approved construction zone. • Remove unwanted materials from topsoil such as roots of trees, rubble and waste etc.	Fully complied
Air Quality changes	• Dust generation due to construction activities and transport of construction materials. • Emissions from vehicles, equipment and machinery.	• Vehicles transporting construction material to be covered; • Construction equipment to be maintained to a good standard and discouraging idling of engines. • Machinery emitting visible smoke to be banned from construction sites; • Contractor to prepare a dust suppression program detailing action to be taken to minimize dust generation (e.g. spraying of roads with water), and the equipment to be used. • Equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce dust emissions;	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		• Locate asphalt and crushing plants away from residential areas and social infrastructure such as hospitals, mosques, schools and madrasas. (Refer to Annex 2 for locations of these). Clearance should be at least 500 m and take into account the prevailing wind direction. • Dust masks to be provided to workers where dust hazards exist; • Proper dust collection and control systems to be installed at crushers; • Air quality monitoring to be carried out as per the schedule in the environmental monitoring plan.	
Noise and Vibration	• Noise from construction vehicles, equipment and machinery. • Vibration caused by construction activities.	• Use of modern plant and equipment with appropriate muffling devices. • All powered mechanical equipment and machinery to be fitted with noise abating gear such as mufflers for effective noise control, in compliance with DoE regulations. • Construction operations to be restricted to 0700 to 1800 hours. • Locate rock crushing, concrete mixing and material shipment yards away from residential areas, schools, colleges and hospitals. • Install temporary noise barriers near sensitive locations such as schools, religious places and hospitals (Refer to Annex 2 for locations) • Providing the construction workers with suitable hearing protection as ear cap, or earmuffs etc. • Surround the piers during construction with an air bubble curtain system or coffer dam. • Use a smaller hammer to reduce the sound pressure. The sound produced in pile driving has a direct relationship to the force used to drive the pile. A smaller hammer will have less force on the pile therefore, producing less sound. • Noise and vibration level monitoring to be carried out as per the schedule in the environmental monitoring plan.	Partially complied
Changes to Topography and Landscape	• Visual intrusion from large piles of embankment and construction materials obstructing views; • Land degradation due to excavation in borrow area.	• Material stockpiles will be removed as soon as work is completed and the area re-landscaped • Top soil to be preserved for rehabilitation of borrow pits • Borrow pits to be either closed or converted to ponds at the completion of work; • Construction wastes to be used in construction activities;	Fully complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
Siting of Construction and Labour camps, plans and equipment and Workshops	• Loss of plantation and vegetation; • Permanent physical and visual impact on the area; • Health risk of the workers. • Social disturbance to nearby community.	• Construction camps, plant and equipment and workshops to be located away from sensitive areas and not within 500 m of existing settlements (Refer to Annex 2 for chainage km) unless agreed to after consultation with local people; • Provide adequate housing for all workers at the construction camps and establish clean canteen/eating and cooking areas; • Camp site will be cleaned up to the satisfaction of the local community after use; • Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside to prevent proliferation of mosquitoes. • Briefing and/or on-site training for the contractor's workers on the environmental requirement of the project and the implementation of mitigation measures; • Minimize vegetation loss while making site arrangements for construction camps and other facilities; • Good sanitation facilities to be provided for the camps; • Wastewater from contractors' workshops and equipment washing yards will be passed through gravel/sand beds, and all oil/grease contaminants will be removed, before discharging. Oil and grease residues will be stored in drums awaiting disposal in line with the agreed waste management plan, and consistent with national and local regulations; • Solid waste must not be dumped, buried or burned at or near the project site, but will be disposed of at the nearest sanitary landfill or site having and complying with the necessary permits; • The sites for camps and associated facilities will be rehabilitated after completion of the project. • HIV/AIDS awareness and prevention program will be implemented in line with social plans under the project. • Construction workers should be under instruction not to be involved/ interfere in social issues of neighbourhood communities.	Fully complied
River protection and bridge construction	• Movement of barges and other construction vessels and bridge construction activities within the river will interfere with local	• In bridge repair and demolition, the bridge structure will not be dropped into the river, but alternative means will be used to	Fully complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
	navigation and interrupt the river traffic; • Silt and Contaminated runoff reaching river water • Underwater noise impacts on fisheries and other aquatic life.	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 the bridge could be lowered. • Rocks and stones will be disposed of so as not to block rivers and streams • Cofferdams, silt fences, sediment barriers, or other devices will be used as appropriate based on the design to prevent spreading 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. • 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. • If hydraulic hammer are to be used the impact of pile driving cannot be avoided. However, the force of the hammer blow can be controlled with hydraulic hammers, and reducing the impact force will reduce the intensity of the resulting sound.	
Surface Water Bodies	• Loss of surface water bodies and impact on fish.	• Avoid or minimize damage to water channels; • Avoid or minimize use of the riverbed materials. • No bituminous or hazardous materials to be used for filling of water bodies; • In case of accidental obstruction or damage, drainage ditches and ponds will be cleaned or repaired immediately.	Fully complied
Surface Water Quality	• Contamination of surface water by disposal of construction waste. • Pollution of domestic water supplies.	• The workforce to be trained in proper methods for storage and handling of materials and chemicals; • Work camps and work sites to be provided with toilets and septic tanks; • Proper drainage system with sedimentation ponds and oil separators to be provided to cope with the rain water and oil spills; • Stockpiled materials will be covered to reduce silt in runoff; • No stockpiling or borrow sites less than100 m from a water body; • Washing of machinery and vehicles	Fully complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		in surface waters to be prohibited; • Sealed washing areas will be provided and wastewater will be collected in a sedimentation/ retention pond for treatment prior to release; • Work in rivers will be scheduled during dry season, and work duration will be as short as possible; • Conduct regular water quality monitoring according to the recommended sampling schedule; • Prevent construction debris from entering drainage or irrigation canals; • Construction work close to ponds or other water bodies to be minimized especially during monsoon season; • Wastes to be collected, stored and taken to approve disposal sites.	
Groundwater Quality	• Depletion of groundwater table due to excessive withdrawal. • Contamination of underground water table from leachate of construction waste.	• Assess availability of water and evaluate impact on use of local water resources to ensure that water utilization for project will not deplete local village supplies. • Arrangements for safe drinking water to be made prior to start work. • Water for consumption to be supplied only after adequate analysis and requisite treatment. • Train workers on the need for judicious use of freshwater resources; • Water reserves to be protected from contamination such as construction and oily waste. • Maintain close liaison with local communities to ensure that any potential conflicts related to common resource utilization for project purposes are resolved quickly.	Partially complied
Materials Exploitation and Management of Quarry and Borrow areas (source of soils)	• Land use change due to borrowing of earth. • Loss of productive top soil. • Chronic erosion and siltation • Deterioration of air quality as well as visual and aesthetic intrusion.	• Update draft materials management plan or MMP (which will also include a mass haulage chart) prepared by EPCM CONSULTANT during detailed design phase. Updated plan to be approved by EPCM Consultant 1 month prior to commencement of works. Contractor to agree and implement MMP provisions. • Balance cut-and-fill requirements to minimization impacts from extraction of aggregates. • Procure materials only from DoE authorized quarries and borrow sites. • If the contractor will operate the	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		quarry site, required environmental permits will be secured prior to operation of quarry/borrow areas. • Use quarry with highest ratio between extractive capacity (both in terms of quality) and loss of natural state. • Use borrow areas in fallow and non-agricultural land. • Do not use quarries in areas of natural woodland or near rivers which provide food and shelter for birds and other animals. • Quarry sites for collection of soils (sand) for fill materials will be located in Tongi River at minimum 50 m downstram of the Tongi Bridge where quality of river bed materials (heavy metals such as Zn, Cd, Cr, As, Hg etc.) has been tested & found within standard of USEPA (see page 239, Annex—3). done during design stage in 2014 . Once quantity of required soils is very small (about 9000m3), so sands should be collected by mini dredger from the river bed and transport to the filling site by pipes. Distance from the river bank and dredging area should not be less than 20m and depth of dredging from the river bed should not be exceeded 2m. • Ensure 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. • Upon completion of extraction activities, quarry and borrow pits will be stabilized and rehabilitated. Before stabilization these will be dewatered and fences will be installed, as appropriate, to minimize health and safety risks.	
Waste generation: General Construction Waste Disposal, Spoil Disposal and Hazardous Waste Disposal	• Unhygienic conditions, health risk to workforce and general public at and around the camp site; • Visual intrusion from large piles of spoil disposal obstructing views; • Drainage congestion due to waste disposal; • Contamination by Oil and lubricants from vehicle maintenance areas;	• Update the draft Waste Management and Spoil Disposal Plan (WMSDP) prepared by the EPCM consultant one month before construction to cover all aspects of waste storage, disposal, and accidental spills to be approved by EPCM Consultant 1 month prior to commencement of works. Contractor to implement WMSDP provisions. • Areas for disposal should be finalized through a mutual agreement in between landowner and DoE; • Disposal areas to be rehabilitated monitored, catalogued, and	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		marked. • Segregation of wastes will be observed. • Recyclables will be recovered and sold to recyclers. • Solid and liquid wastes will not be disposed of in rivers and streams or other natural drainage path; on fragile slopes, flood ways, farmland, forest, religious or other culturally sensitive areas, or areas where a livelihood is evolved. • Spoils will be disposed of in disused quarries and abandoned borrow pits where practicable; • Disposed spoils 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 practices; • Waste disposal should not cause sedimentation and obstruction of regular drainage, or damage to agricultural land and densely vegetated areas. • Waste disposal sites will be located at least 50 m from surface watercourses and will be protected from runoff by ensuring mild slopes and grassing. • Sanitary wastes generating from staff and labour camps to be disposed of in an environmentally friendly manner, i.e. provision of septic tank etc. for toilet wastes. • 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 in local waste disposal sites. • Hazardous waste to be transported to nearby incineration facility; • It should be ensured that all storage containers are in good condition with proper labeling; • Containers should be checked for leakage and necessary repairs undertaken or replaced. • Equipment/vehicle maintenance and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas will be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency. • All areas intended for storage of hazardous materials will be	

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulation. • The contractor will identify named personnel in the management plan/CEMP in charge of the sites, and ensure they are properly trained to control access to these areas; entry will be allowed only under authorization.	
Operation of Asphalt plant Rock crushers, and use of Bitumen	• Air pollution and dust generation. • Spills from Bitumen plants may contaminate surface water quality.	• Undertake precautionary measures for reducing dust emissions from diesel generator sets, hot mix plants, crushers and batching plants. • Provide adequate stack height and dust extraction systems for the hot mix plants. • Ensure water spreading to suppress dusts particularly during dry and windy weather. • Provide grass cover immediately after completion of final earth surface along with watering until they grow and survive. • Tree plantation on the slopes all along the main corridor and other areas of feeder roads, construction yards, construction camps, to reduce the effect of emission of dust and pollutants on the adjacent/nearby communities. • Disposal of Bitumen will not be allowed to enter either running or dry streambeds and nor will be disposed of in ditches or small waste disposal sites prepared by the contractor. • Bitumen storage and mixing areas must be protected against spills. • Proper handling of contaminated soil should be comply with DoE standards.	Fully complied
Flora	• Loss of habitat due to tree cutting. • Vegetation loss due to site preparation and construction activities.	• Suitable Trees to be planted as per TCRP provided by RHD; • Flowering and fruiting shrubs to be planted along the RoW to beautify the landscape; • Contractor's personnel to be directed not to damage any vegetation such as trees or bushes; • Construction vehicles, equipment and machinery to be limited to their designated areas of movement; • Gas cylinders to be used for fuel at the camps for cooking purposes. Cutting of trees/bushes for fuel not to be allowed; • Camp sites and asphalt plants to be	Fully complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		established on waste/barren land rather than on forested or agriculturally productive land. However if such land is not available, it must be ensured that vegetation clearing is minimized and minimum damage is caused to the trees, undergrowth and crops.	
Wildlife	Hunting wildlife and birds during construction.	• Bangladesh Forest Department should check and confirm that no hunting occurs. • New and good condition machinery with low noise generation characteristics to be used in construction. • Construction work not to be carried out at night. • Borrow pits to be fenced to protect animals.	Fully complied
Fisheries	• Impact on fishing activity (production, spawning and breeding grounds). • Disturbance to aquatic life including migration of fish due to bridge construction.	• Construction not to be undertaken during high flood. • Construction along the riverbanks must be avoided during the fish breeding season (July to September). • Deep water channel to be maintained during bridge construction.	Fully complied
Land use	• Land disputes, soil erosion, loss of potential cropland and vegetation, landscape degradation, and damage to road embankments. • Land use change due to borrowing of earth. • Land use change and loss of productive top soil.	• Agricultural areas not to be used as borrow areas. • Land acquisition for borrow areas to be minimized. River sand to be used for embankment. • Necessary permits to be obtained for any borrow pits from the competent authorities and all environmental considerations to be ensured. • Topsoil from borrow areas to be preserved and borrow pits to be rehabilitated after completion of borrow operations. • Borrow pits to be sited on waste land and at least 500 m away from the road. • Priority to be given to borrowing from humps (including from digging of wells) above the general ground level. • Priority should be given to borrowing by excavating/enlarging existing borrow areas.	Fully complied
Traffic Congestion and Road Accidents	• A total of about 45,493 different types of vehicles are moved both way daily and as a result, traffic congestion and road accidents are occurred. During construction stage, traffic congestion and road accidents will be increased.	• Prior to start of site works, update and implement updated Traffic Management Plan (TMP) prepared by EPCM Consultant during detailed design phase (See Annex-8). Updated TMP by the contractor to be approved by the EPCM CONSULTANT prior to start construction of the project. Contractor to implement updated	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		TMP adequately in time; • Communicate to the public through local officials regarding the scope and schedule of construction, as well as construction activities causing disruptions or access restrictions; • 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; • 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; • Provide safe vehicle and pedestrian access around construction areas; • 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). • Provide sufficient lighting at night within and in the vicinity of construction sites. • Designate traffic officers in construction sites.	
Income and Employment	• Income loss due to the loss of agricultural lands, private structures and common property resources	• Contractor as far as practicable to recruit construction workers from amongst the locals and to maintain gender equity while employing the locals. • Priority will always be given to project affected persons, the unemployed and lower income groups. • Set aside areas within the contractor's camps and offices for local people to sell their products.	Partially complied
Health and Safety of the Community	• Health and safety risks due presence of construction camp and ongoing construction activities.	• Include in WPSP barriers (e.g., temporary fence) to be installed at construction areas to deter pedestrian access to the roadway except at designated crossing points. • The workers with different transmittable diseases should be restricted to the construction site and sent for treatment or replaced as an urgent measure. • The general public/local residents will not be allowed in high-risk areas, e.g., excavation sites and areas where heavy equipment is in	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		operation and such sites will have a watchman to keep public out. • Drivers operating construction vehicles to be trained in road safety awareness; • Provision of proper safety and diversion signage. • Crossing provision to be made for pedestrians and vehicles near settlements. • Use of water not to disturb water availability for the public. • Close consultation with local communities to maintain community integrity and social links and avoid conflict situations with respect to resource use. • RHD to Prepare and implement plan for avoiding spread of STDs.	
Occupational Health and Safety - Workers	• Accidental risk and health risks due to unsafe working conditions.	• Contractor will update draft Worker and Public Safety Plan (WPSP) prepared by EPCM Consultant, and instruct workers in health and safety matters. Updated plan to be approved by EPCM Consultant 1 month prior to starting of works. Contractor to implement WPSP provisions. • Establish safety measures as required by law and by good engineering practice, and provide first aid facilities that are readily accessible by workers; • Fencing on all excavation, borrow pits, and sides of temporary bridge, flyovers etc. • Worker's compensation insurance for all project staff; • Basic medical training to be given to specified work staff. • Basic medical service and supplies to be made available for workers. • Appropriate personal protective equipment (hearing protection, safety glasses, helmets, protective footwear and gloves, high visibility vests and other protective clothing) to be provided to all workers. • Provision of adequate sanitation, washing, cooking and dormitory facilities including lighting. • Adequate signage, lighting, barriers, yellow tape and persons with flags during construction to manage traffic at construction sites, haulage and access roads.	Partially complied
Environmental Monitoring and Completion Reporting		• Prepare Monthly and Quarterly Monitoring Reports. • Prepare a project completion report containing environmental management and residual impacts if any.	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
IMPLEMENTATION PHASE: OPERATION			
Tree Planting	Ensuring survival of flora and fauna in the new environment.	• Monitor survival of replanted trees (also compensatory planting) and replant, as necessary. • Undertake proper measures for watering, fertilizing and nursing of trees/ plants/ grasses. • Plantation of additional varieties of trees that supports birds and having high wood value.	Not applicable
Soil Quality	• Soil contamination due to accidental spillage from vehicular movement.	• Proper measures must be ensured to prevent any oil spillage and leakage from the vehicles. • Efforts will be made to clean the spills of oil, toxic chemicals etc. as early as possible.	Not applicable
Noise and Vibration	• Though both noise level and vibration is expected to reduce, special measures/strategies will be required to keep them within limits.	• According to monitoring results, additional sound barriers in the form of trees and hedges will be discussed with the affected people and planted, if agreed; • Signs for sensitive zones (health centres / educational institutions etc.) to prevent the use of pressure horns; • Enforcement and penalties against traffic rules violators; • Monitoring to protect the trees.	Not applicable
Air Quality	• Increased traffic levels and congestion will lead to air pollution levels. • Air conditioning gas emission from BRT buses.	• Roadside tree plantations as applicable and feasible under the climatic conditions. • Regular road maintenance to ensure good surface condition. • Carry out regular onsite testing for assessing emission levels of pollutants from vehicles running on road. • Enforcement and penalties against traffic rules violators. • All work done on air conditioners will follow the Industry Code of Practices for automotive air conditioning. Approved refrigerant gas recycling and storage equipment will be used in these circumstances. • Ambient air quality monitoring should be carried out during operation phase.	Not applicable
Water Quality	• Contamination of water bodies from runoff from bus depot, terminal, stations and roads containing oils and grease; • Groundwater may get polluted due to contaminated road runoff.	• In order to discharge rapid removal of storm-water/road runoff, cross slopes and longitudinal drainage will be provided in the design. • Proper drainage system with sedimentation ponds and oil separators will be provided to avoid contamination by run-off and oil spills. • Retention basins with reed beds provided in the design will improve the quality of polluted storm-	Not applicable

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		water/road runoff. • Prior to operation, an emergency response plan for spills of hazardous materials and oil will be prepared. • Water quality monitoring will be carried out as per schedule suggested in the Environmental Monitoring Plan.	
Cultural Sites	• Noise and vibration near cultural sites specially 2 mosques at Ch 11+360, 18+590 & temple at ch 20+150 which are located adjacent to the road.	• Noise problem can be mitigated through installation of noise barrier and plantation of trees along the boundary of the cultural sites. • Avoid unnecessary noise generation at sensitive cultural sites with regulations.	Not applicable
Road Safety	• Increase in the number of road accidents	• Speed limits will be imposed. • Safety signal will need to be displayed along the road along with display and monitoring of speed limits especially along settlements. • Traffic signs must be provided to warn road users about speed limits, rest areas, eating establishments etc. • Lanes, median, and sharp bends will be marked with reflectorized signs to improve road visibility at night time. • Foot overpasses will be provided near schools, markets areas for safe crossing of the roads. • Proper lighting will be provided along the project road.	Not applicable

Gazipur Bus Depot (C04)

Table II.2 Mitigation Measures implemented in Bus Depot Construction Site

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
IMPLEMENTATION PHASE: CONSTRUCTION STAGE			
Filling up of water logged area	• Loss of retention area; • Earthwork activities during construction stage may block connectivity with other water bodies; • Drainage congestion due to waste disposal and construction activities.	• To deal carefully at design and planning stages based on hydrological data. • Regular cleaning of channels to avoid choking. • Wastes should not be disposed near water bodies. All waste depending on its characteristics, should be disposed of at approved locations.	Fully complied
Fisheries	• Filling of the canal/pond due to construction might affect aquaculture and captive fisheries.	• The excavations for fill materials may be used retention and aquaculture	Fully complied
Wildlife	• The terrestrial wildlife species might be disturbed due to noise and vibration at construction sites and tree felling to cause	• New and good condition machinery with low noise generation characteristics to be used in construction.	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
	dislocation of habitats. However, presences of threatened or endangered wildlife species were not reported at the site.	• Construction work not to be carried out at night.	
Heritage and Culture	• A mosque was identified at 50m north-west side of the project area and may be in risk of negative impacts of construction activities.	• Use of modern plant and equipment with appropriate muffling devices. • Install temporary noise barriers near the mosque. • Proper dust collection and control systems to be installed.	Partially complied
Surface water	• Pollution of surface water may be caused due to disposal of junk, cement refuse and effluents in open water bodies during the construction of bus depot.	• The workforce to be trained in proper means for storage and handling of materials and chemicals. • Work camps and work sites to be provided with toilets and septic tanks. • Washing of machinery and vehicles in surface waters to be prohibited. • Conduct regular water quality monitoring according to the determined sampling schedule. • Prevent construction debris from entering drainage or irrigation canals. • Wastes to be collected, stored and taken to approve disposal sites.	Partially complied
Groundwater Quality	• Contamination of ground water table from leachate of construction waste and wastes from workers' camp	• Workforce camp will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags and other sanitation facilities will be implemented at the construction camp to prevent the wastewater and solid wastes from entering well and groundwater recharge areas. • Groundwater quality monitoring to be carried out as per the schedule in the environmental monitoring plan.	Partially complied
Air Quality	• Dust Generation due to construction activities and transport of construction materials. • Emissions from vehicles, equipment and machinery.	• Regular watering at the exposed sites needed to control dust blowing. • Vehicles transporting construction material to be covered. • Construction equipment to be maintained to a good standard and idling of engines discouraged. • Machinery emitting visible smoke to be banned from construction sites. • Dust masks to be provided to workers where dust hazards exist. • Conduct regular air quality monitoring according to the determined sampling schedule.	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
Noise and vibration	• Noise from construction vehicles, equipment and machinery. • Vibration caused by construction activities.	• All powered mechanical equipment and machinery to be fitted with noise abating gear such as mufflers for effective noise control, in compliance with DoE regulations. • Providing the construction workers with suitable hearing protection like ear cap, or earmuffs etc. • Noise measurement to be carried out as per the schedule in the environmental monitoring plan.	Partially complied
Soil contamination	• Contamination of soils at camp and work sites due to accidental spillage of noxious chemical, petroleum derivatives and bituminous material may happen.	• The chemicals, cement, petroleum derivatives and bituminous materials to be handled, operate and stored cautiously. • The construction materials be stored properly, garbage removed regularly and sites kept clean and tidy.	The contractor assures for future precautions
Construction Camp and Workshop	• Loss of plantation and vegetation. • Social disturbance for nearby community	• Construction camp and workshop to be located away from sensitive areas. • Water and good sanitation facilities to be provided for the camp. • Minimise vegetation loss while making site arrangements for construction camp and other facilities.	Complied
OHS – Workers	• Health risks due to unsafe working conditions	• Provision of safe water, sanitary toilet facility and hygienic accommodation for workers at camp sites. In addition, ensure provision of PPEs and First-Aid facility for them.	Complied
Community Health and Safety	• Safety risks due to construction works	• The labour works with different transmittable diseases should be restricted within the construction site and replaced. • Drivers operating construction vehicles to be trained in road safety awareness. • Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links. • Provision of proper safety and diversion signage.	Complied
IMPLEMENTATION PHASE: OPERATION			
Tree plantation	• Survival of flora and fauna in the new environment.	• Undertake monitoring and maintenance efforts for ensuring survival of planted trees. • Plantation of tree varieties that supports birds and sustainable and having high wood value	Not applicable

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
Soil	• Contamination of soil caused due to spillage of petroleum derivatives and other chemicals due to machinery and vehicle maintenance activities, and leakage from store-house.	• Service machinery and vehicles strictly at designated maintenance workshops where waste oils and lubricants be collected and recycled. • Storage of coolant and oils should be above ground with bunds so that immediate soil contamination due to spillage or leakage can be prevented.	Not applicable
Repair and Maintenance of vehicles	• Accidental spills and leakage of fuels is to be anticipated in the Fuelling area. • In the storage area spillage of Engine cooling liquids, Used motor oil and Used transmission oil will be a problem that can have significant adverse impacts if these find their way in to soil, surface or ground water. • The wash water will contain oil and grease in addition to dust and particulate matter from exhaust. • Diesel combustion gases are rich in carbon oxide (CO) and could be fatal if inhaled. The effect of CO is also cumulative. • Where repair /maintenance work is performed on wet vehicles the floor may become slippery and may cause accidents affecting the safety of the workers. •	• All spillage of liquids including diesel, oils, grease and waters will be collected in a central area and drain to a common location. This includes rain waters which will eventually wash spilled liquids on the surface. These waters will be treated with decantation and oil and grease traps to separate oil and greases to conform to local regulations prior to releasing them outside the depot. • Used engine cooling liquids, used motor oil and used transmission oil will be stored in leak proof containers and disposed of safely using approved methods, to avoid environmental contamination. • All work stations will be equipped with devices for complete evacuation of the engine exhaust gases. The workshop will be ventilated at any time and will include appropriate equipment to extract fumes. Further, the workshop will be equipped with CO detectors. • The floor covering will be of material that it is easy to clean and is slip resistant	Not applicable
Water quality	• Contamination of water bodies from runoff from the bus depot containing oils and grease	• Proper drainage system with oil separators will be provided to avoid contamination by run-off and oil spills.	Not applicable
Waste generation	• Solid waste and waste water form market stalls could contaminate the area and water bodies. Wash water from meat and fish stalls could be issues if proper collection and disposal is not provided • If proper sanitary facilities are not provided sanitation problems could arise.	• Solid waste will be managed by provision of collection bins and disposal facilities. Provisions will be made to dispose meat and fish waste separately at approved locations. • Stall floors will be sealed to collect and divert the wash water for proper management. • Public toilet facilities with utilities as water supply, electricity, drainage system etc. will be constructed within the market areas	Not applicable

Baseline and Sampling Program Results and Analysis

Construction of At-Grade Section including 6 Flyovers (C01)

58. The Contractor conducted the Baseline Monitoring including Sampling of Environmental Parameters in August 2017 and the next Environmental Sampling as per the EMP of EIA report on November 2017. The Contractor submitted the Draft Environmental Management System (EMS), Site Safety Manual, Site Personnel Health and Epidemic Prevention Program, and plans to survey and measure the trees of Ch 0+000 to Ch 0+260. The draft documents have been reviewed and the Contractor was requested to address the comments in a final version without delay.

Surface Water

59. Surface Water samples were collected from two project influenced locations on 27th August for baseline monitoring and on 27th November, 2017 for the first routine sampling. (Figure II.1).

Figure II.1: Surface Water Sample Collection

60. All samples were collected in plastic sampling bottles, kept in an ice cooler, after necessary stabilization/fixing, and analyzed within 72 hours of being collected. Only the samples for oil & grease were collected in glass bottles. Tests have been carried out in the Laboratories of the DPHE, and the University of Dhaka. The laboratory test results are given in Appendix 9. A summary of the Test Results of surface water sampling of the Contract influenced area is given at Table II.3.

Table II.3: Results for Surface Water Quality

Parameters	Unit	Results of November, 2017		Results of August, 2017		Standards for Inland Surface Water*	Analysis Method
		Hajir Pukur	Soydana Hajir Pukur	Hajir Pukur	Soydana Hajir Pukur		
		SW_HF	SW_SD	SW_HF	SW_SD		
Temperature	°C	24.1	24.0	25	25.1	NYS	Thermometer
Turbidity	NTU	15.5	111	26.5	24.2	NYS	Turbidity Meter
pH	-	7.5	7.4	7.0	7.4	6.5-8.5	pH Meter
Total Dissolved Solids (TDS)	mg/L	524	1340	190	90	NYS	TDS Meter
Electrical Conductivity (EC)	µs/cm	1045	2635	418	228	NYS	Multimeter

Parameters	Unit	Results of November, 2017		Results of August, 2017		Standards for Inland Surface Water*	Analysis Method
		Hajir Pukur	Soydana Hajir Pukur	Hajir Pukur	Soydana Hajir Pukur		
		SW_HF	SW_SD	SW_HF	SW_SD		
Total Suspended Solids (TSS)	mg/L	27	48	21	18	NYS	Gravity Multimeter
Iron (Fe)	mg/L	0.24	0.06	0.87	0.80	NYS	AAS
Ammonium Nitrogen (NH_4-N)	µg/ml	4.42	2.94	<MDL	0.02	NYS	Kjeldahl Method
Arsenic (As)	mg/L	0.001	0.001	0.002	0.003	NYS	AAS
Manganese (Mn)	mg/L	0.14	0.08	0.04	0.05	NYS	AAS
Dissolved Oxygen (DO)	mg/L	4.13	5.82	7.50	6.15	5 or more	Multimeter
Chemical Oxygen Demand (COD)	mg/L	64	104	48	88	NYS	CRM
Biochemical Oxygen Demand (BOD_5)	mg/L	16	27	20	19	6 or less	5 days Incubation
Total Coliform (TC)	N/100ml	924	400	71	60	NYS	MFM
Faecal Coliform (FC)	N/100mL	500	235	32	27	NYS	MFM
Total Nitrogen (TN)	µg/ml	11.67	7.78	2.3	2.3	NYS	Kjeldahl Method
Total Phosphorus (TP)	µg/ml	0.208	0.180	1.16	0.33	NYS	Ascorbic acid blue color method
Oil & Grease	mg/L	19.4	9.60	23.4	269.0	NYS	5520.B

*Standards for Inland Surface Water is followed Environmental Conservation Rule (ECR)'97
NYS = Not Yet Standardized

61. Standards for the most of the parameters for surface water have not been established by DoE. The concentrations of BOD_5 in the tested samples did not comply with the national standard during the measurements. Several tested parameters for the samples from Soydana Hajir Pukur increased significantly in Nov 2017 compared with Aug 2017. Though there were no major construction activities beside the water source the more likely reason for these pollutants is from the nearby industries.

Groundwater

62. Groundwater samples were collected from three Contract influenced locations on 27th August 2017 for baseline monitoring and on 27th November, 2017 for the first routine sampling (Figure II.2).

Figure II.2: Groundwater Sample Collection

63. All samples were collected in plastic sampling bottles, kept in an ice cooler, after necessary stabilization/fixing, and analyzed within 72 hours of being collected. Only the samples for oil & grease were collected in glass bottles. Tests were done at the Laboratories of the DPHE, and University of Dhaka. The laboratory test results are included in Appendix 9. A summary of the Test Results of surface water sampling of the Contract influenced area is given at Table II.4.

64. The comparative analysis of the values of TSS, NH_4-N, Mn, and BOD_5 show that, for all the locations the concentration was increased. Additionally, the values of those parameters did comply with the national standard. The reason may be from over extraction for the construction activities or due to the sampling during the dry season when water level is lowered. The results need to be compared again with the results from the next sampling during wet season to draw a reasonable conclusion.

Table II.4: Test Result of Groundwater Sampling Analysis

Parameters	Unit	Results of November, 2017			Results of August, 2017			Standards for Inland Groundwater*	Analysis Method
		Gazipur Terminal	Campsite	Gazipura	Gazipur Terminal	Campsite	Gazipura		
		GW_GT	GW_CS	GW_GP	GW_GT	GW_CS	GW_GP		
Temperature	°C	24	24.1	24.1	24.9	25.2	25.1	20-30	Thermometer
Turbidity	NTU	1.2	0.93	1	0.8	0.7	0.5	10	Turbidity Meter
pH	-	7.1	7	6.7	7.2	7.1	6.8	6.5-8.5	pH Meter
Total Dissolved Solids (TDS)	mg/L	167	190	212	190	90	120	1000	TDS Meter
Electrical Conductivity (EC)	µs/cm	331	82	425	349	389	418	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	11	14	13	2	2	1.5	10	Gravity Multimeter
Iron (Fe)	mg/L	0.06	0.08	0.007	0.84	0.88	0.91	0.3-1	AAS
Ammonia Nitrogen (NH_4-N)	µg/ml	2.90	2.90	2.90	<MDL	<MDL	<MDL	0.5	Kjeldahl Method
Arsenic (As)	mg/L	0.001	0.002	0.001	0.003	0.004	0.004	0.05	AAS
Manganese (Mn)	mg/L	0.52	0.21	0.15	0.09	0.04	0.03	0.1	AAS
Dissolved Oxygen (DO)	mg/L	4.75	4.01	6.91	6.70	5.91	6.17	6.0	Multimeter
Chemical Oxygen Demand (COD)	mg/L	4	4	16	4	8	4	4.0	CRM
Biochemical Oxygen Demand (BOD_5)	mg/L	2	1	6	0.015	0.01	0.019	0.2	5 days incubation
Total Coliform (TC)	N/100ml	0	0	0	0	0	0	0	MFM
Faecal Coliform (FC)	N/100mL	0	0	0	0	0	0	0	MFM
Total Nitrogen (TN)	µg/ml	5.83	7.78	9.72	<MDL	<MDL	0.5	NYS	Kjeldahl Method
Total Phosphorus (TP)	µg/ml	0.069	0.074	0.044	0.62	0.52	0.48	NYS	Ascorbic acid blue color method

*Standards for Groundwater is followed Environmental Conservation Rule (ECR)'97

Air Quality

65. Ambient air quality data at the Contract site was measured initially to collect the baseline air quality data and then to compare this data with the air quality data measured during project activities to check if there are any significant changes. If there are any increased air pollution levels as a result of the construction activities then appropriate mitigation measures will need to be decided and implemented as applicable.

66. The main air pollutants in Greater Dhaka City are nitrogen oxides (NOx), sulphur dioxide (SO_2), total suspended particles (TSP), PM_{10} (particulate matter with diameter of 10 microns or smaller), carbon monoxide (CO), carbon dioxide (CO_2), ozone (O_3), volatile organic compounds (VOCs) and hydrogen sulphide (H_2S).

Figure II.3: Air Quality Monitoring at Project Site

67. The Baseline air quality sampling was performed at and around the Contract location from 28th August to 30th August and from 28th November to 30th November, 2017 for the first routine sampling (Figure II.3.). The laboratory test results are given in Appendix 9 and are summarized in Table II.5 and II.6.

Table II.5: Test Result of Ambient Air Quality Analysis

Parameter	Unit	Concentration Present on November 2017			Concentration Present on August 2017			Bangladesh Standard**	Duration (hours)	Weather Condition	Method of Analysis
		AAQ_GT 23.99717°N 90.41799°E	AAQ_BB 23.94732°N 90.38178°E	AAQ_AP 23.85004°N 90.40919°E	AAQ_GT 23.99717°N 90.41799°E	AAQ_BB 23.94732°N 90.38178°E	AAQ_AP 23.85004°N 90.40919°E				
		Gazipur Terminal	Board Bazar	Airport	Gazipur Terminal	Board Bazar	Airport				
PM_{10}	µg/m³	115.7	104.2	270.2	105.4	137.9	315.7	150	24	Sunny	Gravimetric
SPM	µg/m³	528.04	986.51	1257.84	642.72	1006.58	1620.64	200	24		Gravimetric
$PM_{2.5}$	µg/m³	65.7	57.7	103.9	62.7	79.2	94.3	65	24		Gravimetric
SO_2	µg/m³	44.32	65.29	113.82	27.79	50.44	106.53	365	24		West- Geake
NOx	µg/m³	52.75	88.27	250.41	95.89	198.47	390.75	100	Annual		Jacob and Hochheiser
H_2S	µg/m³	0.013	0.004	0.071	0.009	0.025	0.043	NYS	8		Electro-Chemical Sensor
O_3	µg/m³	5.61	8.75	17.94	9.27	17.36	22.45	NYS	8		Photometric
O_2	%	16.43	19.39	17.63	18.93	20.17	19.59	NYS	8		Electro-Chemical Sensor
TVOC	µg/m³	528	764	1075	724	937	1117	NYS	8		Electro-Chemical Sensor
CO*	ppm	3	1	2	2	3	4	9	8		CO-Meter
CO_2	µg/m³	278.51	386.93	556.27	321.07	452.27	553.86	NYS	8		Electro-Chemical Sensor

Table II.6: Test Result of Ambient Air Quality Analysis (Weather Data)

Sample ID	Location	GPS Location	Time	Humidity (%)	Temperature ^{0} C	Wind Speed Km/h	Wind Direction
Results of November, 2017							
AAQ_AP	Airport	23.85004°N 90.40919°E	1:00pm-2:00pm	42	28.6	1.28	South-East
AAQ_BB	Tongi Board Bazar	23.94732°N 90.38178°E	4:00pm-5:00pm	27.75	23.6	1.1	West-South
AAQ_GT	Gazipur Terminal	23.99717°N 90.41799°E	3:00pm-4:00pm	42.75	24.4	1.27	South-East
Results of August, 2017							
AAQ_AP	Airport	23.85004°N 90.40919°E	13.30 to 14.30	51.5	33.9	2.2	NW to SE
AAQ_BB	Tongi Board Bazar	23.94732°N 90.38178°E	14.00 to 15.00	57.5	33	1.5	SW to NE
AAQ_GT	Gazipur Terminal	23.99717°N 90.41799°E	14.00 to 15.00	46.5	35	7.5	S to N

68. The results of the air quality sampling tests show that the dust particles (SPM, PM_{10}, and $PM_{2.5}$) in the sampling locations are above the DoE standard. Since there were no earthworks during the monitoring period in the sampling locations so it can be said that the pollutants are not due to the project activities. Additionally, the baseline monitoring values were also higher than the national standard. The reason is likely to be the existing high volume of traffic and many commercial and industrial activities along the corridor.

69. The weather monitoring results (temperature, humidity, wind speed and directions) during both the monitoring periods showed in Table II.6.

Noise

70. Baseline Noise Level Measurements were taken at Contract influenced locations from 28th August to 30th August 2017 and from 28th November to 30th November, 2017 for the first routine sampling (Figure II.4). The laboratory test results are given in Appendix 9 of this report.

Figure II.4: Noise Level Monitoring at Day and Night Time in the Project Area

71. Noise level measurements taken during the day and night time are summarized in Table II.6. Noise measurements at each location were taken continuously for 15 minutes during the day and for 15 minutes during the night.

Table II.7: Noise Level at the Project Location

Sample ID	Sample Location	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)		Bangladesh Standard dB (A)** (LAeq)	
				Day	Night	Day	Night	Day	Night
Results of November, 2017									
NM_GT	Gazipur Terminal	23.99718 N, 90.41805 E	Commercial	13:38	21:10	65.58	62.04	65	55
NM_JC	JoydebpurChowrasta, Gazipur	23.98951 N, 90.38261 E	Commercial	12:30	20:40	72.13	74.53	65	55
NM_BhB	Bhogra Bazar, Gazipur	23.97762 N, 90.38057 E	Commercial	12:05	22:11	74.56	73.34	65	55
NM_CS	Campsite, Gazipur	23.97778 N. 90.37052 E	Residential	11:42	21:48	57.72	53.28	55	45
NM_BB	Board Bazar, Gazipur	23.94734 N,	Commercial	16:05	22:36	76.88	73.18	65	55

Sample ID	Sample Location	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)		Bangladesh Standard dB (A)** (LAeq)	
				Day	Night	Day	Night	Day	Night
		90.38173 E							
NM_AP	Airport, Uttara, Dhaka	23.85024 N, 90.40909 E	Commercial	11:39	23:25	74.46	72.93	65	55
Results of August, 2017									
NM_GT	Gazipur Terminal	23.99717 N, 90.41799 E	Commercial	12:35	21:00	66.63	67.30	65	55
NM_JC	JoydebpurChowrasta, Gazipur	23.98956 N, 90.38252 E	Commercial	16:53	21:25	75.11	79.27	65	55
NM_BhB	Bhogra Bazar, Gazipur	23.97767 N, 90.38057 E	Commercial	15:41	22:31	80.15	76.43	65	55
NM_CS	Campsite, Gazipur	23.97796 N. 90.37050 E	Residential	16:03	22:53	59.07	56.69	55	45
NM_BB	Board Bazar, Gazipur	23.94731 N, 90.38178 E	Commercial	12:10	23:26	74.07	73.80	65	55
NM_AP	Airport, Uttara, Dhaka	23.85004 N, 90.40919 E	Commercial	12:43	00:34	76.22	76.74	65	55

Notes:
- Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)
- Shaded cell indicate noise levels in excess of Noise Pollution Control Rules ambient noise limits for a given land use area
- The sound level standards for residential area is 55, commercial area is 65 dBA at day time and residential area 45, commercial area 55 at night time.
- Noise Level is the average noise recorded over the duration of the monitoring period

72. The results show that time-weighted average value of the noise levels monitored within the Contract area exceeded the standard set for all the locations during the both sampling periods. However, from the comparative analysis with the baseline monitoring it is seen that the noise levels decreased during both day and night time at all the locations in November 2017.

Vibration Level

73. Baseline Vibration Levels were monitored at the Contract influenced locations from 28th August to 30th August 2017 and from 29th November to 30th November, 2017 for the first routine sampling (Figure II.5). The results of the Vibration Levels are shown in Table II.8. The laboratory test result is given in Appendix 9 of this report.

Figure II.5: Vibration Level Measurement

Table II.8: Test Results for Vibration Level Measurement

Sample ID	Location	Velocity (mm/s)				Acceleration (m/s^2)				Displacement (mm)			
		Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value
Results of November, 2017													
VB_GT	Gazipur Terminal, Gazipur	28.77	0.05	2.049	0.561	94.6	0.1	27.027	16.300	0.134	0	0.020	0.032
VB_JC	JoydebpurChowrasta, Gazipur	0.33	0.05	0.076	0.113	0.2	0	0.094	0.133	0.036	0	0.007	0.009
VB_BhB	Bhogra Bazar, Gazipur	0.33	0.05	0.054	0.088	0.3	0	0.091	0.100	0.048	0.001	0.005	0.009
VB_CS	Campsite, Gazipur	0.67	0.05	0.115	0.179	0.1	0.1	0.000	0.100	0.078	0	0.013	0.021
VB_BB	Board Bazar, Gazipur	0.17	0.05	0.045	0.094	0.1	0	0.006	0.000	0.18	0	0.003	0.006
VB_AP	Airport, Uttara, Dhaka	0.75	0.05	0.091	0.126	11.4	0	2.484	1.095	0.055	0	0.008	0.009
Results of August, 2017													
VB_GT	Gazipur Terminal, Gazipur	1.21	0.05	0.205	0.414	2.7	0	0.731	0.367	0.123	0.005	0.018	0.046
VB_JC	JoydebpurChowrasta, Gazipur	0.23	0.05	0.054	0.102	0.1	0.1	0	0.100	0.053	0	0.007	0.011
VB_BhB	Bhogra Bazar, Gazipur	0.87	0.05	0.139	0.205	0.3	0	0.122	0.100	0.085	0.001	0.013	0.021
VB_CS	Campsite, Gazipur	1.83	0.05	0.197	0.290	0	0	0	0	0.058	0.001	0.010	0.019
VB_BB	Board Bazar, Gazipur	0.71	0.05	0.118	0.173	1.8	0	0.715	0.625	0.091	0.001	0.014	0.023
VB_AP	Airport, Uttara, Dhaka	16.91	0.05	3.365	1.118	0.1	0.1	0	0.100	0.062	0	0.007	0.007

74. The vibration level measurement results during both the monitoring periods shows that the peak particle velocity of all the measured locations were within the permitted vibration level set in the Technical Specifications (Sub-Clause 1.10 [*Environmental Management*]) of the Contract. The standard for the other two parameters (acceleration, displacement) of vibration measurement have not been set in the Technical Specifications or by the DoE.

Soil

75. The investigation of chemical releases to the soil usually requires the collection of composite samples to characterize a large area or volume of near-surface soil in likely contaminated areas. In this context a composite soil sampling technique was followed to measure the contaminant.

Figure II.6: Soil Sampling at Project Site

76. Baseline Soil samples were collected from all the Contract influenced locations on 27th August 2017 and on 27th November, 2017 for the first routine sampling (Figure II.6). Test results of the soil analyses of the Contract influenced area is given in Table II.9. The Laboratory test results are included in Appendix 9 of this report.

77. The standards for soil parameters have not been set by the DoE or other relevant national agencies in Bangladesh. However, from the comparative analysis with the baseline results it is seen that at all the parameters in all measured locations increased and the values for Cadmium were higher than the EU standard for land application. The reason may be due to earthworks and the landfilling in the sampled locations for the construction works. The sand for the filling in terminal area and campsite locations is sourced from other locations and this might be polluted already.

Table II.9: Test Results for Soil Quality

Parameters	Unit	Results of November, 2017			Results of August, 2017			EU Directive 86/278/EEC for Land Application	Method of Analysis
		Joydevpur Chowrasta	Gazipur Terminal	Campsite	Joydevpur Chowrasta	Gazipur Terminal	Campsite		
		SS_JC	SS_GT	SS_CS	SS_JC	SS_GT	SS_CS		
		23.98975° N 90.38274° E	23.99692° N 90.36852° E	23.97787° N 90.37039° E	23.98975° N 90.38274° E	23.99692° N 90.36852° E	23.97787° N 90.37039° E		
pH	-	6	6	6.5	6	6	7	-	-
Arsenic (As)	mg/kg	8.11	10.25	3.07	0.69	0.71	0.33	-	USEPA 206.2; SM 3113 B
Lead (Pb)	mg/kg	0	217	0	0	24	2.3	1200	USEPA 200.9 Rev 2.2; SM 3111B
Mercury (Hg)	mg/kg	0	0	0	0	0	0	25	-
Cadmium (Cd)	mg/kg	72	78	77	0	0	0	40	USEPA 213.2; SM 3113 B
Chromium (Cr)	mg/kg	128	208	40	17.3	19.8	2.9	-	USEPA 200.9 Rev 2.2; SM 3111B
Zinc (Zn)	mg/kg	807	1303	312	90.9	87.7	3.29	4000	USEPA 200.9; SM 3111B

Fisheries Resource

78. No information was provided as there are no fisheries resources in this project site.

Wildlife

79. No information was provided regarding wildlife.

Construction of BRT Bus Depot (C04)

Surface Water

80. In the construction site, there is only a small ditch. In a portion of this ditch fish are being cultivated. This water body is also used for different types of work including bathing purpose of laborers, small scale construction water source, etc. There is a waste dumping site beside this ditch but no water pollution occurs from the waste. However, during heavy rainfall, water washes out to the ditch from the construction site.

Figure II.7: Surface Water Sample Collection

81. Surface water samples were collected from the Contract location on 5th December 2017 (Figure II.7) and the collected samples were sent to the Department of Public Health Engineering (DPHE) and University of Dhaka (DU) for the testing of several parameters. The results of the surface water quality monitored at the C04 location have been summarised in Table II.10.

Table II.10: Results for Surface Water Quality

Parameters	Unit	Test Results of Dec, 2017	Test Results of May, 2017	Standards for Surface Water*	Analysis Method
Temperature	°C	26.2	25.1	NYS	Thermometer
Turbidity	NTU	8.50	1.3	NYS	Turbidity Meter
pH	-	7.5	9.6	6.5-8.5	pH Meter
Total Dissolved Solids (TDS)	mg/L	135	340	NYS	TDS Meter
Electrical Conductivity (EC)	µS/cm	272	127	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	3	25	NYS	Gravity Multimeter
Iron (Fe)	mg/L	0.49	0.34	NYS	AAS

Parameters	Unit	Test Results of Dec, 2017	Test Results of May, 2017	Standards for Surface Water*	Analysis Method
Ammonia Nitrogen (NH_3-N)	mg/L	0.8	<MDL	NYS	USEPA 350.1; SM 4500-NH3 B
Arsenic (As)	mg/L	0.003	0.001	NYS	AAS
Manganese (Mn)	mg/L	0.26	0.02	NYS	AAS
Dissolved Oxygen (DO)	mg/L	6.86	4.19	5 or more	Multimeter
Chemical Oxygen Demand (COD)	mg/L	4	28	NYS	CRM
Biological Oxygen Demand (BOD_5)	mg/L	2	9	6 or less	5 Days Incubation
Total Coliform (TC)	N/100ml	86	280	NYS	MFM
Fecal Coliform (FC)	N/100ml	40	128	NYS	MFM
Total N	micro mho/cm	5.83	2.6	NYS	Kjeldahi Method
Total P	mg/L	0.262	0.52	NYS	Ascorbic Acid Blue Color Method

Note: for NH_3-N, MDL=0.017
**Environment Conservation Rules, 1997*

82. Standards for the most of the parameters for surface water have not been established by DoE. The results show that the pH value of the water is higher than the national standard. From the comparative analysis with the results of May, 2017 it can be seen that, the values of Temperature, Turbidity, Electrical Conductivity, Iron, Ammonia Nitrogen, Arsenic, Manganese, Dissolved Oxygen and Total Nitrogen has increased. This is to be expected since the sampling was conducted during the dry period and water quality usually decreases in this season. Additionally, no visible pollutants were found due to Contract activities during the sampling. The Laboratory test results are included in Appendix 9 of this report.

Groundwater

83. In and around Dhaka, groundwater is a stable source of water for various activities including irrigation (both shallow and deep tube wells), domestic purposes (hand pumps) and industrial applications (deep wells). There is a tube well in the construction site. The depth of the tube well is around 70ft. It is used as the source of drinking water for the construction workers. This water is also used as construction water. Sometimes the labors use this was for bathing purpose.

84. The groundwater sample was collected from the Contract location on 5th December 2017 (Figure II.8) and the collected sample was sent to the Department of Public Health Engineering (DPHE) and University of Dhaka (DU) for the testing of several parameters. Results of the groundwater sampled at the C04 site have been summarised in Table II.11.

Figure II.8: Groundwater Sample Collection

Table II.11: Results for Groundwater Quality

Parameters	Unit	Test Results of Dec, 2017	Test Results of May, 2017	Standards for Potable Water*	Analysis Method
Temperature	°C	26.3	25.3	20-30	Thermometer
Turbidity	NTU	1.29	2.40	10	Turbidity Meter
pH	-	6.7	7.8	6.5-8.5	pH Meter
Total Dissolved Solids (TDS)	mg/L	186	190	1000	TDS Meter
EC	µS/cm	375	182	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	24	1	10	Gravity Multimeter
Fe	mg/L	0.07	0.07	0.3-1.0	AAS
NH_3-N	mg/L	0.01	<MDL	0.5	USEPA 350.1; SM 4500-NH_3 B
As	mg/L	0.002	0.001	0.05	AAS
Mn	mg/L	0.43	1.67	0.1	AAS
DO	mg/L	5.48	8.05	6	Multimeter
COD	mg/L	8	1	4	CRM
BOD_5	mg/L	6	0.2	0.2	5 days Incubation
Total Coliform(TC)	N/100ml	0	0	0	MFM
Fecal Coliform(FC)	N/100ml	0	0	0	MFM
Total N	mg/L	3.89	<MDL	NYS	Kjeldahi Method
Total P	mg/L	0.104	0.56	NYS	Ascorbic Acid Blue Color Method

Note: for NH_3-N, MDL=0.017 and for Total Nitrogen MDL=0.5
**Environment Conservation Rules, 1997*

85. The laboratory test results of the groundwater samples and the GoB standards for potable water (ECR, 1997) are shown in Table II.11. The results show that except Manganese, COD and BOD_5, all the other

parameters are within the National Standard. The laboratory test results are included in Appendix 9 of this report.

86. The comparative analysis of the values of TSS, COD, and BOD_5 show that the concentration was increased whereas the values for Mn and DO decreased. Additionally, the values of those parameters did not comply with the national standard. The reason may be the over extraction for the construction activities or due to the dry period of sampling; since during the dry period water level changes and is lowered.

Air Quality

87. Ambient air quality data at the C04 site was measured initially to collect the baseline air quality data and then to compare this data with air quality data measured during project activities to verify if there are any significant changes caused by the C04 activities. If there are significantly increased air pollution levels due to the construction activities then appropriate mitigation measures will need to be decided and implemented as applicable.

88. The main air pollutants in Greater Dhaka and Gazipur City are nitrogen oxides (NOx), sulphur dioxide (SO_2), total suspended particles (TSP) and PM10 (particulate matter with diameter of 10 microns or smaller), carbon monoxide (CO), carbon dioxide (CO_2), ozone (O_3), volatile organic compounds (VOCs), and hydrogen sulphide (H_2S).

89. Motor vehicles are the major source of particulate matters (PM) pollution. Most of the PM pollutants (greater than 80%) come from diesel-run vehicles. In the low-lying agricultural land surrounding Dhaka city, hundreds of brick kilns which contribute to high levels of particulate matter operate during the dry months November– April. Dispersal of pollutants depends upon factors like prevailing wind direction and other weather conditions, atmospheric stability, height of the source.

90. Air quality measurements were carried out at the C04 site on 5th December, 2017 (Figure II.3). The results of the air quality sampled at the C04 site have been summarised in Table II.4.

Figure II.9: Air Quality Monitoring at Project Site

91. The results show (Table II.4) that the concentration of the measured air quality parameter for the ambient air did not exceed the national standard except for the value of SPM. The details of the results are included in Appendix 9 of this report.

Table II.12: Test Result of Ambient Air Quality Analysis

Sample Description	Name of the Parameters									
	SPM	PM_{10}	SO_2	NO_x	TVOC	CO	CO_2	O_3	H_2S	O_2
Units	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	ppm	ppm	µg/m³	ppm	µg/m³
Method of Analysis	Gravimetric (EPA Standard)	Gravimetric (EPA Standard)	West-Geake	Jacob and Hochheiser	Electro-Chemical Sensor	Electro-Chemical Sensor	Electro-Chemical Sensor	Electro-Chemical Sensor	Electro-Chemical Sensor	Electro-Chemical Sensor
Test Result for December, 2017	290.73	108.04	18.54	8.62	387	2	482	16.04	0.070	18.63
Duration (Hours)	8	24	24	Annual	-	8	-	8	-	-
Bangladesh (DoE) Standard for Ambient Air	200	150	365	100	NF	9	NF	157	0.02-0.2	-
International/World Bank Standard	NF	150	125	150	750	10	<1100	160	0.15	21%
Remark	Higher	Good	Good	Good	Good	Good	Good	Good	Good	Good
Test Results for May, 2017	305.2	103.5	27.6	30.3	435	14	565	21	0.010	19.6%

92. From the above test results, it can be seen that the level of PM_{10} and H_2S has increased from the level of May, 2017. The values of the other parameters decreased from the level of May, 2017.

Noise

93. Noise from the machines and vibrations caused by the construction activities were expected to be the major pollutants at the C04 bus depot site. Being a residential area, the ambient standard is Leq 55 dB (A) (daytime) and Leq 45 dB (A) (night time) (DoE, 2006).

94. Noise level data was collected during day time only at the construction site on the 5th December, 2017 (Figure II.10). The results of the noise level monitored along with details of the sampling locations have been summarised in Table II.13.

Figure II.10: Noise Level Monitoring at Day Time in the Project Area

Table II.13: Noise Level at the Project Location

Location	GPS Location	Land Use Category	Time	Noise Level (dBA) (LAeq)
Inside Project Area	23.99541° N 90.39645° E	Residential	12:57	49.01
Result for May, 2017				
Inside Project Area	23.995408° N 90.396857° E	Residential	10:01	67.05
Inside Project Area	23.995312° N 90.397937° E	Residential	14:24	58.02
Inside Project Area	23.995064°N 90.394895°E	Residential	15:07	51.49

Notes:

- *Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)*
- *Shaded cells indicate noise levels in excess of Noise Pollution Control Rules ambient noise limits for a given land use area*
- *The sound level standards for residential area at day and night are 55 dBA and 45 dBA respectively.*
- *Noise Level is the average noise recorded over the duration of the monitoring period*

95. The result shows that time weighted average value of the sound monitored inside the C04 site did not exceed the standard set for the residential area. During the noise measurement an excavator was

running and the laborers were on lunch break. So, the construction works were less in volume during the period which may have resulted in the decreased noise level. The analysis results of the noise measurement are included in Appendix 9 of this report.

96. From the result of May 2017, it can be seen that the Noise Level decreased at all the locations in the Contract site from the previous level.

Vibration Level

97. Vibration caused by the construction activities was expected to be a major problem in the construction site of the bus depot. Vibration measurement was conducted during day time at the construction site on the 05 December, 2017 (Figure II.11). the result of the vibration measurement have been sumarised in Table II.14. The details of the results are given in Appendix 9 of this report.

Figure II.11: Vibration Level Measurement at Project Site

98. The above results show that the Maximum Velocity was 0.39 mm/s, the maximum acceleration was 1.1 m/s^2 and the maximum displacement was 0.042 mm. Again, the Mean value for velocity was 0.110 mm/s, for acceleration was 0.021 m/s^2 and for displacement was 0.008mm.

Table II.14: Vibration Level at the Project Location

Sample ID	Location	Velocity (mm/s)				Acceleration (m/s^2)				Displacement (mm)			
		Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value	Max.	Min.	Standard Deviation	Mean Value
VB_BD	23.992524° N 90.39626° E (Inside Project Area)	0.39	0.05	0.062	0.110	1.1	0	0.099	0.021	0.042	0	0.008	0.008

Fisheries Resource

99. No information was provided as there are no fisheries resources in this site.

Wildlife

100. No information was provided regarding wildlife.

Soil

101. Soil samples were collected at the Contract location on 5 December, 2017 (Figure II.12). A Hand auger was used for collecting the soil samples and the composite sampling method was followed. The samples were collected in zipped lock bags and kept in plastic containers. The samples were submitted for analysis at the Bangladesh University of Engineering & Technology (BUET) Laboratory within 72 hours of collection. The result of the soil tests along with details of the sampling location has been summarised in Table II.7.

Figure II.12: Soil Sampling at Project Site

102. The national standard for almost all the parameters have not yet been standardized. The only two parameters which are standardized are below the standard as per EU directive for land application. The details of the results are given in Appendix 9 of this report.

Table II.15: Test Result of Soil Quality Analysis

Parameters	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of Analysis
Arsenic (As)	mg/kg	3.63	-	USEPA 206.2; SM 3113 B
Cadmium (Cd)	mg/kg	0	40	USEPA 213.2; SM 3113 B
Chromium (Cr)	mg/kg	7	-	USEPA 200.9 Rev 2.2; SM 3111 B
Zinc (Zn)	mg/kg	3	4000	USEPA 200.9; SM 3111 B
pH	mg/kg	7.5	-	

C. OVERALL ASSESSMENT OF SAMPLING PROGRAM

At-Grade Section including 6 Flyovers (C01)

103. Although the baseline environmental monitoring was delayed all field surveys were completed within the monitoring period as defined in the ToR. No information was provided regarding fisheries resources, wildlife and waste management. The data from other environmental parameter sampling showed that the construction work appeared to have very few longer-term impacts on the biophysical environment. Though the results show that time weighted equivalent continuous sound levels of the sound monitored along the project corridor exceed the standard set for the land use area this is because the noise monitoring was done during the peak periods and the traffic volume along the project corridor is very high. The ambient air quality results also show that the concentration of air pollutants is higher than the national standard. This is also because of the high traffic volume and the many industrial and commercial activities along the Contract influenced area.

Gazipur Bus Depot Contract (C04)

104. All field surveys were completed on time and as defined in the ToR. Soil quality sampling was also conducted, but no information was provided regarding fisheries resources and wildlife. However, in the construction site, there is only a small ditch. The data from other environmental quality sampling showed that the construction work appeared to have very few longer-term impacts on biophysical environment. The test results show that time weighted equivalent continuous sound level, ambient air quality, and water quality comply with the Bangladesh standards.

D. CONTRACTOR COMPLIANCE

At Grade Section including Flyovers (C01)

105. The Contractor for the Construction of At Grade Section including Flyovers (C01) has fully complied with Environmental monitoring and mitigation program as per the EMP of the EIA. The baseline environmental monitoring and the first environmental quality monitoring has been conducted during the monitoring period. The Contractor submitted the draft Environmental Management System (EMS) after incorporating the comments from the Consultant. The Contractor has been notified several times to submit the final HSMP, Site Safety Manual, Site Personnel Health and Epidemic Prevention Program for approval from consultant. The Contractor has not yet deployed their Environmental Management Officers (EMOs) despite several reminder letters regarding the issue.

106. Mitigation measures regarding surface water, ground water, air quality, noise and dust pollution were fully complied. The Results of the noise level monitoring during day and night time and the ambient air quality monitoring along the project corridor shows that the values were higher than the national standard. the reason for this high ambient noise reading may be a result of the high traffic volume and several industrial and commercial activities along the project influenced area and not construction activities.

Elevated Section including Tongi Bridge (C02)

107. Since the Contract for Elevated Section including Tongi Bridge (C02) started on 15 December 2017 major works have not commenced and thus there was no scope for environmental monitoring. The Contractor has not yet submitted their Environmental Management System (EMS)/Construction Environmental Management Plan (CEMP) for approval from Consultant. The Contractor also yet not complied with the Baseline Monitoring of Environmental Parameters and has not yet not deployed their Environmental Management Officers (EMOs).

Local Roads and Kitchen Markets (C03)

108. Since the Contract for Local Roads and Kitchen Markets (C03) started on 10 December 2017 major civil works have not commenced thus there was no scope for environmental monitoring. However, the Contractor has submitted their Draft Environmental Protection Plan, and the HIV-AIDS Awareness Program for approval from Consultant. The Contractor has not yet complied with the Baseline Monitoring of Environmental Parameters.

Gazipur Bus Depot (C04)

109. The Contractor for the Construction of Bus Depot (C04) has fully complied with Environmental monitoring and mitigation program for filling up of water logged area, fisheries, occupational health and safety and community health and safety issues. Mitigation measures regarding surface water, ground water, air quality, and noise and dust pollution were partially complied. The result of the noise level during day time at the construction site (49.01 dBA) was within the ambient standard (Leq 55 dBA) although the noise recorded was higher than the standard during the previous monitoring period. Moreover, soil quality sampling was conducted during this monitoring period. There is a risk of contamination of soils at camp and work sites due to accidental spillage of noxious chemical, petroleum derivatives and bituminous material may happen. Therefore, mitigation and monitoring measures for preventing soil pollution was stressed to the Contractor.

III. ENVIRONMENTAL MANAGEMENT

A. KEY ENVIRONMENTAL ISSUES IDENTIFIED

110. As the remaining major civil works contracts are just commencing the identification of key issues related to implementation of the EMP is premature. However, the level of understanding of EMP issues of the local Contractor engaged on the Bus Depot works (C04) and the slow implementation of the At-Grade Section Contractor (C01) to carry out the Baseline Monitoring and the first environmental quality monitoring indicates that there is likely to be a need to develop more awareness with all Contractors on their requirements for the implementation of the EMPs in their contract.

B. COMPLIANCE WITH ENVIRONMENT RELATED PROJECT COVENANTS

Compliance with National Environmental Laws

111. The environmental legislation of GOB emphasises reducing the negative impacts of infrastructure development projects and enhancement of the positive impacts. This conforms to the National Environmental Policy 1992 that was enacted based on the Agenda 21 of Rio Conference and subsequent enactments of the Bangladesh Environmental Conservation Act (BECA) 1995 and Bangladesh Environmental Conservation Rules (BECR) 1997. The status of compliance with the national laws is as follows:

Table III.1: Compliance with National Laws

Environment Policy/Rule	Compliance Requirement	Relevance for BRT-2	BRT-2 Performance
Bangladesh Environmental Conservation Act (BECA) 1995 and Bangladesh Environmental Conservation Rules (BECR) 1997	Requires all construction / reconstruction / expansion of roads and bridges projects to submit an EIA with EMP to obtain an Environmental Clearance (EC)	BRT-2 is required to secure and maintain an EC	The environmental clearance (valid for 1 year) for the project was obtained from the DOE on 22nd May 2016. Subsequently the renewal issued on 16th May 2017 for another one year which validity is up to 01 May 2018.

112. The Environmental Clearance Certificate issued for the Project on 22 May 2016 following approval by the DoE of the EIA and the renewal issued on 16 May 2017 for another one year with validity up to 01 May 2018 are included in Appendix 2.

Compliance with ADB Guidelines

113. According to the safeguard policy statement, 2009 of ADB the project falls under Category B and hence an IEE was sufficient to meet the environmental requirements. An IEE report was prepared by the Consultant engaged by the ADB during appraisal in 2012. However, during the detailed design stage between 2013 and 2015 an updated IEE was prepared with the appropriate EMPs being included into the various Bidding Documents. The project is also in conformity with the latest Guideline of ADB i.e. Safeguard Policy Statement 2009.

114. Comments on the Initial Environmental Examination (IEE) were received from ADB on July 2016 and further comments were received on September 2016 with a request to expedite the review and

resubmission of the IEE. A draft of the updated IEE was submitted on 15 Feb 2017 with formal approval of the IEE by ADB remaining prior to the posting of the document for public disclosure on the ADB Website.

Compliance with Loan Agreement

115. Schedule 5 of the Agreements for Loan No's 2863-BAN and 2864-BAN includes covenants for environmental issues[4]. The Project's compliance with the contractual environmental safeguards covenants are shown in the Table III.2.

Table III.2: Compliance with Environmental Considerations of Loan Agreements

Covenant	Reference in the Loan Agreement	Status of Compliance
Environment		
The Borrower shall ensure or cause the EA and the IAs to ensure that the preparation, design, construction, implementation, operation and decommissioning of the Project and all Project facilities comply with: (a) All applicable laws and regulations of the Borrower relating to environment, health and safety; (b) the Environmental Safeguards; and (c) all measures and requirements set forth in the IEE, the EMP, and any corrective or preventative actions set forth in a Safeguards Monitoring Report.	Schedule 5, Para 6.	**Complied.** All requirements addressed in preparation and design stages including contract documentation.
Safeguards – Related procedures in Bidding Documents and Works Contracts		
The Borrower shall ensure or cause the EA and the IAs to ensure that all bidding documents and contracts for Works contain provisions that require contractors to:	Schedule 5, Para 11	**Complied.**
(a) comply with the measures relevant to the contractor set forth in the IEE, the EMP and RP (to the extent they concern impacts on affected people during construction), and any corrective or preventative actions set forth in the Safeguards Monitoring Report;		**Complied.** All Bidding Documents and Contracts contain the required provisions
(b) make available a budget for all such environmental and social measures;		**Complied.**
(c) provide the Borrower with a written notice of any unanticipated environmental, resettlement or indigenous peoples risks or impacts that arise during construction, implementation or operation of the Project that were not considered in the IEE, the EMP and the RP;		**Complied.**
(d) adequately record the condition of roads, agricultural land and other infrastructure prior to starting to transport materials and construction; and		**Complied.**
(e) reinstate pathways, other local infrastructure, and agricultural land to at least their per-project condition upon the completion of construction.		Not applicable until all contracts have been completed.

[4] These clauses are the environmentally specific Loan Covenants in the Legal Agreement also referred to in the ADB Consultation Mission in March 2016 (see para 48, Chapter I of this report)

Covenant	Reference in the Loan Agreement	Status of Compliance
Safeguards Monitoring and Reporting		
The Borrower shall do the following or cause the EA and IAs to do the following:	Schedule 5, Para 12.	
(a) submit semi-annual Safeguards Monitoring Reports to ADB and disclose relevant information from such reports to affected persons promptly upon submission;		**Complied.**
(b) if any unanticipated environmental and/or social risks and impacts arise during construction, implementation or operation of the Project that were not considered in the IEE, the EMP and the RP, promptly inform ADB of the occurrence of such risks or impacts, with detailed description of the event and proposed corrective action plan;		**Complied.**
(c) no later than 6 months after the Effective Date, engage qualified and experienced external expert[s] or qualified NGO[s] under a selection process and terms of reference acceptable to ADB, to verify information produced through the Project monitoring process, and facilitate the carrying out of any verification activities by such external experts; and		
(d) report any actual or potential breach of compliance with the measures and requirements set forth in the EMP and the RP promptly after becoming aware of the breach.		**Complied.**

C. Site Inspections and Audits

116. A site inspection of works of the At Grade Section including Flyovers and the Gazipur Bus Depot was carried out on 09 November 2017 during the ADB Consultation Mission.

117. Under the guidance of the Environmental Specialist, inspectors of the EPCM Consultant regularly conducted environmental monitoring started from April 2017 for the Contracts. The regular site inspections for the bus depot on environmental issues were done by the consultant engineers / environmental specialist with assistance by the Contractor's junior environmental specialist at the Contract site. The Environmental Specialist has conducted meetings with the Contractor representatives (C01 & C04) several times for detailed discussion on the environmental requirements.

D. Consultations and Complaints

118. Consultations were held with local people in the vicinity of the At Grade Section including Flyovers and Gazipur Bus Depot prior to these works proceeding although the works of Bus Depot are on vacant land of BTCL that has been transferred for the use of the Project to MoRTB. To date no complaints have been received or grievances registered in relation to these works.

E. Non-Compliance Notices

119. During the previous six-month period, the Construction Supervision Consultant had been actively monitoring the Contractor's performance in respect to Environmental Safeguards. Issues were identified and communicated formally to the Contractor in the form of official letters.

120. No Non-Compliance Notices have been issued to date with the major civil works contracts just commencing and the Contractor for the Bus Depot Contract having carried out the sampling of the various parameters in the EMP.

IV. CONCLUSION AND RECOMMENDATIONS

A. KEY ISSUES

121. There have been no key Environmental Safeguard issues identified to date at Gazipur Bus Depot (C04) site and the first of the main civil works contract (C01) for the At-Grade section. The Contractor of the first contract (C01) mobilized staff, prepared the required management plans as per EMP implementation and initiated the environmental quality monitoring. The C01 Contractor has submitted his Environmental Management System, Safety Manuals and Health Programme which have been reviewed by the Consultant environmental specialist and returned for correction and further improvements. The monthly environmental monitoring report up to August 2017 has also been submitted by the Co1 Contractor for approval.

122. The relevant Environmental Safeguards identified through the EIA and the IEE have been addressed in the EMPs that have been included in the bidding documents for each of the civil works contracts with both their implementation and monitoring to continue as the major activities proceed.

123. It is expected however that there will be a requirement for extensive awareness training workshops to be carried out once these major activities have commenced to ensure that the implementation of the EMPs is carried out as required by all parties.

B. ADJUSTMENTS TO MONITORING REQUIREMENTS

124. No adjustments have been identified to date for the Monitoring Requirements in the EMPs.

C. NEXT REPORT

125. The next Environmental Monitoring Report will cover the period from January to June 2018 during which all the Civil Works Contracts will have commenced and the procedures for implementation of the EMPs on each contract will have been established with updated base line information recorded.

126. The focus of this report will be to identify if the Contractors have adequately understood their Environmental obligations as set out in the EMP and other relevant provisions of their Contracts, have been able to submit their EMPs and other related documents and have initiated the relevant procedures on site to ensure compliance with these requirements.

APPENDIX 1: Project Works Schedules

APPENDIX 2: Environmental Clearance Certificates

Government of the People's Republic of Bangladesh
Department of Environment
Dhaka Regional Office
Paribesh Bhaban
E-16 Agargaon, Dhaka-1207
www.doe.gov.bd

Memo No: 22.02.0000.131.72.007.17/Renewal- 01 Date: 16/05/2017.

Subject : Renewal of the Environmental Clearance Certificate of the Greater Dhaka Sustainable Urban Transport Project (BRT Gazipur-Airport).

Ref : (1) Clearance Certificate Numbr- DOE/Clearance/5252/2013/175, Date :02/05/2016.
(2) Your Application dated on 20/04/2017.

With reference to your application of 20/04/2017 on the subject mentioned above, the Department of Environment (DOE) is pleased to renew the Environmental Clearance Certificate (ECC) of the Greater Dhaka Sustainable Urban Transport Project (BRT Gazipur-Airport) for one year effecting from 02/05/2017. The ECC needs to be renewal not later than 01/05/2018.

2. The terms and condition set out in the original ECC (DOE/Clearance/5252/2013/175, Date: 02/05/2016) shall remain valid. Violation of any of those conditions shall render this clearance void.

16.05.2017
(Masud Iqbal Md. Shameem)
Director
Phone : 8181794.

Project Director
Greater Dhaka Sustainable Urban
Transport Project (BRT Gazipur-Airport)
Roads & Highways Department (RHD)
House- 04, Road-21, Sector-04
Uttara, Dhaka-1230.

Copy Forwarded to:

1. Assistant Director to the Director General, Department of Environment, Head Office, Dhaka.

E:\Dhaka Region Office\Renewal Clearance\Garments & other Renewal_F-1.doc

Government of the People's Republic of Bangladesh
Department of Environment
Paribesh Bhaban, E-16, Agargaon
Sher-e-Bangla Nagar, Dhaka-1207
www.doe.gov.bd

Environmental Clearance Certificate

Section 12(1) of the Environment Conservation Act, 1995 (Amended 2010)

Clearance Certificate Number: 175

File number: DOE/Clearance/5252/2013

Clearance Certificate Issue Date: 02 /05/2016

Renewal date not later than: 01 /05/2017

A. Clearance Certificate Type
Environmental Clearance Certificate

B. Clearance Certificate Holder
Project Director Greater Dhaka Sustainable Urban Transport Project (BRT Gazipur- Airport) Roads & Highways Department (RHD) House # 04, Road # 21, Sector # 04 Uttara, Dhaka-1230.

C. Premises to which this Clearance Certificate Applies
The proposed BRT corridor extends north from Airport roundabout along the Dhaka-Mymensingh Highway to Joydevpur Chowrasta and then eastwards along Joydevpur road to Gazipur. The project area falls into two districts viz Dhaka for the section from the Airport to Tongi Bridge and Gazipur for north of Tongi Bridge.

D. Activities for which this Clearance Certificate Authorizes and Regulates
The following components will be implemented by the Greater Dhaka Sustainable Urban Transport Project (BRT Gazipur- Airport) authority - • A dedicated lane for BRT in each direction throughout the full length of the proposed road with bypass lanes at stations. • 4.5 km long elevated section in Tongi from km 2+600 to 7+100. • Six additional flyovers at main junction. • 25 BRT stations. • A bus terminal and depot at Gazipur and a terminal at Airport. • Two mixed-traffic lanes and one Non-Motorized Transport (NMT) lane per direction.

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- Footpaths along either side of the BRT NMT lanes.
- Improvement of 68 feeder roads.
- Construction of nine kitchen markets.

E. Terms and Conditions for Environmental Clearance Certificate

1. **Limit Condition for Discharges to Air and Water**: The Environmental Clearance Certificate must comply with schedule 2 and 10, rule 12 of the Environment Conservation Rules, 1997.

2. **Noise Limit**: The Environmental Clearance Certificate must comply with the Noise Pollution (Control) Rules, 2006.

In case of non-coverage of ECR 1997 the World Bank Environment, Health and Safety Guideline shall be adhered to.

3. **Operating conditions:**

3.1 Activities must be carried out in a competent manner. This includes:
(a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
(b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

3.2 All plant and equipment installed at the premises or used in connection with the Environmental Clearance activity:
(a) must be maintained in a proper and efficient condition; and
(b) must be operated in a proper and efficient manner.

3.3 Construction works shall be restricted to day time hours so as to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.

3.4 Storage area for soils and other construction materials shall be carefully selected to avoid disturbance of the natural drainage.

3.5 This shall be ensured that soil is obtained from nearby areas, which are free of invasive plants. Re-vegetation and replanting shall be undertaken if rehabilitation works involve extensive vegetation clearance.

3.6 Vegetation clearance shall be minimizing at the construction phase as to minimize soil erosion. Soils for embankments shall be properly tested and compacted to ensure stability.

3.7 Proper construction practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.

3.8 Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.

3.9 In order to control noise pollution, vehicles & equipment shall be maintained regularly; working during sensitive hours and locating machinery close to sensitive receptor shall be avoided.

3.10 No solid waste can be burnt in the project area. An environment friendly solid waste management should be in place during whole the period of the project in the field.

3.11 Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be demolished or destructed.

3.12 All the required mitigation measures suggested in the EIA report are to be strictly implemented and kept operative/functioning on a continuous basis.

3.13 Any heritage sight, ecological critical area, and other environmentally and/or religious sensitive places shall be avoided during project construction phase.

3.14 Resettlement plan should be properly implemented and people should be adequately compensated, where necessary.

3.15 No activity of filling wetlands is endorsed under this clearance without due permission/clearance of the concerned authority of the Government of Bangladesh.

3.16 Construction material should be properly disposed off after the construction work is over.

3.17 The Environmental Management Plan included in EIA report shall strictly be implemented and kept functioning on a continuous basis.

4.1 Monitoring and Recording conditions:

4.1.1 The results of any monitoring required to be conducted by this Clearance Certificate must be recorded.

4.1.2 The following records must be kept in respect of any samples required to be collected for the purposes of this Clearance Certificate:
(a) the date(s) on which the sample was taken;
(b) the time(s) at which the sample was collected;
(c) the point at which the sample was taken; and
(d) the name of the person who collected the sample.

4.2 Requirement to monitor concentration of pollutants discharged

For each monitoring, the Clearance Certificate holder must monitor (by sampling and obtaining results by analysis) the following parameter: air quality, water quality and Noise.

5. Reporting Conditions: Environmental Monitoring Reports shall be made available simultaneously to Head quarters of DOE and Dhaka Regional office of DOE on a quarterly basis during the whole period of the project.

6. Notification of environmental harm: The Clearance Certificate holder or its employees must notify the Department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.

F. Recording of pollution complaints

The certificate holder must keep a legible record of all complaints made to the certificate holder or any employee or agent of the certificate holder in relation to pollution arising from any activity to which this Environmental certificate applies. The record must include details of the following:

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(a) the date and time of the complaint;
(b) the method by which the complaint was made;
(c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
(d) the nature of the complaint;
(e) the action taken by the certificate holder in relation to the complaint, including any follow-up contact with the complainant; and
(f) if no action was taken by the certificate holder, the reasons why no action was taken.

The record of a complaint must be kept for at least 4 years after the complaint was made. The record must be produced to any authorized officer of the DOE who asks to see them.

G. Validity of the Clearance Certificate

This Environmental Clearance is valid for one year from the date of issuance and Project Authority shall apply for renewal to Dhaka Regional Office of DOE with a copy to DOE Head Office at least 30 days ahead of expiry.

Violation of any of the above conditions shall render this clearance void.

This Environmental Clearance Certificate has been issued with the approval of the appropriate authority.

02.05.2016

(Syed Nazmul Ahsan)
Director (Environment Clearance, c.c)
Phone # 02-8181673

APPENDIX 3: Contract Environmental Clauses

Sl. No.	Clause, S/C No.	Subject	Details
SECTION 7- GENERAL CONDITIONS/ SECTION 8- PARTICULAR CONDITIONS			
1	GCC 4.8 PCC 4.8	**Safety Procedures**	The contractor shall comply with all safety regulations (6.13, 6.14, 6.15, 6.18)
2			Take care of safety of all persons entitled to be on the site
3			Use reasonable effort to keep the worksite clear of unnecessary obstructions so as to avoid dangers to these persons.
4			Provide fencing, lighting, guarding and watching of the works.
5			Provide any temporary works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the works, for the use and protection of the public.
6			Within 28 days of the Commencement Date, the Contractor shall provide a Site Safety Plan and Safety Manual, which shall be subject to the Engineer's consent. The Manual shall establish all of the requirements for planning, operating and maintaining a safe working environment for the Contractor's and Employer's Personnel and any other personnel authorised to enter the Site. The Plan and Manual shall include safety requirements for all Site activities, public traffic and personal protective equipment required for each working area. The Site Safety Plan and Manual shall be improved as deemed necessary by the Engineer or by the Contractor's Safety Engineer without relieving the Contractor of any of his obligations or responsibilities under the Contract.
7			The Contractor shall be required to implement specific safety measures such as temporary works and well controlled traffic management to ensure that the public and adjacent property are not endangered in any way whatsoever. The Contractor shall obtain the written approval of the Engineer for all such safety measures at the work location before proceeding with the Works. However, any such approval by the Engineer shall not relieve the Contractor of any of his obligations under the Contract.
8	GCC 4.10	**The Contractor**	The Employer shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in the Employer's possession on sub-surface and hydrological conditions at the Site, including environmental aspects.
9			The Employer shall similarly make available to the Contractor all such data which come into the Employer's possession after the Base Date. The Contractor shall be responsible for interpreting all such data.
10	GCC 4.18 PCC 4.18	**Protection of Environment**	The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations.
11			The Contractor shall ensure that emissions, surface discharges and effluent from the Contractor's activities shall not exceed the values stated in the Specification or prescribed by applicable Laws.
12			The Contractor shall comply with all applicable national, provincial, and local Environmental laws and regulations.
13			The Contractor shall (a) establish an operational system for managing environmental impacts, (b) carry out all of the monitoring and mitigation measures set forth in the Environmental Management Plan (EMP) attached hereto in Volume 5 of 5 and (c) allocate a budget required to ensure that such measures are carried out. The Contractor shall submit [quarterly]/ [semi-annual] report on carrying out of such measurers to the Employer.
14			More particularly, the Contractor shall comply with (i) the measures and requirements set forth in the Environmental Management Plan (EMP) attached hereto in Volume 5 of 5; and (ii) any corrective or preventive actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the Environmental Management Plan.
15			The Contractor shall allocate a budget for compliance with these measures, requirements and actions.
16	SCC 6.7 PCC 6.7	**Health and Safety**	The contractor shall at all times take all reasonable precautions to maintain the health and safety of the contractor's personnel.

Sl. No.	Clause, S/C No.	Subject	Details
17			The contractor shall appoint an accident prevention officer at the site, responsible for maintaining safety and protection against accidents.
18			In the event of a fatal accident the Contractor shall notify the Engineer immediately by verbal communication and submit a formal report as soon as practicable after its occurrence. For all accidents, whether fatal or not, the Contractor shall notify the appropriate local authorities in accordance with the Laws of the Country.
19			The Contractor shall conduct health and safety programs for workers employed under the project, and shall include information on Human Trafficking and any other dangerous and commonly prevailing disease/illness together with the risk of sexuality transmitted diseases, including HIV/AIDS in such programs.
SECTION 9- TECHNICAL SPECIFICATION, DIVISION 1- GENERAL REQUIREMENTS			
20	D1.1.3	**Maintenance and Protection of Traffic on Access Road to The Bus Depot**	Local traffic flow (including car, rickshaw) on access road to the Bus Depot shall be maintained during the entire period of construction.
21			Traffic flow shall be maintained by making and regularly maintaining diversion roads during the entire period of construction in locations where construction of culverts are to be made.
22	D1.1.3.4	Barriers	The Contractor shall supply all lights, signs, skilled and unskilled labour, equipment and barriers required to ensure the control of traffic and the safety of the public and workmen employed in the Works. Barriers shall be used for closing of lanes or roads, the protection of workmen and guidance of vehicular traffic.
	D1.1.7	**Protection of Environment**	
23	D1.1.7.1	General	The Contractor must act in accordance with Environmental Management Plan (EMP), which has been prepared for this project.
24			The Contractor shall be solely responsible for any remedial or mitigation measures required by the environment-related effects of any of his construction activities. In case of an environmental problem, the Contractor shall immediately notify the Engineer and advice on his proposed corrective action.
25			The Contractor shall also be required to compensate for any damage, loss, spoilage, or disturbance of the properties and health of the project affected people during construction. Specific requirements in this regard are noted below. In conformance with the Contract Documents of which this Environmental Specifications is a part, the Engineer may withhold payments and/or stop construction in the event of serious or repeated violations of the conditions stipulated herein.
26	D1.1.7.2	Compliance with Environmental Laws and Regulations	The Contractor shall follow the laws of the Government of Bangladesh for the Protection of the Environment and other relevant legislation in force, or in the absence of these, with Asian Development Bank requirements.
27	D1.1.7.3	Environmental Management System	The Contractor shall submit a detail of environmental management system which shall include the following and submit to the Engineer for approval.
28			The means, by which the environmental management systems will be supervised, monitored and audited to ensure compliance with the principles and objectives of the environmental management plan (EMP) at all times.
			Records to be prepared and maintained by environmental management staff and communication procedures to be followed so that the Engineer and others associated with the Works are kept fully informed on matters relating to the EMP and applicable regulations throughout the Contract period;
29			Proposals to ensure that construction methods do not compromise the Contractor's commitment to the EMP and compliance with all relevant statutory regulations;
30			An organizational structure showing the appointed environmental management staff and the responsibilities of environmental protection participants;
31			The criteria to be used for the appointment of the principal staff;

Sl. No.	Clause, S/C No.	Subject	Details
32			The proposed interaction and communications procedures between the Contractor's personnel and the environmental protection staff, including proposals for the communications facilities to be provided. In particular, the establishment of a regular communications and reporting system;
33			An undertaking signed by the Contractor to the effect the company will ensure that environmental protection will be given the highest priority during all aspects of the Works and in discharging the Contractual Obligations;
34			The frequency, coverage and intent of environmental management meetings together with the rationale for attendance;
35	D1.1.7.4	Environmental Management Officer (EMO)	The Contractor shall appoint an Environmental Management Officer (EMO)/Environmental Specialist (ES) whose duties throughout the construction period, shall be entirely connected with environmental management on the site;
36	D1.1.7.5	EMO's Lines of Communication	The Contractor's staff organization plan shall show direct lines of communication and reporting between the EMO/ES and the Contractor's project manager and between the EMO for the Contract. The Contractor shall instruct and require the project manager responsible to be directly accountable for all matters concerning the environment.
37	D1.1.7.6	Environmental Report	The Contractor shall submit regular environmental reports to the Engineer as required by the EMP. A summary report shall be submitted as part of the Monthly Progress Report. Prior to the submission, the Contractor's Project Manager shall endorse the report. Reports shall comprehensively address all relevant aspects of environmental regulations and requirements and in particular, report on all environmental audits undertaken during the reporting period. Contents and formats of the report are to be agreed by the Engineer prior to preparing the report.
38	D1.1.7.7	Environmental Management Meetings	The Contractor shall convene regular environmental management meetings in accordance with the EMP and shall require the attendance of the EMO/ES unless otherwise agreed by the Engineer. Notice of all environmental management meetings shall be given to the Engineer who may attend in person or send a representative. The minutes of all such meetings shall be recorded and circulated to the attendees and the Engineer within seven days of the date of the meeting.
39	D1.1.7.8	Environmental Inspections	All project locations including construction areas, sites, plant and equipment areas, staff offices, camps and accommodations that are directly or indirectly associated with the Contract shall be regularly inspected for compliance with the requirements of the EMP and related statutory regulations.
40	D1.1.7.9	Assistance to the Engineer	The Contractor shall provide full co-operation and assistance in all environmental management surveillance to be carried out by the Engineer
41	D1.1.7.10	Measurement and Payment	Environmental Management shall be measured on Lump Sum basis. Payment for Environmental Management including employment of the staff shall be deemed to be full compensation for all supervision, labor, equipment and apparatus necessary or required for complying with the requirements of EMP;
42	D1.1.8.1	**HEALTH, SAFETY AND SITE SECURITY:** Health	The Contractor shall in addition to complying with the requirements of GCC and PCC Sub-Clauses 6.7 [Health and Safety], Sub-Clause 6.13 [Supply of Foodstuff], Sub-Clause 6.14 [Supply of Water], Sub-Clause 6.15 [Measures against Insect and Pest Nuisance], Sub-Clause 6.18 [Festivals and Religious Customs], as well as the national standards of the Government of Bangladesh in respect of health and safety, observe and maintain standards, towards the health and safety, of all of his employees, not less than those laid down by his own national standards or statutory regulations.
43	D1.1.8.2.1	**SAFETY:** Health and Safety Management Plan	The Contractor shall prepare a Health and Safety Plan (HS Plan) and submit to the Engineer for approval within 56 days of receiving the order to commence.
44			How the Contractor will implement and comply specifically with all duties responsibilities and obligations stipulated in the relevant sub-clauses of Clause 6

Sl. No.	Clause, S/C No.	Subject	Details
			of the Conditions of Contract and any other relevant clauses in the Conditions of Contract in addition to any duties, obligations and responsibilities contained within the Specifications and the EMP.
45			The HS Plan shall specify the Contractor's organisational structure through which all health, safety and environmental issues will be mitigated and managed.
46			Appropriate controls and measures to eliminate and or reduce as appropriate, safety risks in accordance with internationally accepted good practice.
47			Specific induction and training needs for: Employer's personnel, Supervising Engineer's personnel, Contractor's personnel, subcontractors' personnel and any other person who are authorised to be on the Site, by the Engineer and or the Employer working on the Site.
48	D1.1.8.2.2	Safety Officer	The Contractor shall appoint both a Safety Manager and an Accident Prevention Officer at the Site, jointly responsible for maintaining health and safety and protection against accidents.
49	D1.1.8.2.3	Personal Protective Equipment	The Contractor shall provide all his personnel and that of the Engineer and Employer, with sufficient quantities of personal protective equipment (PPE) appropriate to the work being carried out and ensure its' proper use. For clarification, PPE includes but is not limited to safety helmets, high visibility reflective jackets, hearing protectors, safety goggles, gloves, safety shoes, waterproof clothing, full body safety harnesses, shock absorbing lanyards, self-retracting lifelines, welding gloves and aprons and the like. The Contractor shall take disciplinary action against any personnel who do not properly utilise or who misuse or abuse the supplied PPE.
50	D1.1.8.3	Site Security	Referring to Conditions of Contract Sub-Clause 4.22, the Contractor shall be responsible for the security of the Site and all Site Offices and accommodations which are provided for his own use for that of the Engineer. The responsibility extends to maintaining a safe working environment at all times.
51			The Contractor shall prepare a register of all persons authorised to be upon the Site which shall include the Employer's and the Engineer's personnel. The Contractor shall maintain such register and shall have it available for inspection by the Engineer at any reasonable time.
52	D1.1.8.3.1	Project Signboards	A project signboard as per Drawing submitted by the Contractor and approved by the Engineer, shall be placed at each end of the Works facing the traffic entering the working area.
53	D1.1.8.4	HIV-AIDS Prevention/Awareness Programme	In compliance with the requirements of Conditions of Contract, Sub-Clause 6.7, the Contractor shall comply with HIV-AIDS Prevention/awareness programme and engage the services of an approved service provider.
54	D1.1.10	**CONTRACTOR'S SITE FACILITIES AND TEMPORARY WORKS:** Contractor's Site Facilities	The potable water supplied to the offices, accommodation and work sites shall be of acceptable quality as specified by the World Health Organisation (WHO). The Contractor shall be solely responsible for establishing and carrying out any and all chemical and/or mechanical treatment of the water in order to have it conform to the standards of the WHO.
SECTION 9- TECHNICAL SPECIFICATION, DIVISION 2- EARTHWORKS			
	D2.2.1	**CLEARING AND GRUBBING**	
55	D2.2.1.1	Tree Cutting	Contractor shall make a survey jointly with the Engineer of the existing trees within the limitation of project area. The Contractor shall submit the location inventory of these trees mentioning their serial numbers, types (local Bengali names), and girths measured one metre above the ground level to the Engineer for his scrutiny and approval.
56	D2.2.1.3.1	Clearing	The material to be cleared shall include but not necessarily be limited to trees, stumps, logs, brush, undergrowth, grass, crops, loose vegetable matter and structures unless provided for elsewhere. Trees and stumps shall be cut to ground level.
57	D2.2.1.3.2	Grubbing	Grubbing shall be confined to major roots beneath the embankment, ditches, canal diversions and footing excavations. In these areas grubbing shall consist of the removal of all major stumps, embedded logs, tree roots and other material, except as otherwise directed by the Engineer.
58		Utility	Holes/trench left by relocating utilities services (Power and Telephone poles, Water line, Gas line, etc.) shall be filled with suitable material compacted to

Sl. No.	Clause, S/C No.	Subject	Details
			comply with section 2.6 of the Specification with the cost of this being deemed to be included in the rate for clearing and grubbing.
59		Top Soil	Topsoil of minimum depth of 100 mm (typically 150mm) shall be stripped and stockpiled separately for possible re-use as landscaping material.
	D2.2.2	**Excavation**	
60	D2.2.2.1	Excavation- Description	The Contractor shall not excavate beyond the lines and grades shown on the Drawings. When an excavation for the permanent works has been carried out to the specified elevation, the Engineer will inspect the excavation and may instruct the Contractor to remove any unstable or unsuitable material from the floor of the excavation and replace it with competent backfill material.
61	D2.2.2.3.2	Use of Excavated Material	Material excavated from existing road pavement which is to be reconstructed may be used in the new road pavement provided the material after suitable breaking and mixing satisfies all requirements of these Specifications.
	D2.2.3	**BORROW PIT**	
62	D2.2.3.2.1	Acquisition and Use of Borrow Pits	The use, depth, location, and dimensions of borrow pits within the right-of-way shall be subject to the approval of the Engineer.
63	D2.2.3.2.2		The Contractor may open borrow pits outside the right-of-way and in such cases the Contractor shall be fully and solely responsible for the expenses incurred and any legal consequences
	D2.2.4	**CHANNEL EXCAVATION**	
64	D2.2.4.1	Description	This work shall consist of excavation for channels for discharging water from side ditches where shown on the Drawings, required in the Specifications or as directed by the Engineer. The work shall include the proper utilisation and hauling or disposal of all excavated materials, and constructing, shaping and finishing of all earthworks.
65	D2.2.4.3.2	Excavation	Deepening and realignment of existing canals and channels shall be carried out in a way to allow free flow of the water.
66			During excavation of new channels these shall as far as possible be kept drained.
	D2.2.6	**EMBANKMENT**	
67	D2.2.6.1	Description	This work shall consist of the construction of embankment and fill by furnishing, placing, compacting and shaping suitable material of acceptable quality obtained from approved sources in accordance with these Specifications and to the lines, levels, grades, dimensions and cross sections shown on the Drawings or as required by the Engineer.
68	D2.2.6.2	Materials	Materials for embankments shall be from sources which the Contractor shall propose and which shall be approved by the Engineer.
SECTION 9- TECHNICAL SPECIFICATION, DIVISION 3- PAVEMENT			
69	D3.3.1.2	Preparation and Stockpiling of Materials	Materials to be used in pavement works shall be processed and stockpiled only in designated areas as approved by the Engineer. The Contractor shall make all arrangements and bear all costs associated with the provision of these storage areas. Preparation and storage of materials along the alignment will not be allowed.
70			The designated areas shall be cleared of all vegetation and topsoil prior to commencing work and the arrival of any materials. The area will be graded and drained, and, where the Engineer deems it necessary, the area shall be surfaced with a 100 mm layer of approved stone or with brick flat soling.
71	D3.3.5.2.4	Bituminous Materials	Details as to the source and type of bitumen must be submitted for approval at least 14 days before the proposed use of the material and should conform to the requirements of Section 3.4.

APPENDIX 4: Environmental Management Plan

Table 1: Environmental Management Plan: Environmental Mitigation Table for BRT Corridor

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
IMPLEMENTATION PHASE: DESIGN/PRE-CONSTRUCTION							
Provision of Early Training	• Awareness and Training on environmental protection aspects relevant to good construction practices may avoid/ reduce some construction impacts.	• EPCM Consultant and RHD to provide training as part of the overall awareness and training program to be delivered before construction.	• Proof of completion. • Posting of proof of completion at worksites	Safeguard Compliance Orientation	Location to be confirmed	EPCM CONSULTANT/ RHD	EPCM CONSULTANT/RHD/PIUs/PMU
Climate Change	• Changes in climate and long term impacts on the environment;	• Consider potential impacts from extreme climate change scenario in designing bridge and culverts.	• Consideration of climate change in project design	Compliance with National guideline	Throughout the project area	EPCM CONSULTANT	RHD
Topography	• Change in topography due to construction-related structures such as bridges, flyovers, stations etc.; and • Visual changes to topography.	• Tree planting for street beautification as per the Tree Cutting and Replantation Plan Plan (TCRP) developed by RHD.	Transport route and worksite cleared of any dust/mud	Compliance with National guideline for land use policy.	Throughout the project areas and other suitable land identified by RHD	RHD	PIUs/FD
Land Acquisition	• Acquisition of 5.510 acre land; • Resettlement of Affected Persons (APs).	• All efforts have been made in BRT design to reduce land acquisition; • Careful alignment and route selection by the design team to minimize resettlement; • Developing proper and adequate compensation package for affected persons; • Prior to site works, payment of compensation to affected people based on the Resettlement Plan.	• Land substitution • Cash compensation of properties acquired.	Compliance with RP	Throughout the project areas	EPCM CONSULTANT; PIUs	PIUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
Loss of Structures (Dwellings, Commercial Buildings and Industrial Structures)	• A total 2160 of structures will be affected through strip-taking along the project corridor where widening is required.	• Compensation for the loss of land, house, trees, structures, crops, wage/income to be included in the Resettlement Plan. • In case of relocation provision of similar or better living conditions for project affected persons (PAPs).	• Number of public grievances re-resettlement and compensation; • Number of complaints from sensitive receptors	Compliance with RP	Throughout the project areas	RHD; PIUs	EPCM CONSULTANT
Construction activities near Educational Institutions, Religious and , Culturally Sensitive Structures	• Educational, religious, and cultural institutions in the project area will be directly and indirectly affected from the project activities. • The monument "Jagroto Chowrongi' will have to be relocated or protected.	• The project implementation should take in to consideration construction of the alignment or making provision of allocating financial resources for rehabilitation of the Madrassa, Mosque and the educational institution. • Provision should be made for two rows of trees between RoW of the alignment and the sensitive structures, and suitable noise barriers to absorb the noise. • The sculpture should be dismantled with care and installed in an appropriate location selected by DC, Gazipur or protected during construction. • Implement the "chance find" procedures for materials that may be discovered during project implementation.	• Records of chance finds • Temporary access provision; • Permanent access restored	Compliance with RP	Throughout the project areas	EPCM CONSULTANT	PIUs
Damage to Public Utilities	• Utility lines will have to be moved disrupting services • The electricity line is above the underground gas line in the same vertical alignment may	• Provision in the design and budget for the relocation of the existing utility infrastructures, wherever required; • All public utilities (e.g. water/gas pipes, power/telephone lines,	• Number of complaints from sensitive receptors • Nos of electric poles relocated;	Compliance with RP and emergency response plan	Throughout the project areas	EPCM CONSULTANT Utility service Providers;	PIUs/PMU

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
	cause an accident due to the short circuiting	mobile tower likely to be affected by the proposed project road expansion will be relocated before the actual commencement of the construction work. • Informing all hospitals, schools, places of worship, and affected communities well in advance; • Utilities will only be removed and relocated with proper agency approvals and permission; • If utilities are damaged during construction, it will be reported to the Consultants and utility authority and repairs will be arranged immediately at the contractor's expense. • Reconnection of utilities will be completed at the shortest practicable time before construction commences. • It is necessary to separate the live parts and insulating material from underground water pipes/gas pipes. To prevent short circuit fires, electric fire alarms (short circuit fire alarms) should be installed in the necessary locations.	• Temporary power supply				

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
[5]Tree Cutting	• Around 4716 trees including 230 large, 1909 medium, 1904 small trees and 685 saplings will be cut along the RoW and within the bus depot site for site preparation.	• Minimize the tree cutting by selecting road widening option based on technical • Trees should not be cut prior the permission from Forest Department. • Afforestation will be done at the ratio of 1 (cut):2(new planting). • A total of 9456 sapling trees will be planted as per TCRP developed by RHD. • For social forestry, afforestation ratio will be as per the consultation with tree owner. • Indigenous trees most suited to the tract will be planted; • An awareness campaign targeted on the neighborhood affected persons will be carried to popularize tree planting and saplings should be provided to interested parties;	• No of tree felled; • Compensatory plantation site identified.	Compliance with tree management plan	Throughout the project area	Contractor; RHD; NGOs	EPCM CONSULTANT/ DF/PIUs/ PMU
IMPLEMENTATION PHASE: CONSTRUCTION							
Changes to Hydrologic Regime	• Temporary drainage blockage, especially at bridge, culverts, service areas, and construction sites.	• Provision of drains of sufficient sizes to take design flows. • Wastes and dredged spoils should not be disposed near any water body. All waste depending on its characteristics, should be disposed of in a controlled and following local requirements. • Minimize alterations in the surface drainage pattern as much as possible.	• Designs of both Cross and side drains; • No of culverts; • Number and size of pipes	• Compliance with Design report	Bridge and culvert sites	EPCM Consultant; Contractor	EPCM CONSULTANT/ PIUs/PMU
Drainage	• Drainage congestion due	• Regular cleaning of channels to	• Designs of both	• Compliance with	Drainage	Contractor	EPCM

[5] Size of the trees refer here circumference of the trees which are: Large=5' and Above; Medium= 2'7"-5'; Small= 7"-2'7"; Saplings= <6"

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
changes	to waste/sediment disposal and construction of road corridor.	avoid choking. • Adequate cross drainage structures will be provided to easily drain off water to canals and other lowland areas; • Ensure that storm water drains and highway drainage systems are periodically cleared to maintain storm water flows during construction. • All irrigation canals along the alignment will be clearly marked on the ground to prevent accidental dumping of fill materials into these canals.	Cross and side drains; • Number of culverts; • Number and size of pipes	Design report	structure sites		CONSULTANT/PIUs/PMU
Soil Erosion and Siltation	• Soil erosion due to construction activities, earthworks, cut and fill operations and from stockpiles. • Erosion and subsequent deposition in the adjacent land.	• Adopt good construction practices. • Adjusting construction schedule for bridge during non-monsoon season. • Turfing of road shoulders to protect slopes. • Earth stockpiles to be provided with gentle slopes. • Ensuring vegetation on road embankments and road cuttings with fast growing crop and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization. • Using stone pitching or riprap at appropriate places especially around overpasses, bridge, culverts.	• Receipt of complaint regarding sediment loss or water turbidity. • Bridge locations; • Retaining walls • Number of any non- compliance reports	• Compliance with National/International guideline limits for soil quality	The full length of the road alignment	Contractor	EPCM CONSULTANT/PIUs
Soil Compaction and Contamination	• Compaction of soil due to movement of vehicles and equipment • Contamination of soil due to leakage/spillage of oil, bituminous and non-bituminous debris	• Construction vehicles, machinery, and equipment to be stationed in the designated RoW to avoid compaction. • Haulage routes to be designated along fallow and consolidated soil areas to reduce compaction of	• Number of any non- compliance reports • Maintenance of temporary passages;	• Compliance with National/International guideline limits for soil quality	Construction sites along the full length of the project	Contractor	EPCM CONSULTANT/ PIUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		arable land. • Fuel storage and filling to be undertaken in areas with concrete surfacing and bunds and interceptor traps • Oil interceptors to be provided at wash down and refueling sites • Oil and grease spill and oil-soaked materials will be sold off to authorized recyclers.					
Riverbed Sediment	• Disturbance of riverbed sediments due to dredging activities; • Contamination of bottom sediments by accidental spilling of bituminous materials and other petro-chemicals.	• Prevent construction debris from entering drainage or irrigation canals; • Construction work close to river to be minimized especially during monsoon season; • Conduct regular riverbed sediment quality monitoring according to the determined sampling schedule. • Train construction workers on safe handling of petro-chemicals to prevent spillage or leakage to the river or other water bodies; • Restrict disposal of any construction waste into the river or nearby water bodies;	• Results of sediment quality analysis • Bridge locations;	• Compliance with National/International guideline limits for Riverbed sediment.	Bridge construction site on Turag River	Contractor	EPCM CONSULTANT/ PIU/BBA
Topsoil removal	• Removal of top soil for construction outside the RoW. • Compaction of topsoil. • Loss of top soil by wind and water erosion. • Covering of top soil by project works.	• The stockpile slope to be no steeper than 2 (H):1 (V) to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil.	• Number of non-compliances observed/ reported	• Compliance with National/International guideline limits for soil quality	Construction sites throughout the road alignment	Contractor	EPCM CONSULTANT/ PIUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		• Use stripped topsoil to cover all disturbed areas and along the proposed tree plantation sites. • Rip ground surface prior to the spreading of topsoil, • Limit equipment and vehicular movements to within the approved construction zone. • Remove unwanted materials from topsoil such as roots of trees, rubble and waste etc.					
Air Quality changes	• Dust generation due to construction activities and transport of construction materials. • Emissions from vehicles, equipment and machinery.	• Vehicles transporting construction material to be covered; • Construction equipment to be maintained to a good standard and discouraging idling of engines. • Machinery emitting visible smoke to be banned from construction sites; • Contractor to prepare a dust suppression program detailing action to be taken to minimize dust generation (e.g. spraying of roads with water), and the equipment to be used. • Equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce dust emissions; • Locate asphalt and crushing plants away from residential areas and social infrastructure such as hospitals, mosques, schools and madrasas. (Refer to Annex 2 for locations of these). Clearance should be at least 500 m and take into account the prevailing wind direction. • Dust masks to be provided to	• Location of stockpiles; • Number of complaints from sensitive receptors; • Heavy equipment and machinery with air pollution control devices; • Ambient air quality found beyond the national standards	• Compliance with DoE and National guideline limits for Air at sensitive receptors. • Certification that vehicles are compliant with air quality standards.	Construction sites along the full length of the project	Contractor	EPCM CONSULTANT/PIUs/DoE

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		workers where dust hazards exist; • Proper dust collection and control systems to be installed at crushers; • Air quality monitoring to be carried out as per the schedule in the environmental monitoring plan.					
Noise and Vibration	• Noise from construction vehicles, equipment and machinery. • Vibration caused by construction activities.	• Use of modern plant and equipment with appropriate muffling devices. • All powered mechanical equipment and machinery to be fitted with noise abating gear such as mufflers for effective noise control, in compliance with DoE regulations. • Construction operations to be restricted to 0700 to 1800 hours. • Locate rock crushing, concrete mixing and material shipment yards away from residential areas, schools, colleges and hospitals. • Install temporary noise barriers near sensitive locations such as schools, religious places and hospitals (Refer to Annex 2 for locations) • Providing the construction workers with suitable hearing protection as ear cap, or earmuffs etc. • Surround the piers during construction with an air bubble curtain system or coffer dam. • Use a smaller hammer to reduce the sound pressure. The sound produced in pile driving has a direct relationship to the force used to drive the pile. A smaller hammer will have less force on the pile therefore, producing less sound. • Noise and vibration level monitoring to be carried out as per the schedule	• Number of complaints from sensitive receptors; • Noise measurement data • Use of silencers in noise-producing equipment and sound barriers;	• Equivalent day and night time noise levels • Compliance with DoE and National guideline limits for Noise at sensitive receptors.	Construction sites along the full length of the project	Contractor	EPCM CONSULTANT/ PIUs/DoE

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		in the environmental monitoring plan.					
Changes to Topography and Landscape	• Visual intrusion from large piles of embankment and construction materials obstructing views; • Land degradation due to excavation in borrow area.	• Material stockpiles will be removed as soon as work is completed and the area re-landscaped • Top soil to be preserved for rehabilitation of borrow pits • Borrow pits to be either closed or converted to ponds at the completion of work; • Construction wastes to be used in construction activities;	• Worksite clear of hazardous wastes such as oil/fuel • Worksite clear of any wastes, collected materials from drainages, unutilized materials and debris • Transport route and worksite cleared of any dust/mud	• Compliance with National guideline for land use policy. • Compliance with Waste management plan	Borrow areas	Contractor	EPCM CONSULTANT/ PIUs
Sitting of Construction and Labour camps, plans and equipment and Workshops	• Loss of plantation and vegetation; • Permanent physical and visual impact on the area; • Health risk of the workers. • Social disturbance to nearby community.	• Construction camps, plant and equipment and workshops to be located away from sensitive areas and not within 500 m of existing settlements (Refer to Annex 2 for chainage km) unless agreed to after consultation with local people; • Provide adequate housing for all workers at the construction camps and establish clean canteen/eating and cooking areas; • Camp site will be cleaned up to the satisfaction of the local community after use; • Standing water will not be allowed to accumulate in the temporary drainage facilities or along the roadside to prevent proliferation of	• Worksite clear of hazardous wastes such as oil/fuel • Worksite clear of any wastes, collected materials from drainages, unutilized materials and debris • Transport route and worksite cleared of any dust/mud	• Compliance with Waste management plan	Construction camps, workshops and labour camps	Contractor	EPCM CONSULTANT/PIUs/PMU

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		mosquitoes. • Briefing and/or on-site training for the contractor's workers on the environmental requirement of the project and the implementation of mitigation measures; • Minimize vegetation loss while making site arrangements for construction camps and other facilities; • Good sanitation facilities to be provided for the camps; • Wastewater from contractors' workshops and equipment washing yards will be passed through gravel/sand beds, and all oil/grease contaminants will be removed, before discharging. Oil and grease residues will be stored in drums awaiting disposal in line with the agreed waste management plan, and consistent with national and local regulations; • Solid waste must not be dumped, buried or burned at or near the project site, but will be disposed of at the nearest sanitary landfill or site having and complying with the necessary permits; • The sites for camps and associated facilities will be rehabilitated after completion of the project. • HIV/AIDS awareness and prevention program will be implemented in line with social plans under the project. • Construction workers should be under instruction not to be involved/ interfere in social issues of					

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		neighborhood communities.					
River protection and bridge construction	• Movement of barges and other construction vessels and bridge construction activities within the river will interfere with local navigation and interrupt the river traffic; • Silt and Contaminated runoff reaching river water • Underwater noise impacts on fisheries and other aquatic life.	• In bridge repair and demolition, 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 these sections away, or alternatively, by construction of a platform onto which the bridge could be lowered. • Rocks and stones will be disposed of so as not to block rivers and streams • Cofferdams, silt fences, sediment barriers, or other devices will be used as appropriate based on the design to prevent spreading 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. • 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. • If hydraulic hammer are to be used the impact of pile driving cannot be avoided. However, the force of the hammer blow can be controlled with hydraulic hammers, and	• Number of non-compliances observed/ reported • Incorporation of IEE recommendation in design and bid documents	• Compliance with BIWTA guideline limits for Navigation.	Bridge construction site on Turag river	Contractor	EPCM CONSULTANT/ PIUs/PMU/BIWTA

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		reducing the impact force will reduce the intensity of the resulting sound.					
Surface Water Bodies	• Loss of surface water bodies and impact on fish.	• Avoid or minimize damage to water channels; • Avoid or minimize use of the riverbed materials. • No bituminous or hazardous materials to be used for filling of water bodies; • In case of accidental obstruction or damage, drainage ditches and ponds will be cleaned or repaired immediately.	• No visible degradation to nearby drainages, khals or water bodies due to construction activities	• Effectiveness of water management measures	All water bodies likely to be affected along the project road (Refer to Annex 2).	Contractor	EPCM CONSULTANT/ PIUs
Surface Water Quality	• Contamination of surface water by disposal of construction waste. • Pollution of domestic water supplies.	• The workforce to be trained in proper methods for storage and handling of materials and chemicals; • Work camps and work sites to be provided with toilets and septic tanks; • Proper drainage system with sedimentation ponds and oil separators to be provided to cope with the rain water and oil spills; • Stockpiled materials will be covered to reduce silt in runoff; • No stockpiling or borrow sites less than100 m from a water body; • Washing of machinery and vehicles in surface waters to be prohibited; • Sealed washing areas will be provided and wastewater will be collected in a sedimentation/ retention pond for treatment prior to release; • Work in rivers will be scheduled during dry season, and work	• Areas for stockpiles, storage of fuels and lubricants and waste materials; • Number of silt traps installed along trenches leading to water bodies • Records of surface water quality inspection	• Compliance with National guideline limits for Surface water.	Construction sites along the full length of the project particularly in areas where there are beel / lowland / pond / ditches (Refer to Annex 2).	Contractor	EPCM CONSULTANT/ PIUs/DoE

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		duration will be as short as possible; • Conduct regular water quality monitoring according to the recommended sampling schedule; • Prevent construction debris from entering drainage or irrigation canals; • Construction work close to ponds or other water bodies to be minimized especially during monsoon season; • Wastes to be collected, stored and taken to approve disposal sites.					
Groundwater Quality	• Depletion of groundwater table due to excessive withdrawal. • Contamination of underground water table from leachate of construction waste.	• Assess availability of water and evaluate impact on use of local water resources to ensure that water utilization for project will not deplete local village supplies. • Arrangements for safe drinking water to be made prior to start work. • Water for consumption to be supplied only after adequate analysis and requisite treatment. • Train workers on the need for judicious use of freshwater resources; • Water reserves to be protected from contamination such as construction and oily waste. • Maintain close liaison with local communities to ensure that any potential conflicts related to common resource utilization for project purposes are resolved quickly.	• Monitoring in accordance with monitoring program. • No breaches of Material Safety Data Sheet (MSDS) for hazardous substances.	• Compliance with National guideline limits for Ground water.	Construction sites along the full length of the project	Contractor	EPCM CONSULTANT/ PIUs/DoE
Materials Exploitation and Management of	• Land use change due to borrowing of earth.	• Update draft materials management plan or MMP (which will also include a mass haulage chart) prepared by	• Air (PM10) and noise level measurements ;	• Compliance with Waste management	Materials Exploitation sites	Contractor	EPCM CONSULTANT/ PIUs/PMU

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
Quarry and Borrow areas	• Land use change and loss of productive top soil. • Chronic erosion and siltation • Deterioration of air quality as well as visual and aesthetic intrusion.	EPCM CONSULTANT during detailed design phase. Updated plan to be approved by EPCM Consultant 1 month prior to commencement of works. Contractor to agree and implement MMP provisions. • Balance cut-and-fill requirements to minimization impacts from extraction of aggregates. • Procure materials only from DoE authorized quarries and borrow sites. • If the contractor will operate the quarry site, required environmental permits will be secured prior to operation of quarry/borrow areas. • Use quarry with highest ratio between extractive capacity (both in terms of quality) and loss of natural state. • Use quarry sites lying close to the alignment, with a high level of accessibility. • Do not use quarries in areas of natural woodland or near rivers which provide food and shelter for birds and other animals. • Borrow/quarry sites will not be located in productive land and forested areas. • During quarry/borrow site operation, provide adequate drainage to avoid accumulation of stagnant water. • Ensure borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of water bodies favorable	• Dust pollution and complain of local residents • Number of non-compliances observed/ reported	plan			

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		for mosquito breeding. • Upon completion of extraction activities, quarry and borrow pits will be stabilized and rehabilitated. Before stabilization these will be dewatered and fences will be installed, as appropriate, to minimize health and safety risks.					
Waste generation: General Construction Waste Disposal, Spoil Disposal and Hazardous Waste Disposal	• Unhygienic conditions, health risk to workforce and general public at and around the camp site; • Visual intrusion from large piles of spoil disposal obstructing views; • Drainage congestion due to waste disposal; • Contamination by Oil and lubricants from vehicle maintenance areas;	• Update the draft Waste Management and Spoil Disposal Plan (WMSDP) prepared by the EPCM consultant one month before construction to cover all aspects of waste storage, disposal, and accidental spills to be approved by EPCM Consultant 1 month prior to commencement of works. Contractor to implement WMSDP provisions. • Areas for disposal should be finalized through a mutual agreement in between landowner and DoE; • Disposal areas to be rehabilitated monitored, catalogued, and marked. • Segregation of wastes will be observed. • Recyclables will be recovered and sold to recyclers. • Solid and liquid wastes will not be disposed of in rivers and streams or other natural drainage path; on fragile slopes, flood ways, farmland, forest, religious or other culturally sensitive areas, or areas where a livelihood is evolved. • Spoils will be disposed of in disused quarries and abandoned borrow pits	• Air (PM10) and noise level measurements ; • Dust pollution; • Number of non-compliances observed/ reported	• Compliance with Waste management plan	Construction sites along the full length of the project, and vehicle maintenance and refueling areas.	Contractor	EPCM CONSULTANT/ PIUs/PMU

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		where practicable; • Disposed spoils 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 practices; • Waste disposal should not cause sedimentation and obstruction of regular drainage, or damage to agricultural land and densely vegetated areas. • Waste disposal sites will be located at least 50 m from surface watercourses and will be protected from runoff by ensuring mild slopes and grassing. • Sanitary wastes generating from staff and labour camps to be disposed of in an environmentally friendly manner, i.e. provision of septic tank etc. for toilet wastes. • 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 in local waste disposal sites. • Hazardous waste to be transported to nearby incineration facility; • It should be ensured that all storage containers are in good condition with proper labeling; • Containers should be checked for leakage and necessary repairs undertaken or replaced. • Equipment/vehicle maintenance					

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		and refueling areas will be confined to areas in construction sites designed to contain spilled lubricants and fuels. Such areas will be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency. • 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. • The contractor will identify named personnel in the management plan/CEMP in charge of the sites, and ensure they are properly trained to control access to these areas; entry will be allowed only under authorization.					
Operation of Asphalt plant Rock crushers, and use of Bitumen	• Air pollution and dust generation. • Spills from Bitumen plants may contaminate surface water quality.	• Undertake precautionary measures for reducing dust emissions from diesel generator sets, hot mix plants, crushers and batching plants. • Provide adequate stack height and dust extraction systems for the hot mix plants. • Ensure water spreading to suppress dusts particularly during dry and windy weather. • Provide grass cover immediately after completion of final earth surface along with watering until they grow and survive. • Tree plantation on the slopes all along the main corridor and other	• Air (PM10) and noise level measurements ; • Dust pollution • Number of non-compliances observed/ reported	• Compliance with Waste management plan	Construction sites along the full length of the project corridor	Contractor	EPCM CONSULTANT/ PIUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		areas of feeder roads, construction yards, construction camps, to reduce the effect of emission of dust and pollutants on the adjacent/nearby communities. • Disposal of Bitumen will not be allowed to enter either running or dry streambeds and nor will be disposed of in ditches or small waste disposal sites prepared by the contractor. • Bitumen storage and mixing areas must be protected against spills. • Proper handling of contaminated soil should be comply with DoE standards.					
Flora	• Loss of habitat due to tree cutting. • Vegetation loss due to site preparation and construction activities.	• Suitable Trees to be planted as per TCRP provided by RHD; • Flowering and fruiting shrubs to be planted along the RoW to beautify the landscape; • Contractor's personnel to be directed not to damage any vegetation such as trees or bushes; • Construction vehicles, equipment and machinery to be limited to their designated areas of movement; • Gas cylinders to be used for fuel at the camps for cooking purposes. Cutting of trees/bushes for fuel not to be allowed; • Camp sites and asphalt plants to be established on waste/barren land rather than on forested or agriculturally productive land. However if such land is not available, it must be ensured that vegetation clearing is minimized and	• Number of complaints from sensitive receptors on disturbance of vegetation. • Illegal felling of trees • PMO and PIU to report in writing the number of trees cut and planted if tree-cutting will be required (to be determined during detailed design stage)	• Compliance with Tree management plan	Construction sites along the full length of the project	RHD	EMCM/PIUs/PMU/FD

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		minimum damage is caused to the trees, undergrowth and crops.					
Wildlife	Hunting wildlife and birds during construction.	• Bangladesh Forest Department should check and confirm that no hunting occurs. • New and good condition machinery with low noise generation characteristics to be used in construction. • Construction work not to be carried out at night. • Borrow pits to be fenced to protect animals.	• Number of complaints from sensitive receptors on disturbance of poaching. • Illegal hunting	Compliance with National/International guideline for wildlife	Along the road alignment and bus depot	Contractor	EMCM/PIUs/FD
Fisheries	• Impact on fishing activity (production, spawning and breeding grounds). • Disturbance to aquatic life including migration of fish due to bridge construction.	• Construction not to be undertaken during high flood. • Construction along the riverbanks must be avoided during the fish breeding season (July to September). • Deep water channel to be maintained during bridge construction.	• Number of complaints from sensitive receptors on disturbance of fishing; • Any evidence of fish mortality.	Compliance with National/International guideline	Throughout the road corridor particularly in pond / ditch / river areas (Refer to Annex 2).	Contractor	EMCM/PIUs
Land use	• Land disputes, soil erosion, loss of potential cropland and vegetation, landscape degradation, and damage to road embankments. • Land use change due to borrowing of earth. • Land use change and loss of productive top soil.	• Agricultural areas not to be used as borrow areas. • Land acquisition for borrow areas to be minimized. River sand to be used for embankment. • Necessary permits to be obtained for any borrow pits from the competent authorities and all environmental considerations to be ensured. • Topsoil from borrow areas to be preserved and borrow pits to be rehabilitated after completion of borrow operations. • Borrow pits to be sited on waste	• Number of complaints from sensitive receptors; • Records of sources of materials	Compliance with National/International guideline	Construction sites along the full length of	Contractor	EMCM/PIUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		land and at least 500 m away from the road. • Priority to be given to borrowing from humps (including from digging of wells) above the general ground level. • Priority should be given to borrowing by excavating/enlarging existing borrow areas.					
Traffic Condition	• Due to construction vehicles, traffic congestion causing inconvenience to the people.	• Prior to start of site works, update and implement updated temporary traffic management plan (TTMP) prepared by EPCM Consultant during detailed design phase. Updated plan to be approved by EPCM CONSULTANT one month prior to commencement of works. Contractor to implement TTMP provisions; • Communicate to the public through local officials regarding the scope and schedule of construction, as well as construction activities causing disruptions or access restrictions; • 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; • 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	• Traffic route during construction works including number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan (Appendix 8); • Number of complaints from sensitive receptors; • Number of signages placed at project location; • Number of walkways, signage, and metal sheets placed at project location	Compliance with Traffic management plan	Construction sites along the full length of corridor	Contractor	EPCM Consultants/PIUs/PMU

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		going in and out of the construction sites to minimize traffic build-up; • Provide safe vehicle and pedestrian access around construction areas; • 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). • Provide sufficient lighting at night within and in the vicinity of construction sites. • Designate traffic officers in construction sites.					
Income and Employment	• Income loss due to the loss of agricultural lands, private structures and common property resources	• Contractor as far as practicable to recruit construction workers from amongst the locals and to maintain gender equity while employing the locals. • Priority will always be given to project affected persons, the unemployed and lower income groups. • Set aside areas within the contractor's camps and offices for local people to sell their products.	Employment records.	Compliance to Bangladesh Labor Law of 2006 and other applicable standards	Along the road alignment	Contractor	EMCM/PIUs
Health and Safety of the Community	• Health and safety risks due presence of construction camp and ongoing construction activities.	• Barriers (e.g., temporary fence) to be installed at construction areas to deter pedestrian access to the roadway except at designated crossing points. • The workers with different transmittable diseases should be restricted to the construction site and sent for treatment or replaced as an urgent measure. • The general public/local residents will not be allowed in high-risk	• Number of accidents; • Number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan (Appendix 5);	Compliance to emergency response plan	Construction sites along the full length of the project	Contractor; RHD	EMCM/PIUs/PMU

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		areas, e.g., excavation sites and areas where heavy equipment is in operation and such sites will have a watchman to keep public out. • Drivers operating construction vehicles to be trained in road safety awareness; • Provision of proper safety and diversion signage. • Crossing provision to be made for pedestrians and vehicles near settlements. • Use of water not to disturb water availability for the public. • Close consultation with local communities to maintain community integrity and social links and avoid conflict situations with respect to resource use. • RHD to Prepare and implement plan for avoiding spread of STDs. • To prevent short circuit fires, electric fire alarms (short circuit fire alarms) should be installed in the necessary locations. Separate the live parts and insulating material from underground water pipes/gas pipes.	• Number of complaints from sensitive receptors; • Number of walkways, signage, and metal sheets placed at project location • Permanent sign boards for hazardous areas • Agreement between landowner and contractors in case of using private lands as work camps, storage areas, etc.				
Occupational Health and Safety - Workers	• Accidental risk and health risks due to unsafe working conditions.	• Contractor will update draft Emergency Response Plan prepared by EPCM Consultant, and instruct workers in health and safety matters. Updated plan to be approved by EPCM Consultant 1 month prior to starting of works. Contractor to implement ERP provisions. • Establish safety measures as	• Equipped first-aid stations • Medical insurance coverage for workers • Number of accidents • Records of supply of	Compliance to emergency response plan	Construction sites along the full length of the project	Contractor	EMCM/PIUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		required by law and by good engineering practice, and provide first aid facilities that are readily accessible by workers; • Fencing on all excavation, borrow pits, and sides of temporary bridge, flyovers etc. • Worker's compensation insurance for all project staff; • Basic medical training to be given to specified work staff. • Basic medical service and supplies to be made available for workers. • Appropriate personal protective equipment (hearing protection, safety glasses, helmets, protective footwear and gloves, high visibility vests and other protective clothing) to be provided to all workers. • Provision of adequate sanitation, washing, cooking and dormitory facilities including lighting. • Adequate signage, lighting, barriers, yellow tape and persons with flags during construction to manage traffic at construction sites, haulage and access roads. • Provision for training to workers, documentation and reporting of occupational accidents, diseases and incidents. • Provision for implementing the proposed emergency response plan which is attached in the Annex 9.	uncontaminated water • Condition of eating areas of workers • Use of personal protective equipment • % of moving equipment outfitted with audible back-up alarms • Permanent sign boards for hazardous areas • Signage for storage and disposal areas • Condition of sanitation facilities for workers. • Record of H&S orientation trainings				
Environmental Monitoring and Completion Reporting		• Prepare Monthly and Quarterly Monitoring Reports. • Prepare a project completion report containing environmental	• Availability and competency of appointed supervisor	Compliance with Reporting procedure	N/A	Contractor	EPCM Consultants /PIUs/PMU

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		management and residual impacts if any.	• Monthly report				
IMPLEMENTATION PHASE: OPERATION							
Tree Planting	Ensuring survival of flora and fauna in the new environment.	• Monitor survival of replanted trees (also compensatory planting) and replant, as necessary. • Undertake proper measures for watering, fertilizing and nursing of trees/ plants/ grasses. • Plantation of additional varieties of trees that supports birds and having high wood value.	• No of tree survived;	Compliance with guideline of Forest Department and the tree management plan	Along the project corridor	RHD/NGO	PIUs/PMU/DF
Soil Quality	• Soil contamination due to accidental spillage from vehicular movement.	• Proper measures must be ensured to prevent any oil spillage and leakage from the vehicles. • Efforts will be made to clean the spills of oil, toxic chemicals etc. as early as possible.	No complaints from sensitive receptors	• Compliance with National/ International guideline limits for soil	Along the project corridor	BRT Operator	PIUs/DoE
Noise and Vibration	• Though both noise level and vibration is expected to reduce, special measures/strategies will be required to keep them within limits.	• According to monitoring results, additional sound barriers in the form of trees and hedges will be discussed with the affected people and planted, if agreed; • Signs for sensitive zones (health centres / educational institutions etc.) to prevent the use of pressure horns; • Enforcement and penalties against traffic rules violators; • Monitoring to protect the trees.	No complaints from sensitive receptors	• Compliance with National guideline limits for Noise level.	Along the project corridor particularly in the major road intersections and densely populated areas	BRT Operator	PIUs/DoE
Air Quality	• Increased traffic levels and congestion will lead to air pollution levels. • Air conditioning gas emission from BRT buses.	• Roadside tree plantations as applicable and feasible under the climatic conditions. • Regular road maintenance to ensure good surface condition. • Carry out regular onsite testing for	No complaints from sensitive receptors	• Compliance with National guideline limits for Air quality.	Along the project corridor particularly in the major road intersections and densely	BRT Operator	PIUs/DoE

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		assessing emission levels of pollutants from vehicles running on road. • Enforcement and penalties against traffic rules violators. • All work done on air conditioners will follow the Industry Code of Practices for automotive air conditioning. Approved refrigerant gas recycling and storage equipment will be used in these circumstances. • Ambient air quality monitoring should be carried out during operation phase.			settlement areas, and Bus Depot		
Water Quality	• Contamination of water bodies from runoff from bus depot, terminal, stations and roads containing oils and grease; • Groundwater may get polluted due to contaminated road runoff.	• In order to discharge rapid removal of storm-water/road runoff, cross slopes and longitudinal drainage will be provided in the design. • Proper drainage system with sedimentation ponds and oil separators will be provided to avoid contamination by run-off and oil spills. • Retention basins with reed beds provided in the design will improve the quality of polluted storm-water/road runoff. • Prior to operation, an emergency response plan for spills of hazardous materials and oil will be prepared. • Water quality monitoring will be carried out as per schedule suggested in the Environmental Monitoring Plan.	No visible degradation to nearby drainages, khals or water bodies due to construction activities	• Compliance with National guideline limits for Surface and Ground water.	Throughout the project road particularly in river/pond/ditch areas	BRT Operator	PIUs/DoE
Cultural Sites	• Noise and vibration near cultural sites like school, college, madrasa, health complex, temple, church	• Noise problem can be mitigated through installation of noise barrier and plantation of trees along the boundary of the cultural sites.	No complaints from sensitive receptors	• Compliance with National guideline limits for	Along the project corridor	BRT Operator	PIUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
	etc.	• Avoid unnecessary noise generation at sensitive cultural sites with regulations.		Noise and dust.			
Road Safety	• Increase in the number of road accidents	• Speed limits will be imposed. • Safety signal will need to be displayed along the road along with display and monitoring of speed limits especially along settlements. • Traffic signs must be provided to warn road users about speed limits, rest areas, eating establishments etc. • Lanes, median, and sharp bends will be marked with reflectorized signs to improve road visibility at night time. • Foot overpasses will be provided near schools, markets areas for safe crossing of the roads. • Proper lighting will be provided along the project road.	No complaints from sensitive receptors	Zero accident	Along the project corridor particularly at road intersections	BRT Operator	PIUs/PMU

Table 2: Environmental Management Plan: Environmental Monitoring Table for BRT Corridor

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
PRE-CONSTRUCTION STAGE						
Tree cutting	• Monitoring activities • Check whether proper compensation as mentioned in RP is received by PAPs.	Inspection	Throughout the project areas	During tree felling and site clearing operations	Contractor	EPCM CONSULTANT/PIUs/PMU/FD
CONSTRUCTION STAGE						
Air Quality	H_2S, SOx, NOx, CO, O_3, O_2,CO_2, TVOC, TSP, PM_{10}, Humidity, Wind direction, Wind speed, Temperature	Air quality standard by DoE, Bangladesh	Throughout the project areas	Twice a year/ on complaints for 2 years	Contractor	EPCM CONSULTANT/PIUs/ DoE
Dust	Dust control	Air quality standard by DoE, Bangladesh	Throughout the project areas	Regularly	Contractor	EPCM CONSULTANT/PIUs/ DoE
Noise and Vibration	dB(A) and PPV	Noise Pollution Control Rules (2006)	Throughout the project areas	Twice a year / on complaints for 2 years	Contractor	EPCM CONSULTANT/PIUs/ DoE
Water Quality	• Surface water: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Surface water near project corridor	Quarterly a year / on complaints for 2 years	Contractor	EPCM CONSULTANT/PIUs/ DoE
	• Groundwater: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Groundwater near project corridor	Twice a year / on complaints for 2 years	Contractor	EPCM CONSULTANT/PIUs/ DoE
Riverbed Material	• As, Pb, Cd, Cr, Hg, Fe, pH	Government of Bangladesh (GoB) and International Standard	Tongi Bridge site at Turag River	Twice a year / on complaints for 2 years	Contractor	EPCM CONSULTANT/PIUs/ DoE
Soil Pollution	• pH, As, Pb, Hg, Cd, Cr, Zn; • Check liquid waste is carried out by experienced personnel and in proper way. • Careful and proper handling of oil	Government of Bangladesh (GoB) and International Standard	At all project sites including Bus Depot	Twice a year / on complaints for 2 years	Contractor	EPCM CONSULTANT/PIUs/ DoE

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
	and other hazardous liquids.					
Soil Erosion	• Visual check for soil erosion and siltation. • Visual inspection of erosion prevention measures and occurrence of erosion.	Government of Bangladesh (GoB) and International Standard	Material storage sites and all the water bodies near the project corridor	Monthly	Contractor	EPCM CONSULTANT/PIUs
Drainage congestion	• Check drainage plan implemented correctly • Conduct regular inspection	Monitoring	Throughout the project areas	Weekly during monsoon	Contractor	EPCM CONSULTANT/PIUs/PMU
Wildlife	• Wildlife habitat and movement	None Specific	Areas alongside road corridor	Quarterly	Contractor	EPCM CONSULTANT/PIUs
Fisheries	• Impact on fish productivity, breeding and spawning		All major water bodies	Once in year	Contractor	EPCM CONSULTANT/PIUs
Waste Management	• Check storage, transportation, disposal, handling of hazardous waste • Waste and effluents to be collected and disposed safely from all camps; • Waste and garbage from bridge construction site to be disposed safely.	Monitoring	Throughout the project areas	Weekly	Contractor	EPCM CONSULTANT/PIUs/PMU
Health and Safety	• Check quality of food and accommodation at construction camp. • Check safe water supply, hygienic toilet at camps and construction of drain at camp sites. • Check toilets are close to construction site and separate toilet for female workers; • First-Aid kit with required tools and medicine; • The heavy construction material to handled and stored safely putting due care on public safety; • Heavy construction materials at	Monitoring	Construction sites, labour camps and bus depot	Regularly	Contractor	EPCM CONSULTANT/PIUs/PMU

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
	bridge construction site to be stored and handled safely; and • Check of personal protective equipment (PPE) for worker at the sites.					
OPERATION STAGE						
Tree Plantation	Check the plantation method and number of tree species	Inspection to ensure proper plantation with proper species	Throughout the project areas	During June/ July	NGO	PIUs/PMU/FD
Air Quality	H_2S, SOx, NOx, CO, O_3, O_2,CO_2, TVOC, TSP, PM_{10}, Humidity, Wind direction, Wind speed, Temperature	Air quality standard by DoE, Bangladesh	Throughout the project areas	Monthly inside the Depot; Twice a year for 3 years	BRT Operator	PIUs/DoE
Noise and Vibration	dB(A) and PPV	Noise Pollution Control Rules (2006)	Throughout the project areas	Monthly inside the Depot ; Twice a year for 3 years	BRT Operator	PIUs/DoE
Water Quality	• Surface water: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3 –N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Surface water near project corridor	Twice a year for 3 years	BRT Operator	PIUs/DoE
	• Groundwater: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3 –N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Surface water near project corridor	Twice a year for 3 years	BRT Operator	PIUs/DoE
Traffic Safety	• Record of accidents, different level of disabilities/ fatalities.	None Specific	Throughout the project section	Full operation period	BRT Operator	PIUs/PMU
Soil Quality	• pH, As, Pb, Hg, Cd, Cr, Zn;	Government of Bangladesh (GoB) and International Standard	At each construction camp post restoration of construction camp site	Yearly close to bus depot	BRT Operator	PIUs/DoE
Wildlife	• Wildlife habitat and movement	None Specific	Areas alongside the road corridor	Quarterly	BRT Operator	PIUs

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
Fisheries	• Impact on fish productivity, breeding and spawning		All major water bodies	End of first year of operation	BRT Operator	PIUs

Table 3: Environmental Management Plan: Environmental Mitigation Table for Bus Depot, Kitchen Markets and LGED roads

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
IMPLEMENTATION PHASE: PRE-CONSTRUCTION							
Provision of Early Training	Awareness and Training on environmental protection aspects relevant to good construction practices may avoid construction period impacts.	EPCM Consultant and LGED to provide training as part of the overall awareness and training programs to be delivered before construction begin.	• Proof of completion. • Posting of proof of completion at worksites	Safeguard Compliance Orientation	Location to be confirmed	EPCM CONSULTANT/LGED	EPCM CONSULTANT/PIU/PMU/LGED
[6]Tree Cutting	• Around 586 trees including 6 large, 57 medium, 260 small and 263 saplings will be cut down within bus depot site due to site preparation and construction activities resulting in potential ecological and economic loss.	• Prohibit cutting of trees for firewood and for use in project. Gas cylinders to be used for fuel at the camp for cooking purposes. Cutting of trees/bushes for fuel not to be allowed. • Invasive species will not be introduced into new environment. • When construction work is completed, trees and understory vegetation must be planted, in order to help the cleared areas in an effort to attract some wildlife such as birds. • Plant at least two trees for every one tree cut.	• No of tree felled; • Compensatory plantation site identified.	Compliance with tree management plan	Within bus depot area	LGED/ EPCM CONSULTANT	PIU/PMU

[6] Size of the trees refer here to circumference of the trees which are: Large=5' and Above; Medium= 2'7''-5'; Small= 7''-2'7''; Saplings= <6''

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
Loss of Structures and Public Utility	• The house within proposed bus depot site will be relocated. • Inconvenience caused by disruption of public utility (Power/ Telephone lines).	• The householders will be included in the RAP for compensation and relocation; • Provision in the design and budget for the relocation of the existing utility infrastructures wherever required.	• Number of public grievances re-resettlement and compensation; • Number of complaints from sensitive receptors • Nos of electric poles relocated; • Temporary power supply	Compliance with RP and emergency response plan	Within the bus depot area	LGED/ EPCM CONSULTANT	PIU/PMU
IMPLEMENTATION PHASE: CONSTRUCTION STAGE							
Filling up of water logged area	• Loss of retention area; • Earthwork activities during construction stage may block connectivity with other water bodies; • Drainage congestion due to waste disposal and construction activities.	• To deal carefully at design and planning stages based on hydrological data. • Regular cleaning of channels to avoid choking. • Wastes should not be disposed near water bodies. All waste depending on its characteristics, should be disposed of at approved locations.	• Designs of both Cross and side drains; • No of culverts; • Number and size of pipes	• Compliance with Design report	Near and around water bodies adjacent to bus depot area	Contractor	EPCM CONSULTANT/PIU
Fisheries	• Filling of the canal/pond due to construction might affect aquaculture and captive fisheries.	• The excavations for fill materials may be used retention and aquaculture	• Number of complaints from sensitive receptors on disturbance of fishing; • Any evidence of fish mortality.	Compliance with National/Intern ational guideline	Within bus depot area	Contractor	EPCM CONSULTANT/PIU
Wildlife	• The terrestrial wildlife species	• New and good condition machinery with low noise generation	• Number of complaints from	Compliance with	Within bus depot area	Contractor	EPCM CONSULTANT/PIU

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
	might be disturbed due to noise and vibration at construction sites and tree felling to cause dislocation of habitats. However, presences of threatened or endangered wildlife species were not reported at the site.	characteristics to be used in construction. • Construction work not to be carried out at night.	sensitive receptors on disturbance of poaching. • Illegal hunting	National/Intern ational guideline for wildlife			
Heritage and Culture	• A mosque was identified at 50m north-west side of the project area and may be in risk of negative impacts of construction activities.	• Use of modern plant and equipment with appropriate muffling devices. • Install temporary noise barriers near the mosque. • Proper dust collection and control systems to be installed.	• Records of chance finds • Temporary access provision; • Permanent access restored	• Compliance with RP • Compliance with National/ International guideline	Within bus depot area	LGED/ Contractor	EPCM CONSULTANT/PIU
Surface water	• Pollution of surface water may be caused due to disposal of junk, cement refuse and effluents in open water bodies during the construction of bus depot.	• The workforce to be trained in proper means for storage and handling of materials and chemicals. • Work camps and work sites to be provided with toilets and septic tanks. • Washing of machinery and vehicles in surface waters to be prohibited. • Conduct regular water quality monitoring according to the determined sampling schedule. • Prevent construction debris from entering drainage or irrigation canals.	• Areas for stockpiles, storage of fuels and lubricants and waste materials; • Number of silt traps installed along trenches leading to water bodies • Records of surface water quality inspection	• Compliance with National guideline limits for Surface water.	Near and around water bodies adjacent to bus depot area	Contractor	EPCM CONSULTANT/PIU

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		• Wastes to be collected, stored and taken to approve disposal sites.					
Groundwater Quality	• Contamination of ground water table from leachate of construction waste and wastes from workers' camp	• Workforce camp will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags and other sanitation facilities will be implemented at the construction camp to prevent the wastewater and solid wastes from entering well and groundwater recharge areas. • Groundwater quality monitoring to be carried out as per the schedule in the environmental monitoring plan.	• Monitoring in accordance with monitoring program. • No breaches of Material Safety Data Sheet (MSDS) for hazardous substances.	Compliance with National guideline limits for Ground water.	Construction site at bus depot area	Contractor	EPCM CONSULTANT/PIU
Air Quality	• Dust Generation due to construction activities and transport of construction materials. • Emissions from vehicles, equipment and machinery.	• Regular watering at the exposed sites needed to control dust blowing. • Vehicles transporting construction material to be covered. • Construction equipment to be maintained to a good standard and idling of engines discouraged. • Machinery emitting visible smoke to be banned from construction sites. • Dust masks to be provided to workers where dust hazards exist. • Conduct regular air quality monitoring according to the determined sampling schedule.	• Location of stockpiles; • Number of complaints from sensitive receptors; • Heavy equipment and machinery with air pollution control devices; • Ambient air quality found beyond the national standards	• Compliance with DoE and National guideline limits for Air at sensitive receptors. • Certification that vehicles are compliant with air quality standards.	Construction site at bus depot area	Contractor	EPCM CONSULTANT/PIU

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
Noise and vibration	• Noise from construction vehicles, equipment and machinery. • Vibration caused by construction activities.	• All powered mechanical equipment and machinery to be fitted with noise abating gear such as mufflers for effective noise control, in compliance with DoE regulations. • Providing the construction workers with suitable hearing protection like ear cap, or earmuffs etc. • Noise measurement to be carried out as per the schedule in the environmental monitoring plan.	• Number of complaints from sensitive receptors; • Noise measurement data • Use of silencers in noise-producing equipment and sound barriers;	• Equivalent day and night time noise levels • Compliance with • DoE and National guideline limits for Noise at sensitive receptors.	Construction site at bus depot area	Contractor	EPCM CONSULTANT/PIU
Soil contamination	• Contamination of soils at camp and work sites due to accidental spillage of noxious chemical, petroleum derivatives and bituminous material may happen.	• The chemicals, cement, petroleum derivatives and bituminous materials to be handled, operate and stored cautiously. • The construction materials be stored properly, garbage removed regularly and sites kept clean and tidy.	• Number of any non-compliance reports • Maintenance of temporary passages;	Compliance with National/ International guideline limits for soil quality	At work camp and construction site	Contractor	EPCM CONSULTANT/PIU
Construction Camp and Workshop	• Loss of plantation and vegetation. • Social disturbance for nearby community	• Construction camp and workshop to be located away from sensitive areas. • Water and good sanitation facilities to be provided for the camp. • Minimise vegetation loss while making site arrangements for construction camp and other facilities.	• Worksite clear of hazardous wastes such as oil/fuel • Worksite clear of any wastes, collected materials from drainages, unutilized materials and debris • Transport route and worksite cleared of any dust/mud	Compliance with Waste management plan	Work site and particularly at Construction camp	Contractor	EPCM CONSULTANT/PIU

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
OHS - Workers	• Health risks due to unsafe working conditions	• Provision of safe water, sanitary toilet facility and hygienic accommodation for workers at camp sites. In addition, ensure provision of PPEs and First-Aid facility for them.	• Equipped first-aid stations • Medical insurance coverage for workers • Number of accidents • Records of supply of uncontaminated water • Condition of eating areas of workers • Use of personal protective equipment • % of moving equipment outfitted with audible back-up alarms • Permanent sign boards for hazardous areas • Signage for storage and disposal areas • Condition of sanitation facilities for workers. • Record of H&S orientation trainings	Compliance to emergency response plan	Work site and particularly at Construction camp	Contractor	EPCM CONSULTANT/PIU/PMU
Community Health and Safety	• Safety risks due to construction works	• The labour works with different transmittable diseases should be restricted within the construction site and replaced. • Drivers operating construction vehicles to be trained in road safety awareness. • Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social	• Number of accidents; • Number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan (Appendix 5); • Number of complaints from sensitive receptors;	Compliance to emergency response plan	Work site and particularly at Construction camp	Contractor	EPCM CONSULTANT/PIU/PMU

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		links. • Provision of proper safety and diversion signage.	• Number of walkways, signage, and metal sheets placed at project location • Permanent sign boards for hazardous areas • Agreement between landowner and contractors in case of using private lands as work camps, storage areas, etc.				
IMPLEMENTATION PHASE: OPERATION							
Tree plantation	• Survival of flora and fauna in the new environment.	• Undertake monitoring and maintenance efforts for ensuring survival of planted trees. • Plantation of tree varieties that supports birds and sustainable and having high wood value	No of tree survived;	Compliance with the tree management plan	Bus depot area	NGO/RHD	PIU/PMU/LGEDBBA/ FD
Soil	• Contamination of soil caused due to spillage of petroleum derivatives and other chemicals due to machinery and vehicle maintenance activities, and leakage from store-house.	• Service machinery and vehicles strictly at designated maintenance workshops where waste oils and lubricants be collected and recycled. • Storage of coolant and oils should be above ground with bunds so that immediate soil contamination due to spillage or leakage can be prevented.	No complaints from sensitive receptors	Compliance with National/ International guideline limits for soil	Near and around the bus depot area	Bus Operator/LGED	LGED/DoE
Repair and Maintenance of vehicles	• Accidental spills and leakage of fuels is to be anticipated in the Fuelling area.	• All spillage of liquids including diesel, oils, grease and waters will be collected in a central area and drain to a common location. This includes rain waters which will	• Repair and Maintenance clear of hazardous wastes such as oil/fuel • Repair and	Compliance with Waste management plan	Near and in the bus depot area	LGED/Bus Operator	LGED/ DoE

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
	• In the storage area spillage of Engine cooling liquids, Used motor oil and Used transmission oil will be a problem that can have significant adverse impacts if these find their way in to soil, surface or ground water. • The wash water will contain oil and grease in addition to dust and particulate matter from exhaust. • Diesel combustion gases are rich in carbon oxide (CO) and could be fatal if inhaled. The effect of CO is also cumulative. • Where repair /maintenance work is performed on wet vehicles the floor may become slippery and may cause accidents affecting the safety of the workers.	eventually wash spilled liquids on the surface. These waters will be treated with decantation and oil and grease traps to separate oil and greases to conform to local regulations prior to releasing them outside the depot. • Used engine cooling liquids, used motor oil and used transmission oil will be stored in leak proof containers and disposed of safely using approved methods, to avoid environmental contamination. • All work stations will be equipped with devices for complete evacuation of the engine exhaust gases. The workshop will be ventilated at any time and will include appropriate equipment to extract fumes. Further, the workshop will be equipped with CO detectors. • The floor covering will be of material that it is easy to clean and is slip resistant	Maintenance clear of any wastes, collected materials from drainages, unutilized materials and debris • Transport route and worksite cleared of any dust/mud				
Water quality	• Contamination of water bodies from	• Proper drainage system with oil separators will be provided to avoid	No visible degradation to nearby drainages,	Compliance with National	Near and around the bus	LGED	LGED/ DoE

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
	runoff from the bus depot containing oils and grease	contamination by run-off and oil spills.	khals or water bodies due to construction activities	guideline limits for Surface and Ground water.	depot area		
Waste generation	• Solid waste and waste water form market stalls could contaminate the area and water bodies. Wash water from meat and fish stalls could be issues if proper collection and disposal is not provided • If proper sanitary facilities are not provided sanitation problems could arise.	• Solid waste will be managed by provision of collection bins and disposal facilities. Provisions will be made to dispose meat and fish waste separately at approved locations. • Stall floors will be sealed to collect and divert the wash water for proper management. • Public toilet facilities with utilities as water supply, electricity, drainage system etc. will be constructed within the market areas	• Air (PM10) and noise level measurements ; • Dust pollution; • Number of non-compliances observed/ reported	• Compliance with Waste management plan	Kitchen markets	LGED	DoE

Table 4: Environmental Management Plan: Environmental Monitoring Table for Bus Depot, Kitchen Markets and LGED Access Roads

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
PRE-CONSTRUCTION STAGE						
Tree cutting	• Monitoring activities	Inspection	Construction sites at bus depot, kitchen markets and LGED road sites	During tree felling and site clearing operations	LGED/ EPCM CONSULTANT	LGED/ PIU/ PMU/EPCM CONSULTANT
CONSTRUCTION STAGE						
Air Quality	H_2S, SOx, NOx, CO, O_3, O_2,CO_2, TVOC, TSP, PM_{10} Humidity, Wind direction, Wind speed, Temperature	Air quality standard by DoE, Bangladesh	Construction sites at bus depot, kitchen markets and LGED road sites	Twice in a year; for 2 years	Contractor	LGED/ PIU/DoE/ EPCM CONSULTANT
Dust	Dust control	Air quality standard by DoE, Bangladesh	Construction sites at bus depot, kitchen markets and LGED road sites	Regularly	Contractor	LGED/ PIU/ DoE/ EPCM CONSULTANT
Noise and Vibration	dB(A) and PPV	Noise Pollution Control Rules (2006)	Construction sites; at bus depot, kitchen markets and LGED road sites	Twice in a year; for 2 years	Contractor	LGED/ PIU/ DoE/ EPCM CONSULTANT
Water Quality	• Surface water: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Surface water sources near bus depot, kitchen markets and LGED road sites	Quarterly per year for 2 years	Contractor	LGED/ PIU/ DoE/ EPCM CONSULTANT
	• Groundwater: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Groundwater sources near bus depot, kitchen markets and LGED road sites	Twice in a year; for 2 years	Contractor	LGED/PIU/ DoE/ EPCM CONSULTANT
Soil Pollution	• pH, As, Pb, Hg, Cd, Cr, Zn; • Check liquid waste is carried out by experienced personnel and in	Government of Bangladesh (GoB) and International Standard	Construction sites; at bus depot, kitchen	Twice per year for 2 years	Contractor	LGED/ PIU/ DoE/ EPCM CONSULTANT

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
	proper way. • Careful and proper handling of oil and other hazardous liquids.		markets and LGED road sites			
Soil Erosion	• Visual check for soil erosion and siltation. • Visual inspection of erosion prevention measures and occurrence of erosion.	Government of Bangladesh (GoB) and International Standard	Material storage sites and all the water bodies near bus depot, kitchen markets and LGED road sites	Once during rainy season of the Construction period	Contractor	LGED/ PIU/ DoE/ EPCM CONSULTANT
Drainage congestion	• Check drainage plan implemented correctly • Conduct regular inspection	Monitoring	Construction site at bus depot	Weekly during monsoon	Contractor	LGED/ PIU/PMU/DoE/ EPCM CONSULTANT
Wildlife	• Wildlife habitat and movement	Not Specified	Areas adjacent to bus depot, kitchen markets and LGED road sites	Quarterly	Contractor	LGED/ PIU/ EPCM CONSULTANT
Fisheries	• Impact on fish productivity, breeding and spawning		Areas adjacent to bus depot, kitchen markets and LGED road sites	Once in year	Contractor	LGED/ PIU/ EPCM CONSULTANT
Waste Management	• Check storage, transportation, disposal, handling of hazardous waste	Monitoring	Construction sites; at bus depot, kitchen markets and LGED road sites	Weekly	Contractor	LGED/ PIU/PMU/DoE/ EPCM CONSULTANT
Health and Safety	• Check quality of food and accommodation at construction camp. • Check safe water supply, hygienic toilet at camps and construction of drain at camp sites. • First-Aid kit with required tools and medicine.	Monitoring	Construction sites; at bus depot, kitchen markets and LGED road sites	Regularly	Contractor	LGED/ PIU/PMU/DoE/ EPCM CONSULTANT
OPERATION STAGE						

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
Tree Plantation	Check the plantation method and number of tree species	Inspection to ensure proper plantation with proper species	Bus depot, kitchen markets and LGED road sides	During June/ July	LGED	LGED/ PIU/PMU
Air Quality	H_2S, SOx, NOx, CO, CO_2, TSP, PM_{10}, Humidity, Wind direction, Wind speed, Temperature	Air quality standard by DoE, Bangladesh	Bus depot, kitchen markets and LGED road sites	Twice per year for 3 years	LGED	LGED/ PIU/ DoE
Noise and Vibration	dB(A) and PPV	Noise Pollution Control Rules (2006)	Bus depot, kitchen markets and LGED road sites	Twice per year for 3 years	LGED	LGED/ PIU/ DoE
Water Quality	• Surface water: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3 –N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Surface water near bus depot, kitchen markets and LGED road sites	Twice per year for 3 years	LGED	LGED/ DoE
	• Groundwater: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3 –N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Groundwater near bus depot, kitchen markets and LGED road sites	Twice per year for 3 years	LGED	LGED/ DoE

Table 5: Environmental Management Plan: Environmental Mitigation Table for Elevated Section including Tongi Bridge

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
DESIGN/PRE-CONSTRUCTION PHASE							
Provision of Early Training	• Awareness and Training on environmental protection aspects relevant to good construction practices may avoid construction period impacts affecting river hydrology and water quality	• EPCM Consultant and BBA to provide training as part of the overall awareness and training programs to be delivered before construction begin.	• Proof of completion. • Posting of proof of completion at worksites	Safeguard Compliance Orientation	Location to be confirmed	EPCM CONSULTANT/BBA	EPCM CONSULTANT/PIU/PMU/BBA
Climate Change	• Changes in climate and long term impacts on the environment;	• Consider potential impacts from extreme climate change scenario in designs for the Tongi Bridge and elevated section.	Consideration of climate change in project design	Compliance with National guideline	Throughout the elevated section including Tongi Bridge	EPCM CONSULTANT	PIUs
[7]Tree Cutting	• Different types of plants need to be removed as a part of site preparation for construction activities which will result in potential ecological and economic loss.	• Prohibit cutting of trees for firewood and for use in project. Gas cylinders to be used for fuel at the camp for cooking purposes • Invasive species will not be introduced into new environment. • When construction work is completed, trees and understorey vegetation must be planted, in order to help the cleared areas in an effort to attract wildlife such as birds. • Plant at least two trees for every one tree cut.	• No of tree felled; • Compensatory plantation site identified.	Compliance with tree management plan	Within elevated section including Tongi Bridge	Contractor; RHD	EPCM CONSULTANT/PIU/PMU/BBA/FD

[7] Size of the trees refer here circumference of the trees which are: Large=5' and Above; Medium= 2'7''-5'; Small= 7''-2'7''; Saplings= <6''

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
Loss of Structures and Public Utilities	• Some houses within proposed section and bridge site will be relocated. • Inconvenience caused by disruption to public utilities (Power/ Telephone lines).	• Need to compensate for the loss of structures. • Provision in the construction budget for the relocation of the existing utility infrastructures wherever required.	• Number of public grievances re-resettlement and compensation; • Number of complaints from sensitive receptors • Nos of electric poles relocated; • Temporary power supply	Compliance with RP and emergency response plan	Within elevated section including Tongi Bridge	EPCM CONSULTANT/BBA	EPCM CONSULTANT/PIU/PMU/BBA
The Bridge site	The impact at bridge site may result from decisions on where to place the work camps and the concrete and steel fabrication areas as well as the batching plant(s)	EPCM Consultant and BBA in consultation with local communities will agree on sites. Construction camps, plant and equipment and workshops to be located away from sensitive areas and not within 500 m.	• Number of non-compliances observed/ reported • Incorporation of IEE recommendation in design and bid documents	• Compliance with BIWTA guideline limits for Navigation.	At and around the bridge site	EPCM CONSULTANT/BBA	EPCM CONSULTANT/PIU/BBA
CONSTRUCTION PHASE							
Road and Navigation Channel Disruption	• During transportation of box girders to the site the road may be completely blocked • Movement of barges and other construction vessels and bridge construction works within the river will interfere with local navigation and interrupt the river traffic.	• The transportation and erection of box girders will be so timed to minimise the impact on road transportation. • The road users and nearby residents will be informed of the activity and consent of police and local authorities will be obtained before commencing the activity. Further, all precautions will be taken to ensure the safety of the workers and road users. • In bridge demolition, the bridge structure will not be dropped into the river, but alternative means will be used to avoid "dropping the	• Number of non-compliances observed/ reported	• Compliance with BIWTA guideline limits for Navigation.	Bridge site	Contractor	EPCM CONSULTANT/PIU/PMU/BBA/ BIWTA

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		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 the bridge could be lowered • 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.					
Riverbed Sediment	• Disturbance of riverbed sediments due to dredging activities; • Contamination of bottom sediments by accidental spilling of bituminous materials and other petro-chemicals.	• Train construction workers on safe handling of petroleum products and chemicals to prevent spillage or leakage to the river or other water bodies; • Restrict disposal of any construction waste into the river or nearby water bodies; • Prevent construction debris from entering drainage or irrigation canals; • Construction work close to river to be minimized especially during monsoon season; • Conduct regular riverbed sediment quality monitoring according to the recommended sampling schedule.	• Results of sediment quality analysis • Bridge locations;	• Compliance with National/Intern ational guideline limits for Riverbed sediment.	At and around the bridge site	Contractor	EPCM CONSULTANT/PI U/BBA/DoE

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
Air Quality changes	• Dust generation due to construction activities and transport of construction materials. • Emissions from vehicles, equipment and machinery.	• Vehicles transporting construction material to be covered; • Construction equipment to be maintained to a good standard and discouraging idling of engines. • Machinery emitting visible smoke to be banned from construction sites; • Contractor to prepare a dust suppression program detailing action to be taken to minimize dust generation (e.g. spraying of roads with water), and the equipment to be used. • Equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce dust emissions; • Locate asphalt and crushing plants away from residential areas and social infrastructure such as hospitals, mosques, schools and madrasas. (Refer to Annex 2 for locations of these). Clearance should be at least 500 m and take into account the prevailing wind direction. • Dust masks to be provided to workers where dust hazards exist; • Proper dust collection and control systems to be installed at crushers; • Air quality monitoring to be carried out as per the schedule in the environmental monitoring plan.	• Location of stockpiles; • Number of complaints from sensitive receptors; • Heavy equipment and machinery with air pollution control devices; • Ambient air quality found beyond the national standards	• Compliance with DoE and National guideline limits for Air at sensitive receptors. • Certification that vehicles are compliant with air quality standards.	Construction sites along the full length of the project	Contractor	EPCM CONSULTANT/PIUs/DoE
Noise and Vibration	• During erection of box girders high noise and vibration may result.	• The road users and nearby residents will be informed of the activity and consent of police and local authorities will be obtained before commencing the activity. Further, all	• Number of complaints from sensitive receptors; • Noise	• Equivalent day and night time noise levels • Compliance with	Construction sites along the full length of the project	Contractor	EPCM CONSULTANT/PIUs/DoE

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
	• Noise from construction vehicles, equipment and machinery. • Vibration caused by construction activities.	precautions will be taken to ensure the safety of the workers and road users. • Use of modern plant and equipment with appropriate muffling devices. • All powered mechanical equipment and machinery to be fitted with noise abating gear such as mufflers for effective noise control, in compliance with DoE regulations. • Construction operations to be restricted to appropriate time schedules. BoX girder transport and erection may have to be carried out during the night. • Locate rock crushing, concrete mixing and material shipment yards away from residential areas, schools, colleges and hospitals. • Install temporary noise barriers near sensitive locations such as schools, religious places and hospitals (Refer to Annex 2 for locations) • Providing the construction workers with suitable ear protection as ear cap, or earmuffs etc. • Surround the piers during construction with an air bubble curtain system or coffer dam. • Use a smaller hammer to reduce the sound pressure. The sound produced in pile driving has a direct relationship to the force used to drive the pile. A smaller hammer will have less force on the pile therefore, producing less sound. • Noise and vibration level monitoring to be carried out as per the schedule	measurement data • Use of silencers in noise-producing equipment and sound barriers;	DoE and National guideline limits for Noise at sensitive receptors.			

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		in the environmental monitoring plan.					
Surface Water Quality and Hydrology	• Construction of piers, especially in the water filled sections could result in temporary erosion and deposition, potentially impacting shoreline and causing water pollution.	• The bridge is to be designed and built in line with existing bridge and latest hydrologic study results. The water quality testing will focus in sampling both upstream and downstream of the bridge construction site to establish change over time. Parameters to be tested as shown in main EMP.	• Areas for stockpiles, storage of fuels and lubricants and waste materials; • Number of silt traps installed along trenches leading to water bodies • Records of surface water quality inspection	• Compliance with National guideline limits for Surface water.	Take samples U/S and D/S of the Tongi Bridge	Contractor	EPCM CONSULTANT/PIU/BBA/DoE
Dredging and Dredged Materials	• River bank erosion and pollution due to spilling/seepage of oil in the river. • Increase in sedimentation and dispersion of pollutants in dredged material	• Permits/NOC to be obtained, from relevant authority such as BIWTA prior to extraction • While dredging, special care to be given to prevent any spillage/seepage of oil from the dredging machines; • Movement of barges should be within the designated study areas; • Dredged material from the river bank to be tested for presence of heavy metals and other pollutants before its use. Note – some areas were tested during the preparation of IEE (refer to Annex 2).	• Results of Dredged Materials quality analysis • Bridge locations;	• Compliance with National/ International guideline limits for Dredged Materials.	At and around the bridge site	Contractor	EPCM CONSULTANT/PIU/BBA/ BWTA/DoE
Fisheries	• Disturbance to aquatic life including migration of fish due to bridge construction.	• Construction not to be undertaken during high flood. • Construction along the riverbanks must be avoided during the fish breeding season (July to September). • Deep water channel to be maintained during bridge construction.	• Number of complaints from sensitive receptors on disturbance of fishing; • Any evidence of fish mortality.	• Compliance with National/International guideline	Throughout the road corridor particularly in pond / ditch / river areas (Refer to Annex 2).	Contractor	EPCM CONSULTANT/PIU/BBA

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
OPERATION PHASE							
Riverbed Sediment Contamination	Riverbed sediments contamination due to accidental spillage from vehicular movement.	• Proper measures must be ensured to prevent any oil spillage and leakage from the vehicle reaching river water. • Efforts will be made to clean the spills of oil, toxic chemicals etc. as early as possible.	No complaints from sensitive receptors	• Compliance with National/ International guideline limits for Riverbed sediment	Bridge area	BBA	BBA/DoE

Table 6: Environmental Management Plan: Environmental Monitoring Table for Elevated Section including Tongi Bridge

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
PRE-CONSTRUCTION STAGE						
Tree cutting	• Monitoring activities • Check whether proper compensation as mentioned in RP is received by PAPs.	Inspection	Areas surrounding elevated section	During tree felling and site clearing operations	Contractor	EPCM CONSULTANT/PIU/PMU/BBA/FD
CONSTRUCTION STAGE						
Air Quality	H_2S, SOx, NOx, CO, O_3, O_2,CO_2, TVOC, TSP, PM_{10}, Humidity, Wind direction, Wind speed, Temperature	Air quality standard by DoE, Bangladesh	Areas surrounding elevated section	Twice in a year; for 2 years	Contractor	EPCM CONSULTANT/PIU/BBA/DoE
Dust	Dust control	Air quality standard by DoE, Bangladesh	Areas surrounding elevated section	Regularly	Contractor	EPCM CONSULTANT/PIU/BBA/DoE
Noise and Vibration	dB(A) and PPV	Noise Pollution Control Rules (2006)	Areas surrounding elevated section	Twice in a year; for 2 years	Contractor	EPCM CONSULTANT/PIU/BBA/DoE
Water Quality	• Surface water: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P.	Water quality standard by DoE, Bangladesh	Surface water sources near elevated section	Quarterly in a year; for 2 years	Contractor	EPCM CONSULTANT/PIU/BBA/DoE
	• Groundwater: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3–N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P.	Water quality standard by DoE, Bangladesh	Groundwater near elevated section	Twice in a year; for 2 years	Contractor	EPCM CONSULTANT/PIU/BBA/DoE
Riverbed Material	• pH, Fe, As, Pb, Hg, Cd, Cr	Government of Bangladesh (GoB) and International Standard	Tongi Bridge site at Turag River	Twice a year / on complaints for 2 years	Contractor	EPCM CONSULTANT/PIU/BBA
Soil Erosion	• Visual check for soil erosion and siltation. • Visual inspection of erosion prevention measures and occurrence of erosion.	Government of Bangladesh (GoB) and International Standard	Material storage sites and all the water bodies near the elevated section	Once during rainy season of the Construction period	Contractor	EPCM CONSULTANT/PIU/BBA

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
Drainage congestion	• Check drainage plan implemented correctly • Conduct regular inspection	Monitoring	Areas surrounding elevated section	Weekly during monsoon	Contractor	EPCM CONSULTANT/PIU/PMU/BBA
Wildlife	• Wildlife habitat and movement	Not Specified	Areas surrounding elevated section	Quarterly	Contractor	EPCM CONSULTANT/PIU/BBA
Fisheries	• Impact on fish productivity, breeding and spawning	Not Specified	All major water bodies near elevated sector and Turag River	Once in a year; for 2 years	Contractor	EPCM CONSULTANT/PIU/BBA
Waste Management	• Check storage, transportation, disposal, handling of hazardous waste • Waste and effluents to be collected and disposed safely from all camps; • Waste and garbage from bridge construction site to be disposed safely.	Monitoring	Areas surrounding elevated section	Weekly; during construction	Contractor	EPCM CONSULTANT/PIU/BBA
Health and Safety	• Check quality of food and accommodation at construction camp. • Check safe water supply, hygienic toilet at camps and construction of drain at camp sites. • Check toilets are close to construction site and separate toilet for female workers; • First-Aid kit with required tools and medicine; • The heavy construction material to handled and stored safely putting due care on public safety; • Heavy construction materials at bridge construction site to be stored and handled safely; and • Check of personal protective	Monitoring	Construction sites, labor camps and areas surrounding elevated section	Regularly; during construction	Contractor	EPCM CONSULTANT/PIU/BBA

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
	equipment (PPE) for worker at the sites.					
OPERATION STAGE						
Tree Plantation	Check the plantation method and number of tree species	Inspection to ensure proper plantation with proper species	Areas surrounding elevated section	During June/ July in first year	NGO	PIU/PMU/BBA/FD
Air Quality	H_2S, SOx, NOx, CO, O_3, O_2,CO_2, TVOC, TSP, PM_{10}, Humidity, Wind direction, Wind speed, Temperature	Air quality standard by DoE, Bangladesh	Areas surrounding elevated section	Twice in year; for 3 years	BRT Operator	PIU/BBA/DoE
Noise and Vibration	dB(A) and PPV	Noise Pollution Control Rules (2006)	Areas surrounding elevated section	Twice in year for 3 years	BRT Operator	PIU/BBA/DoE
Water Quality	• Surface water: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3 –N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Surface water sources near areas surrounding elevated section	Twice per year for 3 years	BRT Operator	PIU/BBA/DoE
	• Groundwater: Temperature, Turbidity, pH, TDS, EC, TSS, Fe, NH_3 –N, As, Fe, Mn, DO, COD, BOD_5, TC, FC, Total N, Total P	Water quality standard by DoE, Bangladesh	Ground water near areas surrounding elevated	Twice per year for 3 years	BRT Operator	PIU/BBA/DoE
Traffic Safety	• Record of accidents, different level of disabilities/ fatalities.	Not Specified	Areas surrounding elevated section	Full operation period	BRT Operator	PIU/PMU/BBA
Wildlife	• Wildlife habitat and movement	Not Specified	Areas alongside the road corridor	Quarterly	BRT Operator	PIU/BBA
Fisheries	• Impact on fish productivity, breeding and spawning		All major water bodies	At the beginning and at End of first year of operation	BRT Operator	PIU/BBA

APPENDIX 5: Environmental Management Implementation Works Schedules

Table 1: EMP Implementation Schedule for Contract 01: At Grade Section and Flyovers

Environmental Components	EMP	Time Line: Construction Phase (30 Months)
Technical Support	Updating of EMP and performance indicators	
Flora	Tree cutting along the ROW	
	Compensatory afforestation (Minimum 1:2)	
	Monitoring of Tree Cutting and Plantation	
	Maintenance of tree	
Drainage congestion	Provision of adequate drainage	
	Monitoring drainage congestion	
Erosion, Sedimentation and Soil	River bank protection measures	
	Soil conversation	
	Monitoring of soil erosion	
Land	Compensation against land acquisition	
	Landscaping on approach road and service areas	
Slope/Embankment	Covering of embankment with grasses and herbs	
Protection at approach Road	Embankment protection of the approach Road	
Water and Drinking Water Supply	Monitoring of Surface Water Quality	
	Monitoring of Groundwater Quality and Levels	
	Installation of oil and grease traps at construction sites	
	Construction of soak pits at construction and rehabilitation sites	
	Ensuring arsenic free drinking water for construction camps	
Air Quality and Dust Management	Monitoring of Ambient Air Quality	
	Water Spraying/Watering at construction and stockpile sites	
Noise Quality and Barriers	Monitoring of Noise and Vibration	
	Provision of Noise Barriers	
Construction Safety	Provision of PPEs	
Health Issues	Health Check-up Camps	
Capacity Development and Training	Environmental safety and awareness	

APPENDIX 6: Sampling Program

Environmental monitoring requires a set of indicators that can be conveniently measured, assessed and evaluated periodically to establish trends of change in baseline environment quality. A list of parameters to be tested, sample number and sampling frequency are given in Table 1 to Table 6. These indicators may be independent or may be functionally related. The physico-chemical, ecological, human interest and socio-economic indicators should be well defined and a mutual relationship among the indicators should be well understood. The sampling program, in view of the possible impacts as assessed earlier, should consider the indicators for the impact assessment related to the following parameters:

Table 1: Proposed Monitoring Items: Surface water

Parameter	Unit	Country Standards	Referred International Standards	Remarks (Measurement site, Frequency, Method, etc.)
Temperature	^{0}C	20-30^{0}C		Construction Phase: Quarterly per year for 2 years Operation Phase: Twice per year for 3 years Monitoring Site: 1. Upstream of Tongi Bridge 2. Downstream of Tongi Bridge 3. Bus depot 4. Near Road side/ Construction yard Sampling period: dry season and rainy season
pH	-	6.5–8.5		
TDS	mg/L	Not Yet Set		
EC	µS/cm	2250 at 25^{0}C		
Turbidity	NTU	Not Yet Set		
DO	mg/L	≥5		
BOD	mg/L	≤10		
As COD	mg/L	Not Yet Set		
TSS	mg/L	Not Yet Set		
Fe	mg/L	Not Yet Set		
Mn	mg/L	Not Yet Set		
NH3-N	mg/L	1.2		
Total N	mg/L	Not Yet Set		
Total P	mg/L	Not Yet Set		
As	mg/L	Not Yet Set		
Total Coliform	CFU/100ml	≥1000		
Fecal Coliform	CFU/100ml	Not Yet Set		

Table 2: Proposed Monitoring Items: Groundwater

Parameter	Unit	Country Standards	Referred International Standards	Remarks (Measurement site, Frequency, Method, etc.)
Temperature	^{0}C	20-30^{0}C		Construction Phase: Twice per year for 2 years Operation Phase: Twice per year for 3 years Monitoring Site: 1. Bridge site 2. Bus depot 3. Construction yard 4. Near Road side/ Kitchen market site Sampling period: dry season and rainy season
pH	-	6.5–8.5		
TDS	mg/L	1000		
EC	µS/cm	Not Yet Set		
Turbidity	NTU	10		
DO	mg/L	6		
BOD	mg/L	0.2		
As COD	mg/L	4		
TSS	mg/L	10		
Fe	mg/L	0.3-1.0		
Mn	mg/L	0.1		
NH3-N	mg/L	Not Yet Set		
Total N	mg/L	1.0		
Total P	mg/L	0.0		
As	mg/L	0.05		
Total Coliform	CFU/100ml	0.0		
Fecal Coliform	CFU/100ml	0.0		

Table 3: Proposed Monitoring Items: Ambient Air Quality

Parameter	Unit	Country Standards	Referred International Standards	Remarks (Measurement site, Frequency, Method, etc.)
CO	µg/m3	40000 (1 hour)		Construction Phase: Twice per year or on complaints for 2 years Operation Phase: Twice per year for 3 years Monitoring Site: 1. Bridge site 2. Bus depot 3. Busy intersection area near feeder road 4. Construction yard 5. Kitchen market site Measurement Period: 8 hours (dry
NOx	µg/m3	100 (Annual)		
SOx	µg/m3	365 (24 hour)		
O3	µg/m3	235 (1 hour)		
TSP	µg/m3	200 (8 hour)		
PM10	µg/m3	150 (24 hour)		
TVOC	mg/m3	-		
H2S	mg/m3	-		
O2	%	-		

Parameter	Unit	Country Standards	Referred International Standards	Remarks (Measurement site, Frequency, Method, etc.)
CO2	mg/m3	-		season, rainy season)
Humidity, Wind direction, Wind speed, Temperature				

Table 4: Proposed Monitoring Items: Noise/Vibration

Unit	Country Standards			Referred International Standards	Remarks (Measurement site, Frequency, Method, etc.)
	Zone	Day	Night		
LAeq dB	Silent zone	50	40		Construction Phase: Twice per year or on complaints for 2 years Operation Phase: Twice per year for 3 years Monitoring Site: 1. Bridge site 2. Bus depot 3. Busy intersection area near feeder road 4. Construction yard 5. Kitchen market site Measurement Period: 8 hours (dry season, rainy season) Day time: 6 a.m. to 9 p.m. Night time: 9 p.m. to 6 a.m.
	Residential Area	55	45		
	Mixed area	60	50		
	Commercial Area	70	60		
	Industrial	75	70		
PPV	-			BS 5228-2:2009	

Table 5: Proposed Monitoring Items: Soil Quality

Parameter	Unit	Country Standards	International Standards (EU Directive 86/278/EEC for Land Application)	Remarks (Measurement site, Frequency, Method, etc.)
Arsenic (As)	mg/kg	-	-	Construction Phase: Twice per year for 2 years Operation Phase: Once per year for 3 years Monitoring Site: 1. Bus depot 2. Construction yard 3. kitchen market site 4. LGED Road sites 5. All construction sites Sampling period: dry season and rainy season
Lead (Pb)	mg/kg	-	1200	
Cadmium (Cd)	mg/kg	-	40	
Chromium (Cr)	mg/kg	-	-	
Zinc (Zn)	mg/kg	-	4000	
Mercury (Hg)	mg/kg	-	25	
pH	-	-	-	

Table 6: Proposed Monitoring Items: Riverbed Sediment

Parameter	Unit	Country Standards	International Standards (Probable Effect Concentration: USEPA, 2000)	Remarks (Measurement site, Frequency, Method, etc.)
Arsenic (As)	mg/kg	-	33	Construction Phase: Twice per year for 2 years Monitoring Site: 1. Upstream of Tongi Bridge 2. Downstream of Tongi Bridge Sampling period: dry season and rainy season
Lead (Pb)	mg/kg	-	128	
Cadmium (Cd)	mg/kg	-	4.98	
Chromium (Cr)	mg/kg	-	111	
Iron (Fe)	mg/kg	-	-	
Mercury (Hg)	mg/kg	-	1.06	
pH	-	-	-	

APPENDIX 7: Compliance Monitoring Checklist – At Grade Section Including Flyovers (C01)

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
Conditions at project sites					
A.	**General**				
1.	Site Office and camp sites locations appropriate	✓			The site office is within the project area and the site camp is within the site area. There is no disturbance occurring due to the establishment of the site office and site camp to the locality.
2.	Environment, Health and Safety Officer designated		✓		Environmental officer is yet not appointed but a Deputy Environmental Management Officer (EMO) is working without approval his CV from the Consultant. There is no medical officer appointed for ensuring health and safety but there are Safety Supervisors in the site for monitoring.
3.	Employment Record keeping arrangement		✓		The employment records are kept in a register book manually every day in the field and then compiled in computer.
4.	Payment Record keeping arrangement		✓		The payment records are kept in a register book manually every day in the field and then compiled in computer.
5.	Legal working hours approval		✓		The workers work 10 hours a day at site including 1-hour lunch break.
6.	Provision for monthly meeting for inspection of site activities		✓		Meetings are called about working progress and future planning every month.
B.	**Health and Sanitation**				
B1	**Public Health & Safety**				
1.	Hygienic labour sheds kitchens and sanitation facilities at camp and work sites			✓	The toilets and bathroom were unhygienic and needs improvement. A discussion was conducted to improve the facilities.
2.	Sanitary toilets construction with septic tanks		✓		The toilets for the labourers in the campsite are provided with septic tank but needs improvement. However, there is no proper sanitary facility at the work site.
3.	Safe water supply arrangements		✓		Drinking water is supplied from deep tube well but needs improvement.
4.	Emergency medical facilities and First Aid Box at Field Office and work sites		✓		A well-equipped first aid box is kept at the site but yet not there is an appointed medical officer in the site for emergency
5.	Waste disposal arrangement at camp and work sites		✓		No definite place is designed to dispose the wastes. But all types of wastes are not mixed. Different types of wastes are gathered and disposed separately
6.	Adequate traffic signs and warning notices provided on site and dangerous areas		✓		They contractor is working with their full capacity. However, it needs to be improved.
B2	**Occupational Health & Safety**				
1.	First-Aid Box availability at work sites	✓			A well-equipped first aid box is available at the site
2.	Fire extinguishers/fighting facilities properly maintained and not expired			✓	No fire extinguisher is kept at the site office.
3.	Provision of personal protection equipment's (PPEs) and		✓		Though the PPEs are available at site but the workers are not using these at all the

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
	working clothing to workers				time. To conduct an awareness rising programmes was advised to the Contractor.
4.	Handling of cement and other hazardous materials by workers		✓		Workers use gloves, boots in case of handling concrete. During the monitoring period only, concrete was handled. No hazardous materials are used. In case of lifting concrete to the roof, pump is used mostly.
5.	Working hour and vacation days maintained		✓		The labourers work for 10 hours a day including a lunch break of 1 hour and vacation days are maintained
6.	Provision of recreational facilities at camp sites		✓		There are few provision of recreational facilities in the site
7.	Workers' complaints taken care of by the supervisor		✓		A supervisor for the workers is appointed to take care of the problems and receiving complaints from the workers
8.	Provision of leave (national and emergency)	✓			National leaves are provided and the workers can take emergency leave too.
9.	Children below 15 employment		✓		There is no child of below 15 years of age working in the site. However, sometimes few children are working for the project indirectly.
C.	**Environmental Pollution**				
C1	**Dust and emission control**				
1.	Proper storage of materials and regular watering of dust blowing construction area.		✓		Watering is done regularly to reduce dust and mitigate air pollution but the frequency should be increased.
2.	Dropping of fill material everywhere during transportation is avoided	✓			During transportation the fill materials are covered with plastic covers to avoid dropping everywhere
3.	Construction vehicles and plants maintained properly to reduce emissions	✓			There is no plant in the site area yet but vehicles are being maintained properly.
C2	**Noise Pollution**				
1.	Movement of vehicles and operation of plants fixed at desired hours	✓			Heavy vehicles movements are done mostly from morning to afternoon.
2.	Heavy equipment maintained properly and operated at scheduled hours	✓			Time schedule is maintained for operating heavy equipment
3.	Noise control measures at sensitive sites		✓		The heavy noise works are done within the afternoon mostly which affects less on the surrounding households. The labourers are provided with air plugs and cotton balls during the operation of heavy machineries.
C3	**Water Pollution**				
1.	Wastes, cement, effluents and junks not disposed in water		✓		No wastes are disposed in water. Proper measures are taken for preventing rain wash. However, due to heavy rainfall, some rain washes already occurred. In future more, precaution will be taken to prevent this.
2.	Sanitary, kitchen and other organic wastes not disposed in water bodies	✓			The kitchen wastes are mostly organic. The sanitary wastes are managed by the septic tank. However, no wastes are disposed in water bodies.
C4	**Flora and Fauna**				
1.	Trees and bushes outside the construction area preserved from		✓		Outside the construction area, the trees and bushes are not fully preserved from

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
	damages				damages. Dust and emissions sometimes harm them. But in future the prevention measures will be stronger.
2.	No old trees cut down or impacted by the construction or operation	✓			No old trees are cut down by the construction operation and all actions were taken accordingly the guidelines of EMP.
3.	Cutting down has not taken place without the prior approval of the relevant local authorities	✓			The trees will be cut down after taking approval from the supervision engineers.
4.	Disturbance to terrestrial fauna minimized	✓			There are not much high sound frequency works going on in the site. But if needed, works are done within day time when already the noise level is peak to minimize the disturbance.
C5	**Waste Management**				
1.	Waste disposal arrangement at camp and work sites		✓		No definite place is designed to dispose the wastes. But all types of wastes are not mixed. Different types of wastes are gathered and disposed separately. No wastes are disposed in water.
2.	Separated labelled containers/areas provided for facilitating recycling and waste segregation		✓		No labelled containers are used. However, different type wastes are disposed separately.
3.	Construction wastes/recyclable wastes and general refuse removed off site regularly		✓		The wastes are kept in a specific place and they are removed off site regularly
4.	Chemical wastes, if any, collected and disposed of properly	✓			During the monitoring period, no sources of chemical wastes are seen. In case of concrete wastes, all are disposed properly
D.	**Environmental documents at Field Office and Project sites**				
1.	Field Office possesses copies of EMP, contract document and Technical Specifications	✓			All the documents are kept in the field office.
2.	All accidents at work sites recorded and reported	✓			No serious accidents have occurred in the site area. Small accidents which can be cured by first aid treatment are not recorded usually. However, in future records will be kept in case of all accidents.
3.	Heavy equipment maintenance records	✓			Not much heavy equipment operating in the site. However, once heavy equipment is operated, the maintenance records are kept.

Note: FC = fully complied, PC = partially complied and NC = not complied

APPENDIX 8: Compliance Monitoring Checklist – Gazipur Bus Depot Contract (C04)

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
Conditions at project sites					
A.	**General**				
1.	Site Office and camp sites locations appropriate	✓			The site office is within the project area and the site camp is within the site area. There is no disturbance occurring due to the establishment of the site office and site camp to the locality.
2.	Environment, Health and Safety Officer designated	✓			Environmental officer is appointed and a diploma medical officer is also appointed for ensuring health and safety
3.	Employment Record keeping arrangement	✓			The employment records are kept in a register book manually every day in the field and then compiled in computer.
4.	Payment Record keeping arrangement	✓			The payment records are kept in a register book manually every day in the field and then compiled in computer.
5.	Legal working hours approval		✓		The workers work 10 hours a day at site including 1 hour lunch break.
6.	Provision for monthly meeting for inspection of site activities		✓		Meetings are called about working progress and future planning every month.
B.	**Health and Sanitation**				
B1	**Public Health & Safety**				
1.	Hygienic labour sheds kitchens and sanitation facilities at camp and work sites			✓	The toilets and bathroom were unhygienic and needs improvement. A discussion was conducted to improve the facilities.
2.	Sanitary toilets construction with septic tanks		✓		The toilets for the labourers are provided with septic tank but needs improvement.
3.	Safe water supply arrangements		✓		Drinking water is supplied from deep tube well but needs improvement.
4.	Emergency medical facilities and First Aid Box at Field Office and work sites	✓			A well-equipped first aid box is kept at the site and a diploma medical officer is appointed in the site for emergency
5.	Waste disposal arrangement at camp and work sites		✓		No definite place is designed to dispose the wastes. But all types of wastes are not mixed. Different types of wastes are gathered and disposed separately
6.	Adequate traffic signs and warning notices provided on site and dangerous areas		✓		They contractor is working with their full capacity. However, it needs to be improved.
B2	**Occupational Health & Safety**				
1.	First-Aid Box availability at work sites	✓			A well-equipped first aid box is available at the site
2.	Fire extinguishers/fighting facilities properly maintained and not expired	✓			A fire extinguisher is kept at the site office.
3.	Provision of personal protection equipment's (PPEs) and working clothing to workers		✓		Though the PPEs are available at site but the workers are not using these at all the time. To conduct an awareness rising programmes was advised to the Contractor.
4.	Handling of cement and other hazardous materials by workers	✓			Workers use gloves, boots in case of handling concrete. During the monitoring period only concrete was handled. No hazardous materials are used. In case of

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
					lifting concrete to the roof, pump is used mostly.
5.	Working hour and vacation days maintained		✓		The labourers work for 10 hours a day including a lunch break of 1 hour and vacation days are maintained
6.	Provision of recreational facilities at camp sites		✓		There are few provision of recreational facilities in the site
7.	Workers' complaints taken care of by the supervisor		✓		A supervisor for the workers is appointed to take care of the problems and receiving complaints from the workers
8.	Provision of leave (national and emergency)	✓			National leaves are provided and the workers can take emergency leave too.
9.	Children below 15 employment		✓		There is no child of below 15 years of age working in the site. However, sometimes few children are working for the project indirectly.
C.	**Environmental Pollution**				
C1	**Dust and emission control**				
1.	Proper storage of materials and regular watering of dust blowing construction area.		✓		Watering is done regularly to reduce dust and mitigate air pollution but the frequency should be increased.
2.	Dropping of fill material everywhere during transportation is avoided	✓			During transportation the fill materials are covered with plastic covers to avoid dropping everywhere
3.	Construction vehicles and plants maintained properly to reduce emissions	✓			There is no plant in the site area yet but vehicles are being maintained properly.
C2	**Noise Pollution**				
1.	Movement of vehicles and operation of plants fixed at desired hours	✓			Heavy vehicles movements are done mostly from morning to afternoon.
2.	Heavy equipment maintained properly and operated at scheduled hours	✓			Time schedule is maintained for operating heavy equipment
3.	Noise control measures at sensitive sites		✓		The heavy noise works are done within the afternoon mostly which affects less on the surrounding households. The labourers are provided with air plugs and cotton balls during the operation of heavy machineries.
C3	**Water Pollution**				
1.	Wastes, cement, effluents and junks not disposed in water		✓		No wastes are disposed in water. Proper measures are taken for preventing rain wash. However, due to heavy rainfall, some rain washes already occurred. In future more, precaution will be taken to prevent this.
2.	Sanitary, kitchen and other organic wastes not disposed in water bodies	✓			The kitchen wastes are mostly organic. The sanitary wastes are managed by the septic tank. However, no wastes are disposed in water bodies.
C4	**Flora and Fauna**				
1.	Trees and bushes outside the construction area preserved from damages		✓		Outside the construction area, the trees and bushes are not fully preserved from damages. Dust and emissions sometimes harm them. But in future the prevention measures will be stronger.
2.	No old trees cut down or impacted by the construction or	✓			Some old trees are cut down by the construction operation but all actions were

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
	operation				taken accordingly the guidelines of EMP.
3.	Cutting down has not taken place without the prior approval of the relevant local authorities	✓			The trees were cut down after taking approval from the supervision engineers.
4.	Disturbance to terrestrial fauna minimized	✓			There are not much high sound frequency works going on in the site. But if needed, works are done within day time when already the noise level is peak to minimize the disturbance.
C5	**Waste Management**				
1.	Waste disposal arrangement at camp and work sites		✓		No definite place is designed to dispose the wastes. But all types of wastes are not mixed. Different types of wastes are gathered and disposed separately. No wastes are disposed in water.
2.	Separated labelled containers/areas provided for facilitating recycling and waste segregation		✓		No labelled containers are used. However, different type wastes are disposed separately.
3.	Construction wastes/recyclable wastes and general refuse removed off site regularly		✓		The wastes are kept in a specific place and they are removed off site regularly
4.	Chemical wastes, if any, collected and disposed of properly	✓			During the monitoring period, no sources of chemical wastes are seen. In case of concrete wastes, all are disposed properly
D.	**Environmental documents at Field Office and Project sites**				
1.	Field Office possesses copies of EMP, contract document and Technical Specifications	✓			All the documents are kept in the field office.
2.	All accidents at work sites recorded and reported	✓			No serious accidents have occurred in the site area. Small accidents which can be cured by first aid treatment are not recorded usually. However, in future records will be kept in case of all accidents.
3.	Heavy equipment maintenance records	✓			Not much heavy equipment operating in the site. However, once heavy equipment is operated, the maintenance records are kept.

Note: FC = fully complied, PC = partially complied and NC = not complied

APPENDIX 8: Photographs

Monitoring by RHD and Supervision Consultant

Labourers wearing PPE

Project Site Visit by ADB, RHD, LGED and Supervision Consultant

Sanitary Latrines for labourers

Drinking water supply for the labourers

Living arrangements for the labourers

	
Filling of Gazipur Terminal Area	Preparation of Construction Yard for C01
	
Meeting with Contractor at Site Office	General View of Works in progress
	
Security Personnel at the Project Area	Filling of Construction Yard for C01

APPENDIX 9: The Laboratory Test Report

At Grade Section including Flyovers – C01

Baseline Monitoring in August, 2017

Ambient Air Quality Monitoring Result

DSCL

Multidisciplinary Development Consultants

Name of the Project	Bus Rapid Transit (BRT) Project, Contract Package-01
Description of sample	Ambient Air Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	27-30 August, 2017

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Concentration Present			Bangladesh Standard**	Duration (hours)	Weather Condition	Method of Analysis
		AAQ_GT 23.99717°N 90.41799°E	AAQ_BB 23.94732°N 90.38178°E	AAQ_AP 23.85004°N 90.40819°E				
PM_{10}	µg/m³	105.4	137.9	315.7	150	24	Sunny	Gravimetric
SPM	µg/m³	642.72	1006.58	1620.64	200	24		Gravimetric
$PM_{2.5}$	µg/m³	62.7	79.2	94.3	65	24		Gravimetric
SO_2	µg/m³	27.79	50.44	106.53	365	24		West-Geake
NOx	µg/m³	95.89	198.47	390.75	100	Annual		Jacob and Hochheiser
H_2S	µg/m³	0.009	0.025	0.043	NYS	8		Electro-Chemical Sensor
O_3	µg/m³	9.27	17.38	22.45	NYS	8		Photometric
O_2	%	18.93	20.17	19.59	NYS	8		Electro-Chemical Sensor
TVOC	µg/m³	724	937	1117	NYS	8		Electro-Chemical Sensor
CO*	ppm	2	3	4	9	8		CO-Meter
CO_2	µg/m³	321.07	452.27	553.86	NYS	8		Electro-Chemical Sensor

Note:
** CO concentrations and standards are 8-hourly only.*
*** The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.*
NYS: Not Yet Standardized

Monitoring Results of Weather Data

Sample ID	Location	GPS Location	Time	Humidity (%)	Temperature °C	Wind Speed Km/h	Wind Direction
AAQ_AP	Airport	23.85004°N 90.40819°E	13.30 to 14.30	51.5	33.9	2.2	NW to SE
AAQ_BB	Tongi Board Bazar	23.94732°N 90.38178°E	14.00 to 15.00	57.5	33	1.5	SW to NE
AAQ_GT	Gazipur Terminal	23.99717°N 90.41799°E	14.00 to 15.00	46.5	35	7.5	S to N

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House# 734 (5-B), Road# 10, Avenue# 04
DOHS Mirpur, Dhaka-1216, Bangladesh. Tel: +8804478095444
Email: dscl@dsclbd.com Web: www.dsclbd.com

DSCL

Multidisciplinary Development Consultants

Location	Sample Site Description
AAQ_AP	➢ Airport area was busy with a lot of vehicles. ➢ Large amount of dust particles were present in the area ➢ Huge smoke was coming from vehicles ➢ The weather was mostly sunny.
AAQ_BB	➢ Highway was busy with a lot of vehicles. ➢ Large amount of dust particles were present in the area ➢ Huge smoke was coming from vehicles ➢ The weather was mostly sunny.
AAQ_GT	➢ It was a bus stand area, so vehicle load was a lot. ➢ Large amount of dust particles were present in the area. ➢ The weather was mostly sunny.

Development Solutions Consultant Limited

Test Performed By:
Moynul Hasan
Environmental Specialist

Report Prepared By:
Tanzia Sharmin
Environmental Specialist

Checked By:
Israt Jahan Sumi
Director

Development Solutions Consultant Ltd.
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Email: dscl@dsclbd.com Web: www.dsclbd.com

Noise Level Monitoring Result

DSCL

Multidisciplinary Development Consultants

Name of the Project	Bus Rapid Transit (BRT) Project, Contract Package-1
Description of sample	Noise Level
Sample Collector	Collected by DSCL Personnel
Sampling Date	27-30 August, 2017

Noise Level Analysis

Sample ID	Sample Location	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)	
				Day	Night	Day	Night
NM_GT	Gazipur Terminal	23.99717 N, 90.41799 E	Commercial	12:35	21:00	66.63	67.30
NM_JC	Joydebpur Chowrasta, Gazipur	23.98956 N, 90.38152 E	Commercial	16:53	21:25	75.11	79.27
NM_BhB	Bhogra Bazar, Gazipur	23.97767 N, 90.38057 E	Commercial	15:41	22:31	80.15	76.43
NM_CS	Campsite, Gazipur	23.97796 N, 90.37050 E	Residential	16:03	22:53	59.07	56.69
NM_BB	Board Bazar, Gazipur	23.94731 N, 90.38178 E	Commercial	12:10	23:26	74.07	73.80
NM_AP	Airport, Uttara, Dhaka	23.85004 N, 90.40919 E	Commercial	12:43	00:34	76.22	76.74

Notes:
- *Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)*
- *Shaded cell indicate noise levels in excess of Noise Pollution Control Rules ambient noise limits for a given land use area*
- *The sound level standards for residential area is 55, commercial area is 65 dBA at day time and residential area 45, commercial area 55 at night time.*
- *Noise Level is the average noise recorded over the duration of the monitoring period*

Abbreviation:
NM- Noise Measurement, dB- decibel

Test Performed By:	Checked By:
Moynul Hasan Environmental Specialist	Israt Jahan Sumi Director

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Surface Water Quality Test Results

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 154/ CC, DPHE, CL, Dhaka. Date: 10-09-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017080133	Sample Receiving date: 28-08-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-08-2017	Sample Source: Suface Water
Sent by:Tanzia Sharmin, Deputy Manager ,(Water & Environment) , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (Sample : SW_HF)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 28-08-2017	Date of Testing: 28/08/2017-07/09/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Chemical Oxygen demand (COD)	4.0	48	mg/L	CRM	-
3	Coliform (Faecal)	0	32	N/100	MFM	-
4	Coliform (Total)	0	71	N/100	MFM	-
5	Dissolved Oxygen (DO)	6.0	7.50	mg/L	Multimeter	-
6	EC	-	418	µS/cm	Multimeter	-
7	Iron (Fe)	0.3-1	0.87	mg/L	AAS	0.05
8	Manganese (Mn)	0.1	0.04	mg/L	AAS	0.03
9	pH	6.5-8.5	7.0		pH meter	-
10	Temperature	20-30	25	°C	Thermometer	-
11	Total Suspended Solid (TSS)	10	21	mg/L	Gravity Multimeter	-
12	Turbidity	10	26.5	NTU	Turbidity Meter	-
13	Biological Oxygen Demand (BOD)	0.2	20	mg/L	5 days incubation	0.20

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, CRM-Closed Reflex Methods, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	10.09.17	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	10/09/2017 মোঃ বিপ্লব হোসেন চীফ কেমিস্ট জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা।
2.) Name: Taslima Akhter Designation: Sample Analyzer	10.09.17 জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা	2.) Name: Designation:	

Page 1 of 1

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Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 154/ CC, DPHE, CL, Dhaka. Date: 10-09-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017080134	Sample Receiving date: 28-08-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-08-2017	Sample Source: Suface Water
Sent by:Tanzia Sharmin, Deputy Manager ,(Water & Environment) , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (Sample : SW_SD)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 28-08-2017	Date of Testing: 28/08/2017-07/09/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Chemical Oxygen demand (COD)	4.0	8	mg/L	CRM	-
3	Coliform (Faecal)	0	0	N/100	MFM	-
4	Coliform (Total)	0	0	N/100	MFM	-
5	Dissolved Oxygen (DO)	6.0	5.91	mg/L	Multimeter	-
6	EC	-	389	µS/cm	Multimeter	-
7	Iron (Fe)	0.3-1	0.88	mg/L	AAS	0.05
8	Manganese (Mn)	0.1	0.04	mg/L	AAS	0.03
9	pH	6.5-8.5	7.1		pH meter	-
10	Temperature	20-30	25.2	°C	Thermometer	-
11	Total Suspended Solid (TSS)	10	2	mg/L	Gravity Multimeter	-
12	Turbidity	10	0.7	NTU	Turbidity Meter	-
13	Biological Oxygen Demand (BOD)	0.2	19	mg/L	5 days incubation	0.20

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, CRM-Closed Reflex Methods, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	10.09.17	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	10/09/2017 মোঃ বিপ্লব হোসেন চীফ কেমিস্ট জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা।
2.) Name: Taslima Akhter Designation: Sample Analyzer	10.09.17 তাসলিমা বিশ্বাস জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা	2.) Name: Designation:	

Page 1 of 1

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা ১০০০
বাংলাদেশ

Department of Soil, Water and Environment
University of Dhaka
Dhaka 1000
Bangladesh

Date: 11. 09. 2017

Report of Analysis

Sample supplied by
Mrs. Tanzia Sharmin
Deputy Manager (Water & Environment)
Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04
DOHS Mirpur, Dhaka-1216, Bangladesh

Project Name: Bus Rapid Transit (BRT) Project (Package-1)

Sample Title: Surface Water Samples for Oil and Grease Test

Analytical Results:

Serial No.	Particulars of Supplied Sample (Sample ID)	Test Parameters Oil and Grease (mg/L)	Test Method (APHA)
1.	Surface Water **(SW_HF)**	23.4	5520.B
2.	Surface Water **(SW_SD)**	269.0	5520.B

(Dr. Sirajul Hoque)
Professor and Chairman

Dr. Sirajul Hoque
Professor & Chairman
Department of Soil, Water & Environment
University of Dhaka, Dhaka-1000

Telephone: 9661920-73/7470, Fax: (880-2) 8615583, e-mail: swed@du.ac.bd

Groundwater Quality Test Results

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 154/ CC, DPHE, CL, Dhaka. Date: 10-09-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017080136	Sample Receiving date: 28-08-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-08-2017	Sample Source: Ground Water
Sent by:Tanzia Sharmin, Deputy Manager ,(Water & Environment) , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (Sample : GW_CS)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 28-08-2017	Date of Testing: 28/08/2017-07/09/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Chemical Oxygen demand (COD)	4.0	8	mg/L	CRM	-
3	Coliform (Faecal)	0	0	N/100	MFM	-
4	Coliform (Total)	0	0	N/100	MFM	-
5	Dissolved Oxygen (DO)	6.0	5.91	mg/L	Multimeter	-
6	EC	-	389	µS/cm	Multimeter	-
7	Iron (Fe)	0.3-1	0.88	mg/L	AAS	0.05
8	Manganese (Mn)	0.1	0.04	mg/L	AAS	0.03
9	pH	6.5-8.5	7.1		pH meter	-
10	Temperature	20-30	25.2	°C	Thermometer	-
11	Total Suspended Solid (TSS)	10	2	mg/L	Gravity Multimeter	-
12	Turbidity	10	0.7	NTU	Turbidity Meter	-
13	Biological Oxygen Demand (BOD)	0.2	0.01	mg/L	5 days incubation	0.20

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, CRM-Closed Reflex Methods, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature 10.09.17

2.) Name: Taslima Akhter
Designation: Sample Analyzer
10.09.17

Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature 10/09/2017

2.) Name:
Designation:

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Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 154/ CC, DPHE, CL, Dhaka. Date: 10-09-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017080137	Sample Receiving date: 28-08-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-08-2017	Sample Source: Ground Water
Sent by:Tanzia Sharmin, Deputy Manager ,(Water & Environment) , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (Sample : GW_GP)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 28-08-2017	Date of Testing: 28/08/2017-07/09/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.004	mg/L	AAS	0.001
2	Chemical Oxygen demand (COD)	4.0	4	mg/L	CRM	-
3	Coliform (Faecal)	0	0	N/100	MFM	-
4	Coliform (Total)	0	0	N/100	MFM	-
5	Dissolved Oxygen (DO)	6.0	6.17	mg/L	Multimeter	-
6	EC	-	418	µS/cm	Multimeter	-
7	Iron (Fe)	0.3-1	0.91	mg/L	AAS	0.05
8	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
9	pH	6.5-8.5	6.8		pH meter	-
10	Temperature	20-30	25.1	°C	Thermometer	-
11	Total Suspended Solid (TSS)	10	1.5	mg/L	Gravity Multimeter	-
12	Turbidity	10	0.5	NTU	Turbidity Meter	-
13	Biological Oxygen Demand (BOD)	0.2	0.019	mg/L	5 days incubation	0.20

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, CRM-Closed Reflex Methods, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Solful Alam Khosru Designation: Sample Analyzer	10.09.17	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	10/09/2017 মোঃ বিপ্লব হোসেন চীফ কেমিস্ট জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা।
2.) Name: Taslima Akhter Designation: Sample Analyzer	10.09.17 তাসলিমা বিশ্বাস জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা	2.) Name: Designation:	

Page 1 of 1

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 154/ CC, DPHE, CL, Dhaka. Date: 10-09-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017080135	Sample Receiving date: 28-08-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-08-2017	Sample Source: Ground Water
Sent by:Tanzia Sharmin, Deputy Manager ,(Water & Environment) , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (Sample : GW_GT)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 28-08-2017	Date of Testing: 28/08/2017-07/09/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Chemical Oxygen demand (COD)	4.0	4	mg/L	CRM	-
3	Coliform (Faecal)	0	0	N/100	MFM	-
4	Coliform (Total)	0	0	N/100	MFM	-
5	Dissolved Oxygen (DO)	6.0	6.70	mg/L	Multimeter	-
6	EC	-	349	µS/cm	Multimeter	-
7	Iron (Fe)	0.3-1	0.84	mg/L	AAS	0.05
8	Manganese (Mn)	0.1	0.09	mg/L	AAS	0.03
9	pH	6.5-8.5	7.2		pH meter	-
10	Temperature	20-30	24.9	°C	Thermometer	-
11	Total Suspended Solid (TSS)	10	2	mg/L	Gravity Multimeter	-
12	Turbidity	10	0.8	NTU	Turbidity Meter	-
13	Biological Oxygen Demand (BOD)	0.2	0.015	mg/L	5 days incubation	0.20

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, CRM-Closed Reflex Methods, MFM= Membrane Filtration Method, LOQ - Limit of Quantitation.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	10.09.17	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	10/09/2017
2.) Name: Taslima Akhter Designation: Sample Analyzer	10.09.17	2.) Name: Designation:	

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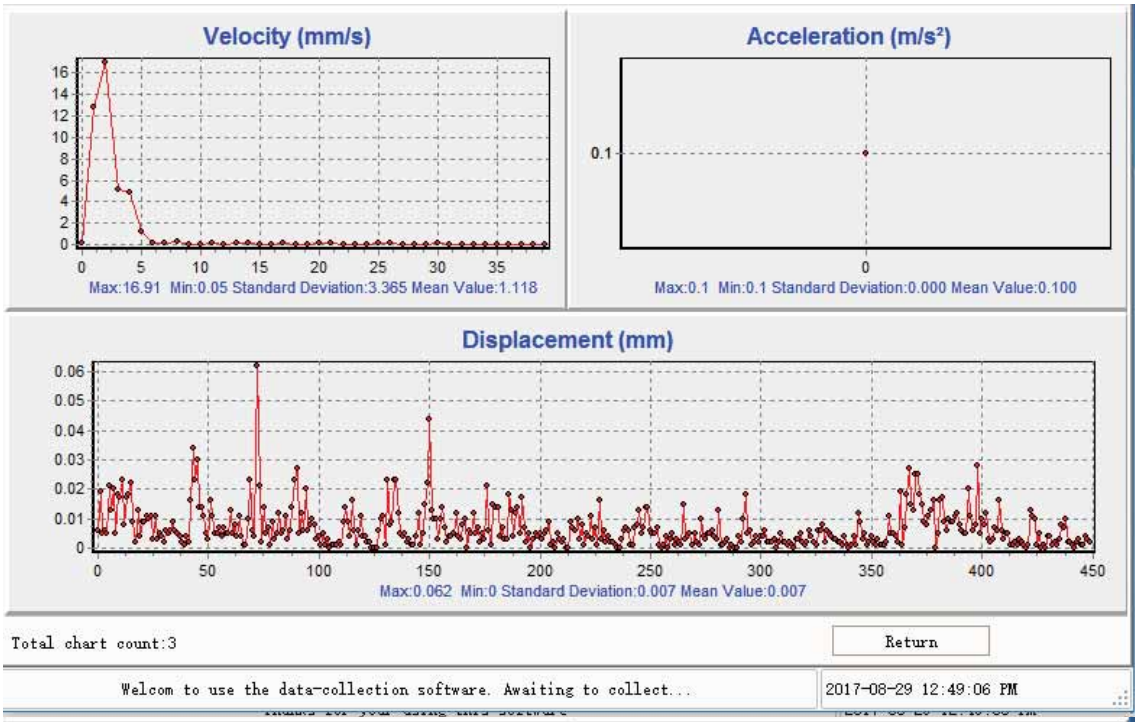
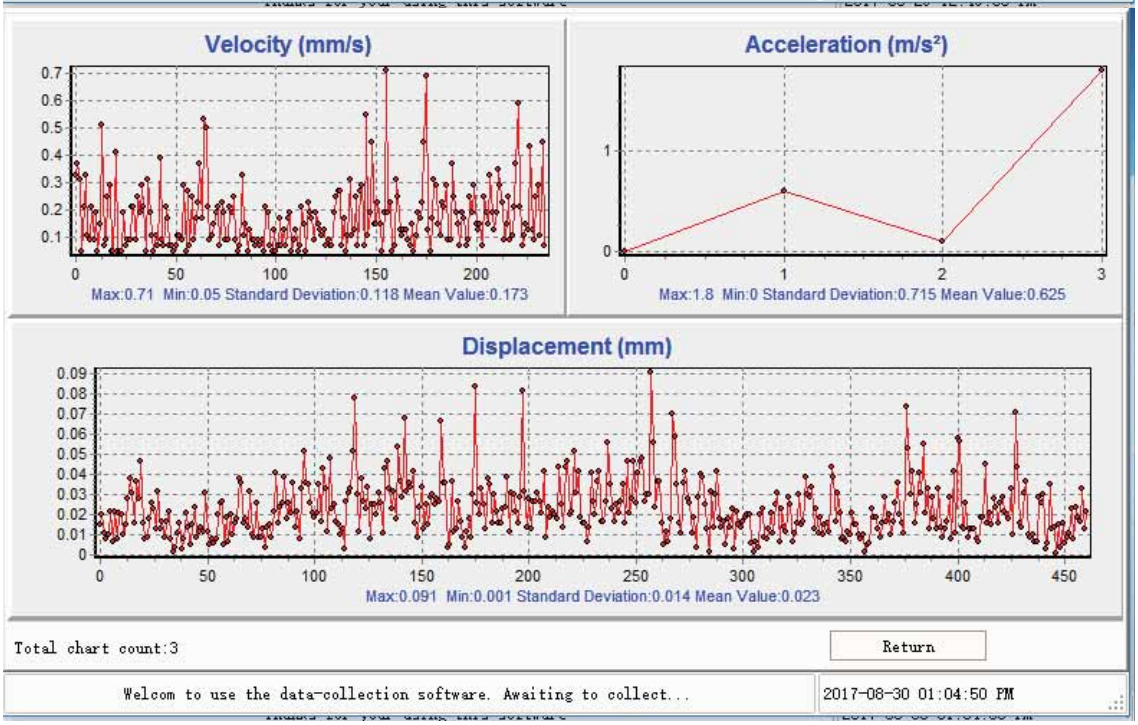
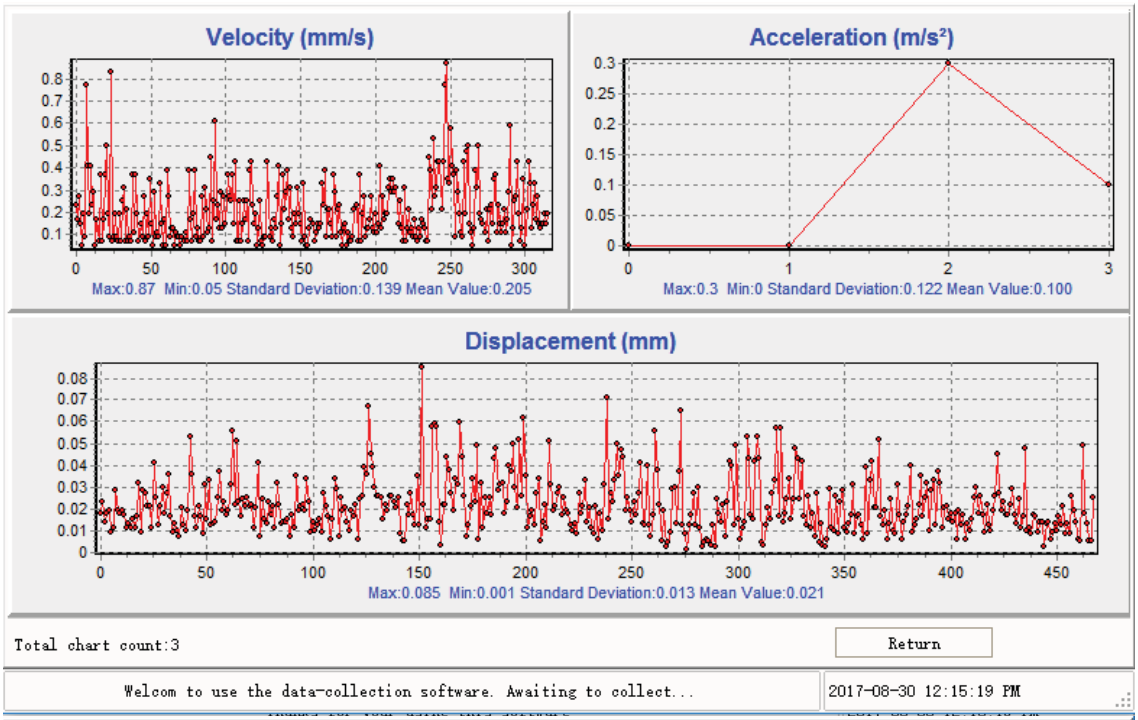
Vibration Level Measurement Results



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Acceleration (m/s²)
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Displacement (mm)
Max:0.085 Min:0.001 Standard Deviation:0.013 Mean Value:0.021
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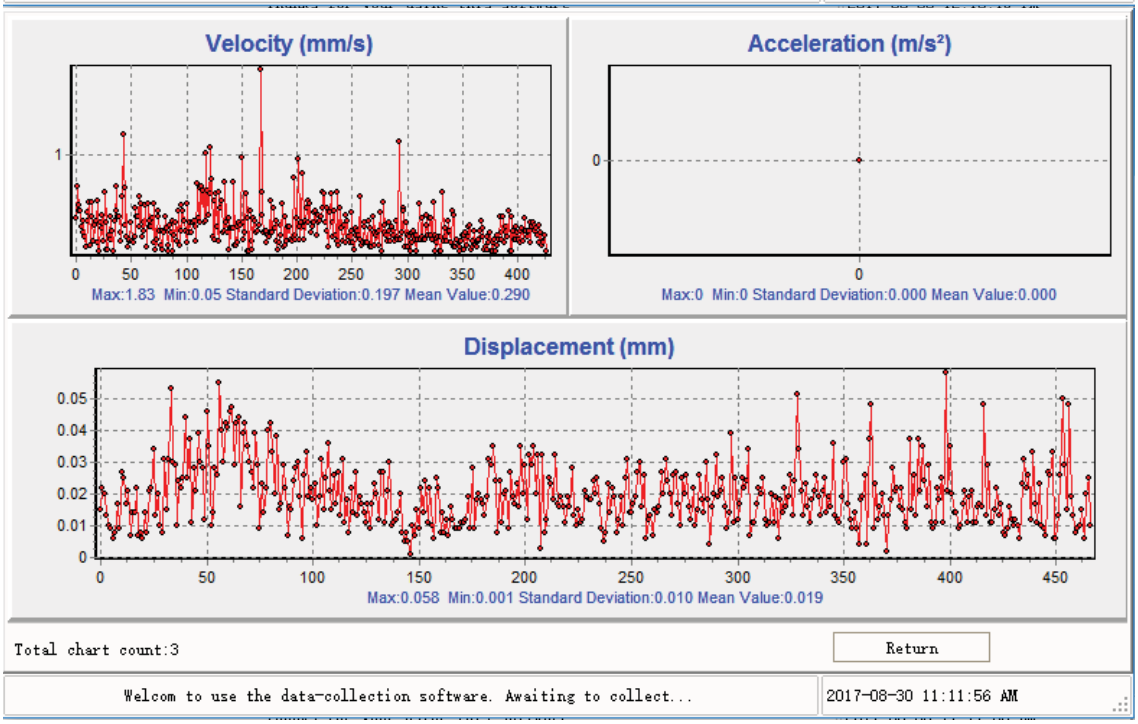
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Acceleration (m/s²)
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Displacement (mm)
Max:0.058 Min:0.001 Standard Deviation:0.010 Mean Value:0.019
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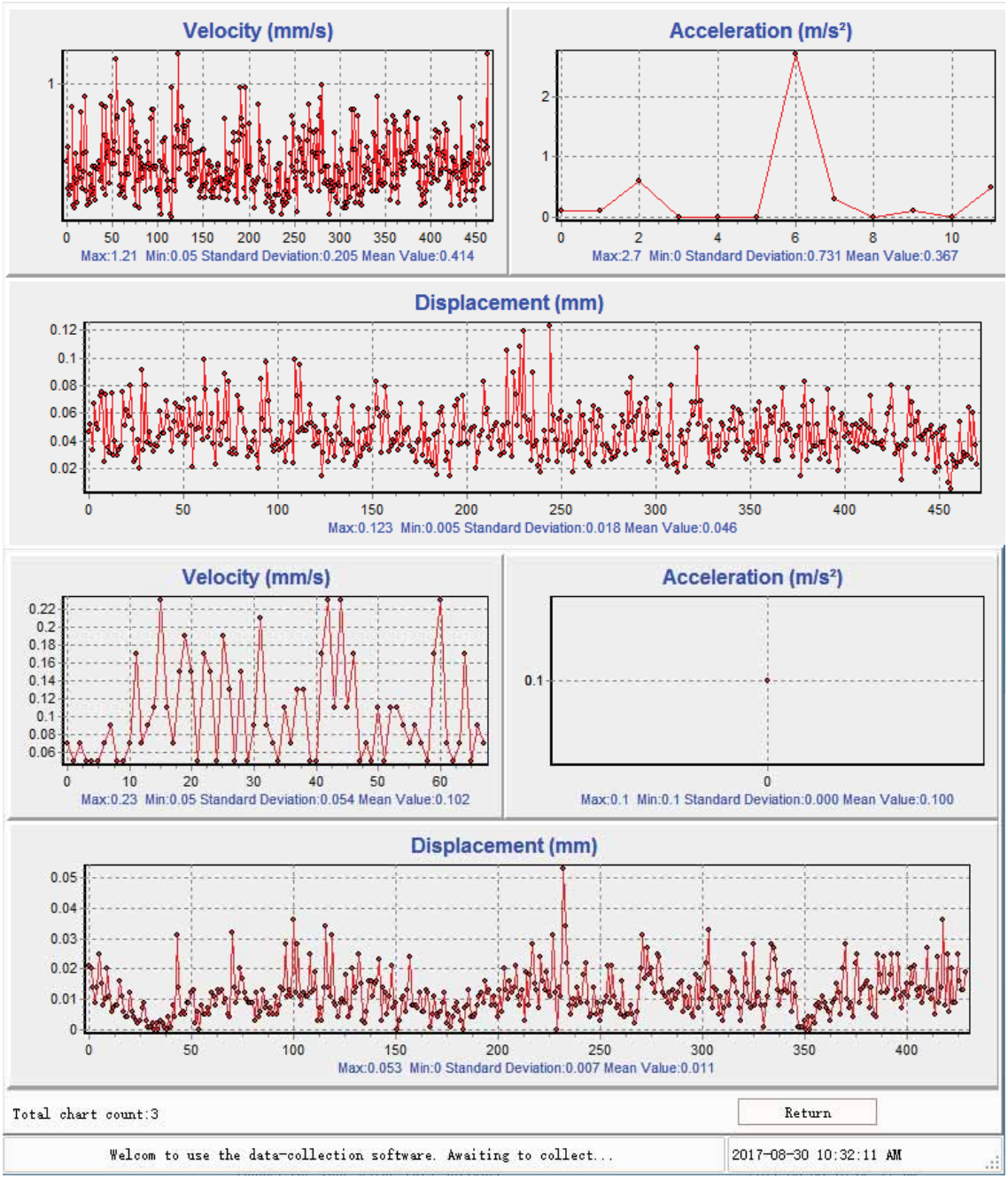
Return
Welcom to use the data-collection software. Awaiting to collect...
2017-08-30 11:11:56 AM


Velocity (mm/s)
Max:1.21 Min:0.05 Standard Deviation:0.205 Mean Value:0.414
Acceleration (m/s²)
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Displacement (mm)
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Velocity (mm/s)
Max:0.23 Min:0.05 Standard Deviation:0.054 Mean Value:0.102
Acceleration (m/s²)
Max:0.1 Min:0.1 Standard Deviation:0.000 Mean Value:0.100
Displacement (mm)
Max:0.053 Min:0 Standard Deviation:0.007 Mean Value:0.011
Total chart count:3
Return
Welcom to use the data-collection software. Awaiting to collect...
2017-08-30 10:32:11 AM

Soil Quality Test Results

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)
DEPARTMENT OF CIVIL ENGINEERING
Mobile: 01819 557 964; PABX: 966 5650-80 Ext. 7226; www.buet.ac.bd/ce/
ENVIRONMENTAL ENGINEERING LABORATORY

BRTC No. : **1101-42856; Dt: 28/8/2017** Ref. No. : Bus Rapid Transit (BRT) Project (Package-1); Dt: 28/9/2017
Sent by : Ms.Tanzia Sharmin, Deputy Manager (Water & Environment)
Project : **Request for Soil Quality Test for Bus Rapid Transit (BRT) Project (Package-1)**
Company Address : **Development Solutions Consultant Ltd.(DSCL) & House of Professionals & Experts (HOPE)**
Sample Id : **SS_GT: (Soil Sample # -01)** Source : Not Specifically mentioned Location : **BRT at Gazipur**
Date of Test : 28/8/2017 - 3/10/2017

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	pH Value	Unit	6	—	—	—
2	Arsenic (As)	mg/kg	0.71	—	USEPA 206.2; SM 3113 B	—
3	Lead (Pb)	mg/kg	24	1200	USEPA 200.9 Rev 2.2; SM 3111 B	—
4	Mercury (Hg)	mg/kg	0	25	—	—
5	Cadmium (Cd)	mg/kg	0	40	USEPA 213.2 ; SM 3113 B	—
6	Chromium (Cr)	mg/kg	19.8	—	USEPA 200.9 Rev 2.2; SM 3111 B	—
7	Zinc (Zn)	mg/kg	87.7	4000	USEPA 200.9 ; SM 3111 B	—

Comments : 1. Sample was supplied by CLIENT
2. Sample was received in unsealed condition.
Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned by:
Dr. Abu Siddique
Professor, Dept. of Civil Engg.

Authenticity of this page is verifiable from http://verify.ce.buet.ac.bd with the QR Code or ID
bhZb5W9t7

Test Performed by:
Dr. Farooque Ahmed
Professor, Dept. of Civil Engineering
4/10/2017

BUETCE QD Ver 1.3

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

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ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **1101-42856; Dt: 28/8/2017** Ref. No. : Bus Rapid Transit (BRT) Project (Package-1); Dt: 28/9/2017

Sent by : Ms.Tanzia Sharmin, Deputy Manager (Water & Environment)

Project : **Request for Soil Quality Test for Bus Rapid Transit (BRT) Project (Package-1)**

Company Address : **Development Solutions Consultant Ltd.(DSCL) & House of Professionals & Experts (HOPE)**

Sample Id : **SS_CS: (Soil Sample # -03)** Source : Not Specifically mentioned Location : **BRT at Gazipur**

Date of Test : 28/8/2017 - 3/10/2017

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	pH Value	Unit	7	—	—	—
2	Arsenic (As)	mg/kg	0.33	—	USEPA 206.2; SM 3113 B	—
3	Lead (Pb)	mg/kg	2.3	1200	USEPA 200.9 Rev 2.2; SM 3111 B	—
4	Mercury (Hg)	mg/kg	0	25	—	—
5	Cadmium (Cd)	mg/kg	0	40	USEPA 213.2 ; SM 3113 B	—
6	Chromium (Cr)	mg/kg	2.9	—	USEPA 200.9 Rev 2.2; SM 3111 B	—
7	Zinc (Zn)	mg/kg	3.29	4000	USEPA 200.9 ; SM 3111 B	—

Comments : 1. Sample was supplied by CLIENT
2. Sample was received in unsealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned by:

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

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r6g5WCLWK

Test Performed by

Dr. Farooque Ahmed
Professor, Dept. of Civil Engineering

BUETCE 002145

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)

DEPARTMENT OF CIVIL ENGINEERING

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ENVIRONMENTAL ENGINEERING LABORATORY

BRTC Bureau of Research, Testing & Consultation

BRTC No. : **1101-42856; Dt: 28/8/2017** Ref. No. : Bus Rapid Transit (BRT) Project (Package-1); Dt: 28/9/2017

Sent by : Ms.Tanzia Sharmin, Deputy Manager (Water & Environment)

Project : **Request for Soil Quality Test for Bus Rapid Transit (BRT) Project (Package-1)**

Company Address : **Development Solutions Consultant Ltd.(DSCL) & House of Professionals & Experts (HOPE)**

Sample Id : **SS_JC: (Soil Sample # -02)** Source : Not Specifically mentioned Location : **BRT at Gazipur**

Date of Test : 28/8/2017 - 3/10/2017

TEST REPORT (TOTAL EXTRACTION OF SOIL SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	pH Value	Unit	6	---	---	---
2	Arsenic (As)	mg/kg	0.69	---	USEPA 206.2; SM 3113 B	---
3	Lead (Pb)	mg/kg	0	1200	USEPA 200.9 Rev 2.2; SM 3111 B	---
4	Mercury (Hg)	mg/kg	0	25	---	---
5	Cadmium (Cd)	mg/kg	0	40	USEPA 213.2 ; SM 3113 B	---
6	Chromium (Cr)	mg/kg	17.3	---	USEPA 200.9 Rev 2.2; SM 3111 B	---
7	Zinc (Zn)	mg/kg	90.9	4000	USEPA 200.9 ; SM 3111 B	---

Comments : 1. Sample was supplied by CLIENT
2. Sample was received in unsealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a SOIL sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned *by* :

Dr. Abu Siddique
Professor, Dept. of Civil Engg.

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9FDnKGh3n

Test Performed *by* :

Dr. Farooque Ahmed 4/10/2017
Professor, Dept. of Civil Engineering

BUETCE 00201144

Page 1

First Environmental Sampling November, 2017

Ambient Air Quality Monitoring Result

DSCL

Multidisciplinary Development Consultants

Name of the Project	Bus Rapid Transit (BRT) Project, Contract Package-01
Description of sample	Ambient Air Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	27-30 November, 2017

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Concentration Present			Bangladesh Standard**	Duration (hours)	Weather Condition	Method of Analysis
		AAQ_GT 23.99717°N 90.41799°E	AAQ_BB 23.94732°N 90.38178°E	AAQ_AP 23.85004°N 90.40919°E				
PM_{10}	µg/m³	115.7	104.2	270.2	150	24	Sunny	Gravimetric
SPM	µg/m³	528.04	986.51	1257.84	200	24		Gravimetric
$PM_{2.5}$	µg/m³	65.7	57.7	103.9	65	24		Gravimetric
SO_2	µg/m³	44.32	65.29	113.82	365	24		West-Geake
NOx	µg/m³	52.75	88.27	250.41	100	Annual		Jacob and Hochheiser
H_2S	µg/m³	0.013	0.004	0.071	NYS	8		Electro-Chemical Sensor
O_3	µg/m³	5.61	8.75	17.94	NYS	8		Photometric
O_2	%	16.43	19.39	17.63	NYS	8		Electro-Chemical Sensor
TVOC	µg/m³	528	764	1075	NYS	8		Electro-Chemical Sensor
CO*	ppm	003	001	002	9	8		CO-Meter
CO_2	µg/m³	278.51	386.93	556.27	NYS	8		Electro-Chemical Sensor

Note:
** CO concentrations and standards are 8-hourly only.*
*** The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.*
NYS: Not Yet Standardized

Monitoring Results of Weather Data

Sample ID	Location	GPS Location	Time	Humidity (%)	Temperature (°C)	Wind Speed (Knots)	Wind Direction
AAQ_AP	Airport	23.85004°N 90.40919°E	1:00pm-2:00pm	42	28.6	1.28	South-East
AAQ_BB	Tongi Board Bazar	23.94732°N 90.38178°E	4:00pm-5:00pm	27.75	23.6	1.1	West-South
AAQ_GT	Gazipur Terminal	23.99717°N 90.41799°E	3:00pm-4:00pm	42.75	24.4	1.27	South-East

Development Solutions Consultant Ltd.
House# 734 (S-B), Road# 10, Avenue# 04
DOHS Mirpur, Dhaka-1216, Bangladesh. Tel: +8804478035444
Email: dscl@dsclbd.com Web: www.dsclbd.com

DSCL

Multidisciplinary Development Consultants

Location	Sample Site Description
AAQ_AP	➢ Airport area was busy with a lot of vehicles. ➢ Large amount of dust particles were present in the area ➢ Huge smoke was coming from vehicles ➢ The weather was mostly sunny.
AAQ_BB	➢ Highway was busy with a lot of vehicles. ➢ Large amount of dust particles were present in the area ➢ Huge smoke was coming from vehicles ➢ The weather was mostly sunny.
AAQ_GT	➢ It was a bus stand area, so vehicle load was a lot. ➢ Large amount of dust particles were present in the area. ➢ The weather was mostly sunny.

Development Solutions Consultant Limited DSCL

Test Performed By:
Tonmoy Pandit
Jr. Environmental Specialist

Report Prepared By:
Tanzia Sharmin
Deputy Manager
(Water & Environment)

Checked By:
Israt Jahan Sumi
Director

Development Solutions Consultant Ltd.
House# 734 (5-B), Road# 10, Avenue# 04
DOHS Mirpur, Dhaka-1216, Bangladesh. Tel: +8804478035444
Email: dscl@dsclbd.com Web: www.dsclbd.com

Surface Water and Groundwater Quality Test Results

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা ১০০০

Department of Soil, Water and Environment
University of Dhaka
Dhaka 1000
Bangladesh

Date: 11. 12. 2017

Report of Analysis

Sample supplied by
Mrs. Tanzia Sharmin
Deputy Manager (Water & Environment)
Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04
DOHS Mirpur, Dhaka-1216, Bangladesh

Project Name: Bus Rapid Transit (BRT) Project (Package-1)

Sample Title: Surface Water and Ground Water Quality Test

Analytical Results:

Serial No.	Water Source	Sample ID	Test Parameters		
			Ammonium Nitrogen (NH_4-N) (µg/ml)	Total Nitrogen (µg/ml)	Total Phosphorus (µg/ml)
1.	Surface Water	SW_HF	4.42	11.67	0.208
2.	Surface Water	SW_SD	2.94	7.78	0.180
3.	Ground Water	GW_CS	2.90	7.78	0.074
4.	Ground Water	GW_GP	2.90	9.72	0.044
5.	Ground Water	GW_GT	2.90	5.83	0.069

Methods Used:

1. NH_4-N: Kjeldahl method
2. Total N: Kjeldahl method
3. Total P: Ascorbic acid blue colour method

(Professor Dr. Sirajul Hoque)
Chairman

Dr. Sirajul Hoque
Professor & Chairman
Department of Soil, Water & Environment
University of Dhaka, Dhaka-1000

Telephone: 9661920-73/7470, Fax: (880-2) 8615583, e-mail: swed@du.ac.bd

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা ১০০০
বাংলাদেশ

Department of Soil, Water and Environment
University of Dhaka
Dhaka 1000
Bangladesh

Dept. of Soil, Water & Environment
Dhaka-1000
Bangladesh
University of Dhaka

Date: 10. 12. 2017

Report of Analysis

Sample supplied by
Mrs. Tanzia Sharmin
Deputy Manager (Water & Environment)
Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04
DOHS Mirpur, Dhaka-1216, Bangladesh

Project Name: Bus Rapid Transit (BRT) Project (Package-1)

Sample Title: Surface Water Samples for Oil and Grease Test

Analytical Results:

Serial No.	Water Source	Sample ID	Test Parameters	Test Method (APHA)
			Oil and Grease (mg/L)	
1.	Surface Water	SW_HF	19.4	5520.B
2.	Surface Water	SW_SD	9.60	5520.B

(Professor Dr. Sirajul Hoque)
Chairman

Dr. Sirajul Hoque
Professor & Chairman
Department of Soil, Water & Environment
University of Dhaka, Dhaka-1000

Telephone: 9661920-73/7470, Fax: (880-2) 8615583, e-mail: swed@du.ac.bd

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 365/ CC, DPHE, CL, Dhaka.

Date: 26-12-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017120021	Sample Receiving date: 28-11-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-11-2017	Sample Source: Suface Water
Sent by:Tanzia Sharmin ,Deputy Manager , DSCL, DOHS Mirpur, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (BRT Project , Sample : SW_HF)	Union:, Vill.:
Sample Collection date: 28-11-2017	Date of Testing: 28/11/2017-21/12/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	16	mg/L	5 days Incubation	-
3	Chemical Oxygen Demand (COD)	4.0	64	mg/L	CRM	-
4	Coliform (Faecal)	0	500	N/100ml	MFM	-
5	Coliform (Total)	0	924	N/100ml	MFM	-
6	Dissolved Oxygen (DO)	6.0	4.13	mg/L	Multimeter	-
7	EC	-	1045	µS/cm	Multimeter	-
8	Iron (Fe)	0.3-1	0.24	mg/L	AAS	0.05
9	Manganese (Mn)	0.1	0.14	mg/L	AAS	0.03
10	pH	6.5-8.5	7.5	-	pH Meter	-
11	Temperature	20-30	24.1	°C	Thermometer	-
12	Total Dissolved Solid (TDS)	1000	524	mg/L	Multimeter	-
13	Total Suspended Solid (TSS)	10	27	mg/L	Gravity Multimeter	-
14	Turbidity	10	15.5	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods , MFM= Membrane Filtration Method, LOQ - Limit of Quantitation

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature: 26.12.17

2.) Name: Taslima Akhter
Designation: Sample Analyzer
Signature: 26.12.17
নসরুনা বিশ্বাস
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার
ঢাকা

Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature: BHossain 26/12/2017
মোঃ বিপ্লব হোসেন
চীফ কেমিস্ট
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা।

2.) Name:
Designation:

Page 2 of 2

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 365/ CC, DPHE, CL, Dhaka.

Date: 26-12-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017120022	Sample Receiving date: 28-11-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-11-2017	Sample Source: Suface Water
Sent by:Tanzia Sharmin ,Deputy Manager , DSCL, DOHS Mirpur, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (BRT Project , Sample : SW_SD)	Union:, Vill.:
Sample Collection date: 28-11-2017	Date of Testing: 28/11/2017-21/12/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	27	mg/L	5 days Incubation	-
3	Chemical Oxygen Demand (COD)	4.0	104	mg/L	CRM	-
4	Coliform (Faecal)	0	235	N/100ml	MFM	-
5	Coliform (Total)	0	400	N/100ml	MFM	-
6	Dissolved Oxygen (DO)	6.0	5.82	mg/L	Multimeter	-
7	EC	-	2635	µS/cm	Multimeter	-
8	Iron (Fe)	0.3-1	0.06	mg/L	AAS	0.05
9	Manganese (Mn)	0.1	0.08	mg/L	AAS	0.03
10	pH	6.5-8.5	7.4	-	pH Meter	-
11	Temperature	20-30	24.0	°C	Thermometer	-
12	Total Dissolved Solid (TDS)	1000	1340	mg/L	Multimeter	-
13	Total Suspended Solid (TSS)	10	48	mg/L	Gravity Multimeter	-
14	Turbidity	10	111	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods , MFM= Membrane Filtration Method, LOQ - Limit of Quantitation

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature: 26.12.17

2.) Name: Taslima Akhter
Designation: Sample Analyzer
26.12.17
যমুনা বিশ্বোধারা
পরিবেশ প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার
রাজধানী, ঢাকা

Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature
26/12/2017
মোঃ বিপ্লব হোসেন
চীফ কেমিস্ট
পরিবেশ প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার রাজধানী, ঢাকা।

2.) Name:
Designation:

Page 2 of 2

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 365/ CC, DPHE, CL, Dhaka.

Date: 26-12-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017120025	Sample Receiving date: 28-11-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-11-2017	Sample Source: Ground Water
Sent by:Tanzia Sharmin ,Deputy Manager , DSCL, DOHS Mirpur, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (BRT Project , Sample : GW_GP)	Union:, Vill.:
Sample Collection date: 28-11-2017	Date of Testing: 28/11/2017-21/12/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	6	mg/L	5 days Incubation	-
3	Chemical Oxygen Demand (COD)	4.0	16	mg/L	CRM	-
4	Coliform (Faecal)	0	0	N/100ml	MFM	-
5	Coliform (Total)	0	0	N/100ml	MFM	-
6	Dissolved Oxygen (DO)	6.0	6.91	mg/L	Multimeter	-
7	EC	-	425	µS/cm	Multimeter	-
8	Iron (Fe)	0.3-1	0.007	mg/L	AAS	0.05
9	Manganese (Mn)	0.1	0.15	mg/L	AAS	0.03
10	pH	6.5-8.5	6.7	-	pH Meter	-
11	Temperature	20-30	24.1	°C	Thermometer	-
12	Total Dissolved Solid (TDS)	1000	212	mg/L	Multimeter	-
13	Total Suspended Solid (TSS)	10	13	mg/L	Gravity Multimeter	-
14	Turbidity	10	1	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods , MFM= Membrane Filtration Method, LOQ - Limit of Quantitation

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature: 28.12.17

2.) Name: Taslima Akhter
Designation: Sample Analyzer
Signature: 28.12.17
নমুনা বিশ্লেষক
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার
মহাখালী, ঢাকা

Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature: B Hossain 26/12/2017
মোঃ বিপ্লব হোসেন
চীফ কেমিস্ট
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা।

2.) Name:
Designation:

Page 2 of 2

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 365/ CC, DPHE, CL, Dhaka. Date: 26-12-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017120024	Sample Receiving date: 28-11-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-11-2017	Sample Source: Ground Water
Sent by:Tanzia Sharmin ,Deputy Manager , DSCL, DOHS Mirpur, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (BRT Project , Sample : GW_GT)	Union:, Vill.:
Sample Collection date: 28-11-2017	Date of Testing: 28/11/2017-21/12/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	2	mg/L	5 days Incubation	-
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Coliform (Faecal)	0	0	N/100ml	MFM	-
5	Coliform (Total)	0	0	N/100ml	MFM	-
6	Dissolved Oxygen (DO)	6.0	4.75	mg/L	Multimeter	-
7	EC	-	331	µS/cm	Multimeter	-
8	Iron (Fe)	0.3-1	0.06	mg/L	AAS	0.05
9	Manganese (Mn)	0.1	0.52	mg/L	AAS	0.03
10	pH	6.5-8.5	7.1	-	pH Meter	-
11	Temperature	20-30	24.0	°C	Thermometer	-
12	Total Dissolved Solid (TDS)	1000	167	mg/L	Multimeter	-
13	Total Suspended Solid (TSS)	10	11	mg/L	Gravity Multimeter	-
14	Turbidity	10	1.2	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods , MFM= Membrane Filtration Method, LOQ - Limit of Quantitation

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature

2.) Name: Taslima Akhter
Designation: Sample Analyzer
28.12.17

নমুনা বিশ্লেষক
পরিবেশ অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার
গাজীপুর, ঢাকা

Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature
26/12/2017
মোঃ বিপ্লব হোসেন
চীফ কেমিস্ট
পরিবেশ অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার গাজীপুর, ঢাকা।

2.) Name:
Designation:

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 365/ CC, DPHE, CL, Dhaka.

Date: 26-12-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017120023	Sample Receiving date: 28-11-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 28-11-2017	Sample Source: Ground Water
Sent by:Tanzia Sharmin ,Deputy Manager , DSCL, DOHS Mirpur, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (BRT Project , Sample : GW_CS)	Union:, Vill.:
Sample Collection date: 28-11-2017	Date of Testing: 28/11/2017-21/12/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	1	mg/L	5 days incubation	-
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Coliform (Faecal)	0	0	N/100ml	MFM	-
5	Coliform (Total)	0	0	N/100ml	MFM	-
6	Dissolved Oxygen (DO)	6.0	4.05	mg/L	Multimeter	-
7	EC	-	82	µS/cm	Multimeter	-
8	Iron (Fe)	0.3-1	0.08	mg/L	AAS	0.05
9	Manganese (Mn)	0.1	0.21	mg/L	AAS	0.03
10	pH	6.5-8.5	7.0	-	pH Meter	-
11	Temperature	20-30	24.1	°C	Thermometer	-
12	Total Dissolved Solid (TDS)	1000	190	mg/L	Multimeter	-
13	Total Suspended Solid (TSS)	10	14	mg/L	Gravity Multimeter	-
14	Turbidity	10	0.93	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods , MFM= Membrane Filtration Method, LOQ - Limit of Quantitation

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:

Signature

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
26.12.17

2.) Name: Taslima Akhter
Designation: Sample Analyzer
26.12.17
সহকারী বিশ্লেষক
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার
মহাখালী, ঢাকা

Countersigned/Approved by:

Signature

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
26/12/2017
মোঃ বিপ্লব হোসেন
চীফ কেমিস্ট
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা।

2.) Name:
Designation:

Page 2 of 2

Noise Level Measurement Results

DSCL

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

Name of the Project	Bus Rapid Transit (BRT) Project, Comtract Package-1
Description of sample	Noise Level
Sample Collector	Collected by DSCL Personnel
Sampling Date	29-31 November, 2017

Noise Level Analysis

Sample ID	Sample Location	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)		Bangladesh Standard dB (A)** (LAeq)	
				Day	Night	Day	Night	Day	Night
NM_GT	Gazipur Terminal	23.99718 N, 90.41805 E	Commercial	13:38	21:10	65.58	62.04	65	55
NM_JC	Joydebpur Chowrasta, Gazipur	23.98951 N, 90.38261 E	Commercial	12:30	20:40	72.13	74.53	65	55
NM_BhB	Bhogra Bazar, Gazipur	23.97762 N, 90.38057 E	Commercial	12:05	22:11	74.56	73.34	65	55
NM_CS	Campsite, Gazipur	23.97778 N, 90.37052 E	Residential	11:42	21:48	57.72	53.28	55	45
NM_BB	Board Bazar, Gazipur	23.94734 N, 90.38173 E	Commercial	16:05	22:36	76.88	73.18	65	55
NM_AP	Airport, Uttara, Dhaka	23.85024 N, 90.40909 E	Commercial	11:39	23:25	74.46	72.93	65	55

Notes:

- *Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)*
- *Shaded cell indicate noise levels in excess of Noise Pollution Control Rules ambient noise limits for a given land use area*
- *The sound level standards for commercial area are 65 dBA , for silent area 55 dBA and for commercial area 65 dBA at day time*
- *Noise Level is the average noise recorded over the duration of the monitoring period*

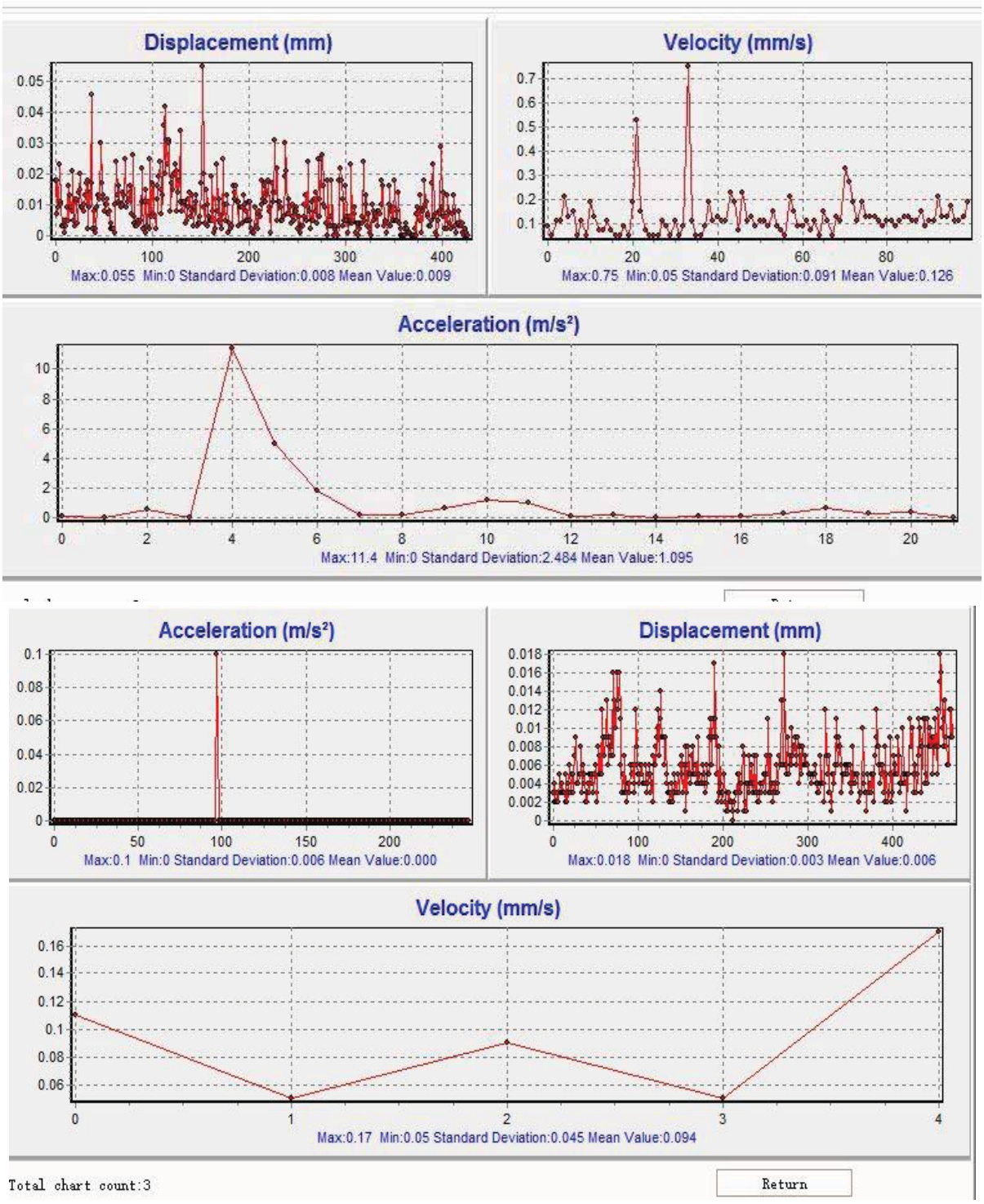
Abbreviation:

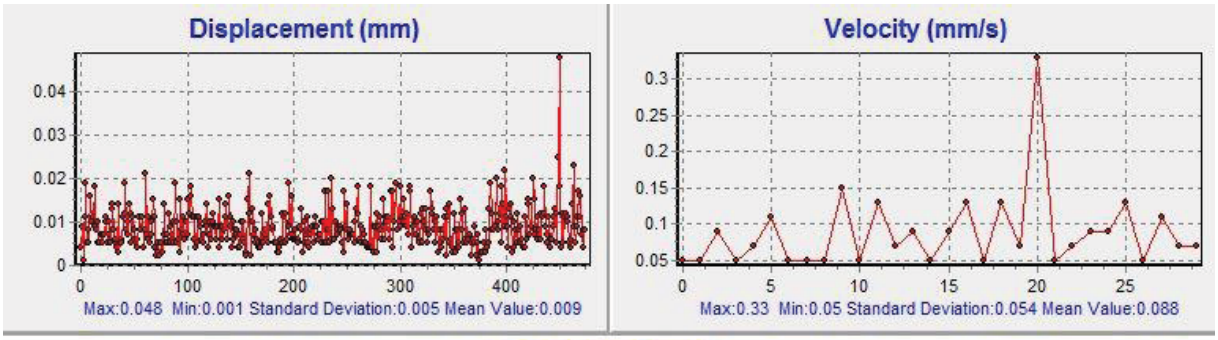
NM- Noise Measurement, dB- decibel

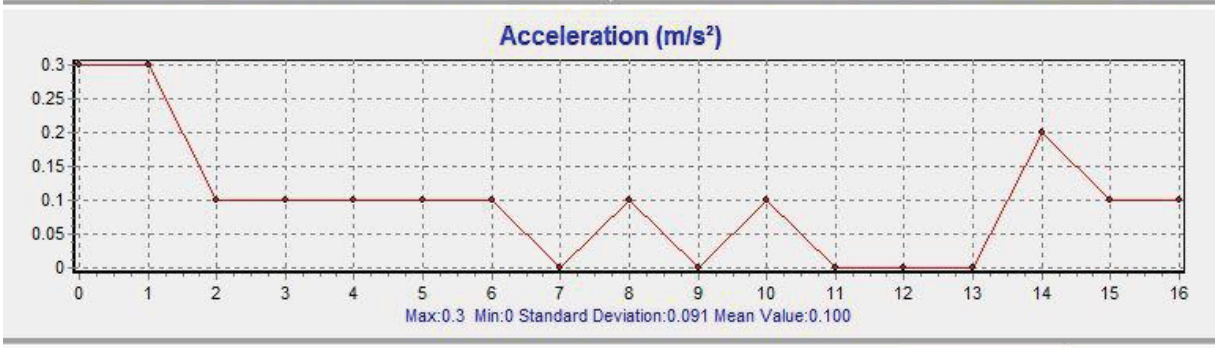
Test Performed By:	Checked By:
Tonmoy Pandit Jr. Environmental Specialist	**Israt Jahan** Director

Development Solutions Consultant Ltd.
House# 734 (5-B), Road# 10, Avenue# 04
DOHS Mirpur, Dhaka-1216, Bangladesh. Tel: +8804478035444
Email: dscl@dsclbd.com Web: www.dsclbd.com

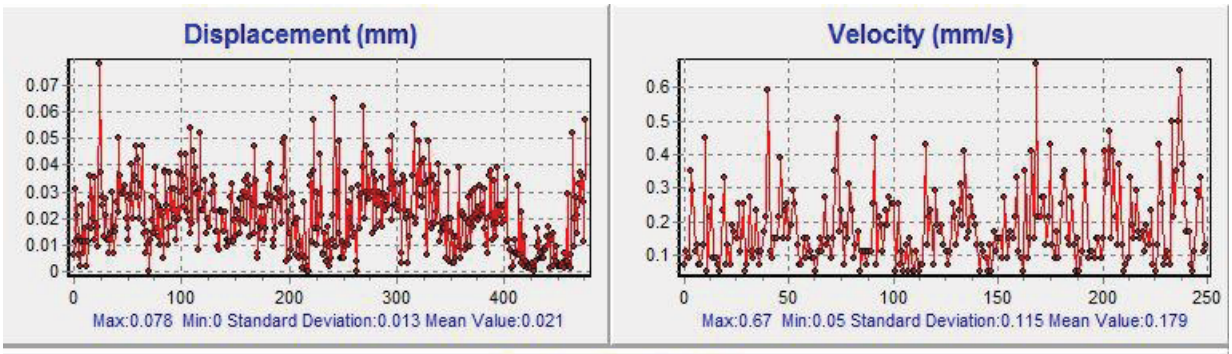
Vibration Level Measurement Results

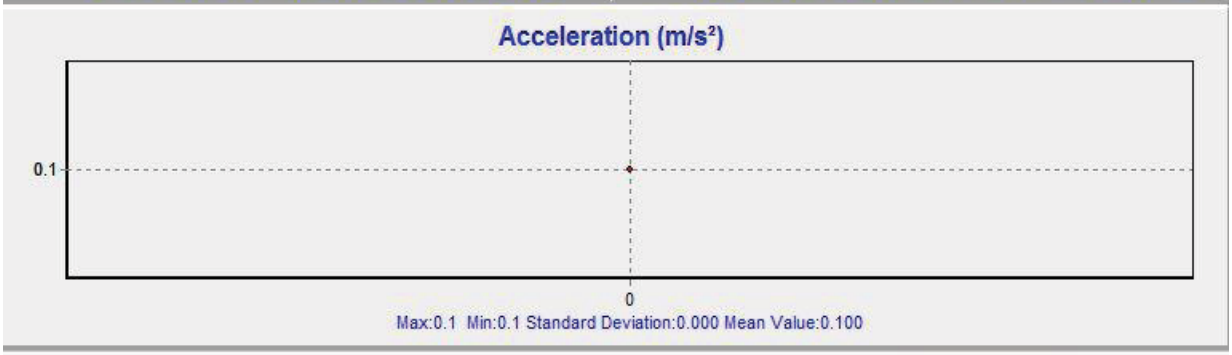




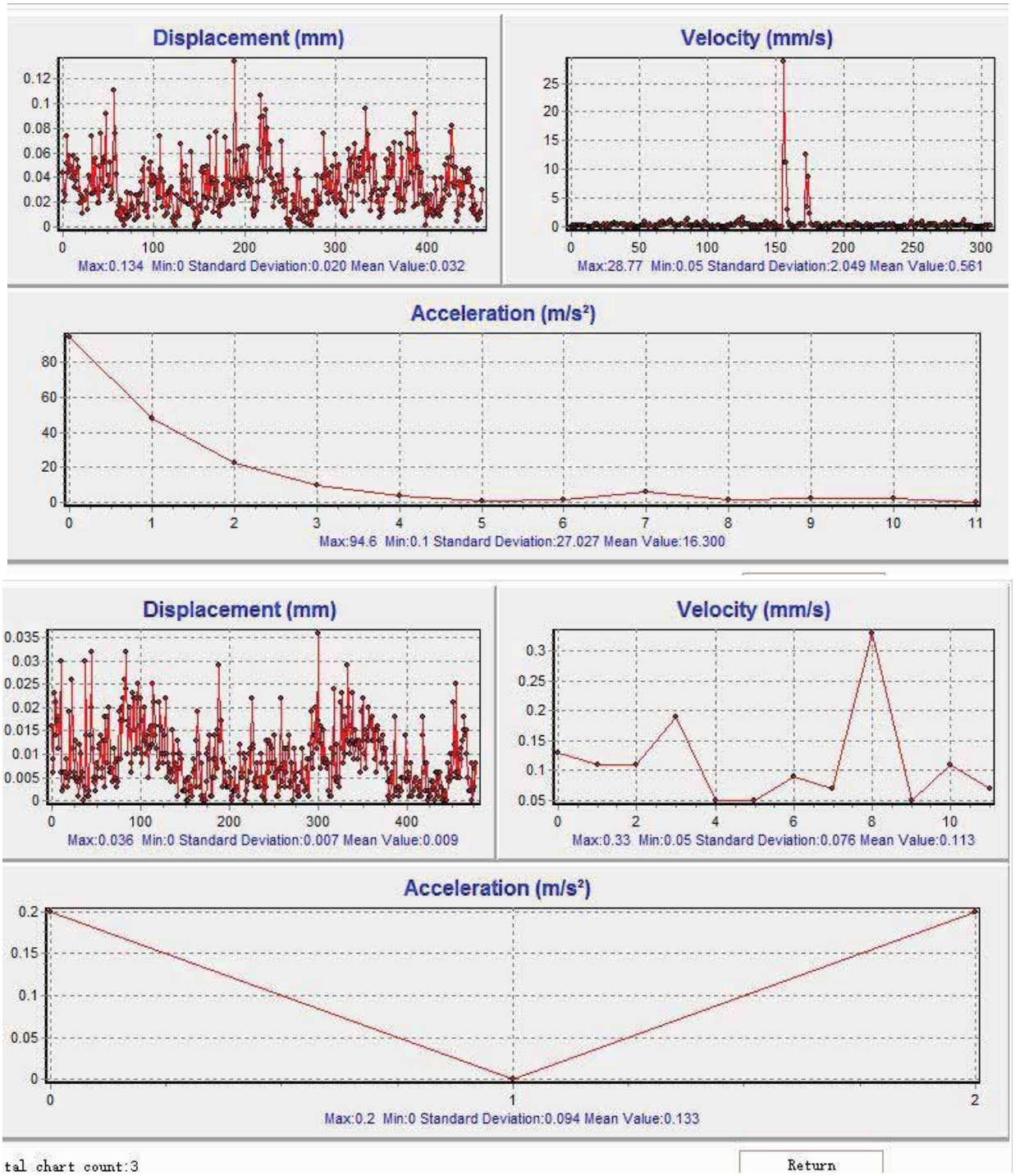


Total chart count:3 Return





'otal chart count:3 Return


Displacement (mm)
Max:0.134 Min:0 Standard Deviation:0.020 Mean Value:0.032
Velocity (mm/s)
Max:28.77 Min:0.05 Standard Deviation:2.049 Mean Value:0.561
Acceleration (m/s²)
Max:94.6 Min:0.1 Standard Deviation:27.027 Mean Value:16.300
Displacement (mm)
Max:0.036 Min:0 Standard Deviation:0.007 Mean Value:0.009
Velocity (mm/s)
Max:0.33 Min:0.05 Standard Deviation:0.076 Mean Value:0.113
Acceleration (m/s²)
Max:0.2 Min:0 Standard Deviation:0.094 Mean Value:0.133
tal chart count:3
Return

Soil Quality Test Results

DEPARTMENT OF CIVIL ENGINEERING
Bangladesh University of
Engineering and Technology
Dhaka - 1000, Bangladesh

পুরকৌশল বিভাগ
বাংলাদেশ প্রকৌশল বিশ্ববিদ্যালয়, ঢাকা-১০০০

Tel: 9665639, PABX: 9665650-80, 8614640-44, Ext. 7226 Fax: (8802) 9665639

Department of Civil Engineering, BUET
Environmental Engineering Division

BRTC No. **1101-48448/CE/14-15** Dt. 28/11/2017

Sent by: Tanzia Sharmin, Deputy Manager (Water and Environment)
Development Solutions Consultant Ltd., DOHS, Mirpur, Dhaka

Ref: Your letter 28/11/2017

Project: Bus Rapid Transit (BRT) Project (Package-1)

Date of Test: 28/11/2017 – 06/12/2017

Test of Soil Sample

Sl. No.	Parameter	Unit	Concentration Present		
			Sample ID (SS_GT)	Sample ID (SS_CS)	Sample ID (SS_JC)
1.	pH	–	6.0	6.5	6.0
2.	Arsenic (As)	mg/kg	10.25	3.07	8.11
3.	Lead (Pb)	mg/kg	217	0.0	0.0
4.	Mercury (Hg)	mg/kg	0.0	0.0	0.0
5.	Cadmium (Cd)	mg/kg	78	77	72
6.	Chromium (Cr)	mg/kg	208	40	128
7.	Zinc (Zn)	mg/kg	1303	312	807

Dr. Abu Siddique
Professor of Civil Engineering
and
Test-in-Charge

8/1/2018
Dr. Md. Delwar Hossain
Professor of Civil Engineering
BUET, Dhaka

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BUETCE 0059896

Construction of BRT Bus Depot

Ambient Air Quality Monitoring Result

DSCL

Multidisciplinary Development Consultants

Name of the Project	Greater Dhaka Sustainable Urban Transport Project (BRT Gazipur-Airport)
Project Location	Construction and Completion of BRT Bus Depot at Gazipur
GPS Coordination	23.995453°N; 90.396781° E
Description of sample	Ambient Air Quality
Sample Collector	Collected by DSCL Personnel
Sample ID	AAQ-01
Sampling Date	06 December, 2017

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Project Site	Bangladesh Standard**	Duration (hours)	Weather Condition	Method of Analysis
PM_{10}	$\mu g/m^3$	108.04	150	24	Sunny	Gravimetric
SPM	$\mu g/m^3$	290.73	200	24		Gravimetric
SO_2	$\mu g/m^3$	18.54	365	24		West- Geake
NOx	$\mu g/m^3$	8.62	100	Annual		Jacob and Hochheiser
H_2S	$\mu g/m^3$	0.070	NYS	8		Electro-Chemical Sensor
O_3	$\mu g/m^3$	16.04	NYS	8		Photometric
O_2	%	18.63	NYS	8		Electro-Chemical Sensor
TVOC	$\mu g/m^3$	387	NYS	8		Electro-Chemical Sensor
CO*	ppm	002	9	8		CO-Meter
CO_2	$\mu g/m^3$	482	NYS	8		Electro-Chemical Sensor

Note:
** CO concentrations and standards are 8-hourly only.*
*** The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rule, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.*
NYS: Not Yet Standardized

Monitoring Results of Weather Data

Sample ID	Location	GPS Location	Time	Humidity (%)	Temperature (°C)	Wind Speed (Knots)	Wind Direction
AAQ_01	BRT Bus Depot	23.995453°N; 90.396781° E	11:30am-12:30pm	21	30.9	2.4	East-South

Development Solutions Consultant Ltd.
House# 734 (5-B), Road# 10, Avenue# 04
DOHS Mirpur, Dhaka-1216, Bangladesh. Tel: +8804478095444
Email: dscl@dsclbd.com Web: www.dsclbd.com

Noise Level Measurement Result

DSCL

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

Name of the Project	Greater Dhaka Sustainable Urban Transport Project (GDSUTP) (BRT Gazipur-Airport), Construction and Completion of BRT Bus Depot at Gazipur
Project Address	Village: Joydebpur, Upazila: Gazipur Sadar, District: Gazipur
Description of sample	Noise Level
Sample Collector	Collected by DSCL Personnel
Sampling Date	05 December, 2017

Noise Level Analysis

Location	GPS Location	Land Use Category	Time	Bangladesh Standard at Day Time (dBA)	Noise Level (dBA) (LAeq)
NM_BD	23.99541° N 90.39645° E	Residential	12:57	55	49.01

Notes:

- *Land use category is based on the classification provided in the Noise Pollution Control Rules (2006)*
- *Shaded cell indicate noise levels in excess of Noise Pollution Control Rules ambient noise limits for a given land use area*
- *The sound level standards for commercial area are 65 dBA , for silent area 55 dBA and for commercial area 65 dBA at day time*
- *Noise Level is the average noise recorded over the duration of the monitoring period*

Abbreviation:

NM- Noise Measurement, dB- decibel

Test Performed By:	Checked By:
Tonmoy Pandit Jr. Environmental Specialist	**Israt Jahan** Director

Development Solutions Consultant Ltd.
House# 734 (5-B), Road# 10, Avenue# 04
DOHS Mirpur, Dhaka-1216, Bangladesh. Tel: +8804478035444
Email: dscl@dsclbd.com Web: www.dsclbd.com

Water Quality Test Results

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা ১০০০
বাংলাদেশ

Department of Soil, Water and Environment
University of Dhaka
Dhaka 1000
Bangladesh

Date: 11. 12. 2017

Report of Analysis

Sample supplied by
Mr. Tonmoy Pandit
Junior Environmental Specialist
Development Solutions Consultant Ltd.
House-734 (5-B), Road-10, Avenue-04
DOHS Mirpur, Dhaka-1216, Bangladesh

Project Name: Construction of Bus Rapid Transit (BRT) Bus Depot at Gazipur

Sample Title: Surface Water and Ground Water Quality Test

Analytical Results:

Serial No.	Water Source	Sample ID	Test Parameters	
			Total Nitrogen (µg/ml)	Total Phosphorus (µg/ml)
1.	Surface Water	SW_BD	5.83	0.262
2.	Ground Water	GW_BD	3.89	0.104

Methods Used:

1. Total N: Kjeldahl method
2. Total P: Ascorbic acid blue colour method

(Professor Dr. Sirajul Hoque)
Chairman

Dr. Sirajul Hoque
Professor & Chairman
Department of Soil, Water & Environment
University of Dhaka, Dhaka

Telephone: 9661920-73/7470, Fax: (880-2) 8615583, e-mail: swed@du.ac.bd

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 366/ CC, DPHE, CL, Dhaka.

Date: 26-12-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017120100	Sample Receiving date: 06-12-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 06-12-2017	Sample Source: Suface Water
Sent by:Tonmoy Pandit ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (Sample - SW_BD)	Union:, Vill.:BRT Project
Sample Collection date: 06-12-2017	Date of Testing: 06/12/2017-26/12/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.003	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	2	mg/L	5 days Incubation	-
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	-
4	Coliform (Faecal)	0	40	N/100ml	MFM	-
5	Coliform (Total)	0	86	N/100ml	MFM	-
6	Dissolved Oxygen (DO)	6.0	6.86	mg/L	Multimeter	-
7	EC	-	272	µS/cm	Multimeter	-
8	Iron (Fe)	0.3-1	0.49	mg/L	AAS	0.05
9	Manganese (Mn)	0.1	0.26	mg/L	AAS	0.03
10	Nitrogen (Ammonia)	0.50	0.8	mg/L	UVS	0.01
11	pH	6.5-8.5	7.5	-	pH Meter	-
12	Temperature	20-30	26.2	°C	Thermometer	-
13	Total Dissolved Solid (TDS)	1000	135	mg/L	Multimeter	-
14	Total Suspended Solid (TSS)	10	3	mg/L	Gravity Multimeter	-
15	Turbidity	10	8.50	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods , MFM= Membrane Filtration Method, LOQ - Limit of Quantitation

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	L

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature
26.12.17

2.) Name: Taslima Akhter
Designation: Sample Analyzer
26.12.17

নমুনা বিশ্লেষক
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার
মহাখালী, ঢাকা

Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature
26/12/2017
মোঃ বিপ্লব হোসেন
চীফ কেমিস্ট
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার মহাখালী, ঢাকা।

2.) Name:
Designation:

Page 2 of 2

Government of the People's Republic of Bangladesh
Office of the Chief Chemist
Department of Public Health Engineering
Central Lab, 38-39, Mohakhali C/A, Dhaka-1212
Phone: 88-02-9881927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 367/ CC, DPHE, CL, Dhaka.

Date: 26-12-2017

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2017120101	Sample Receiving date: 06-12-2017
Ref. Memo No: DSCL/2017/Nill & Dated: 06-12-2017	Sample Source: Ground Water
Sent by:Tonmoy Pandit ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (Sample - GW_BD)	Union:, Vill.:BRT Project
Sample Collection date: 06-12-2017	Date of Testing: 06/12/2017-26/12/2017

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.002	mg/L	AAS	0.001
2	Biochemical Oxygen Demand (BOD)	0.2	6	mg/L	5 days Incubation	-
3	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
4	Coliform (Faecal)	0	0	N/100ml	MFM	-
5	Coliform (Total)	0	0	N/100ml	MFM	-
6	Dissolved Oxygen (DO)	6.0	5.48	mg/L	Multimeter	-
7	EC	-	375	µS/cm	Multimeter	-
8	Iron (Fe)	0.3-1	0.07	mg/L	AAS	0.05
9	Manganese (Mn)	0.1	0.43	mg/L	AAS	0.03
10	Nitrogen (Ammonia)	0.50	0.01	mg/L	UVS	0.01
11	pH	6.5-8.5	6.7	-	pH Meter	-
12	Temperature	20-30	26.3	°C	Thermometer	-
13	Total Dissolved Solid (TDS)	1000	186	mg/L	Multimeter	-
14	Total Suspended Solid (TSS)	10	24	mg/L	Gravity Multimeter	-
15	Turbidity	10	1.29	NTU	Turbidity Meter	-

Comments: Sample was collected & Supplied by client.
N.B: AAS- Atomic Absorption Spectrophotometer, UVS- UV-Visible Spectrophotometer, CRM-Closed Reflex Methods , MFM= Membrane Filtration Method, LOQ - Limit of Quantitation

Page 1 of 2

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature

2.) Name: Taslima Akhter
Designation: Sample Analyzer
Signature
6.12.17
যমুনা বিশ্লেষক
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার
রাজধানী, ঢাকা

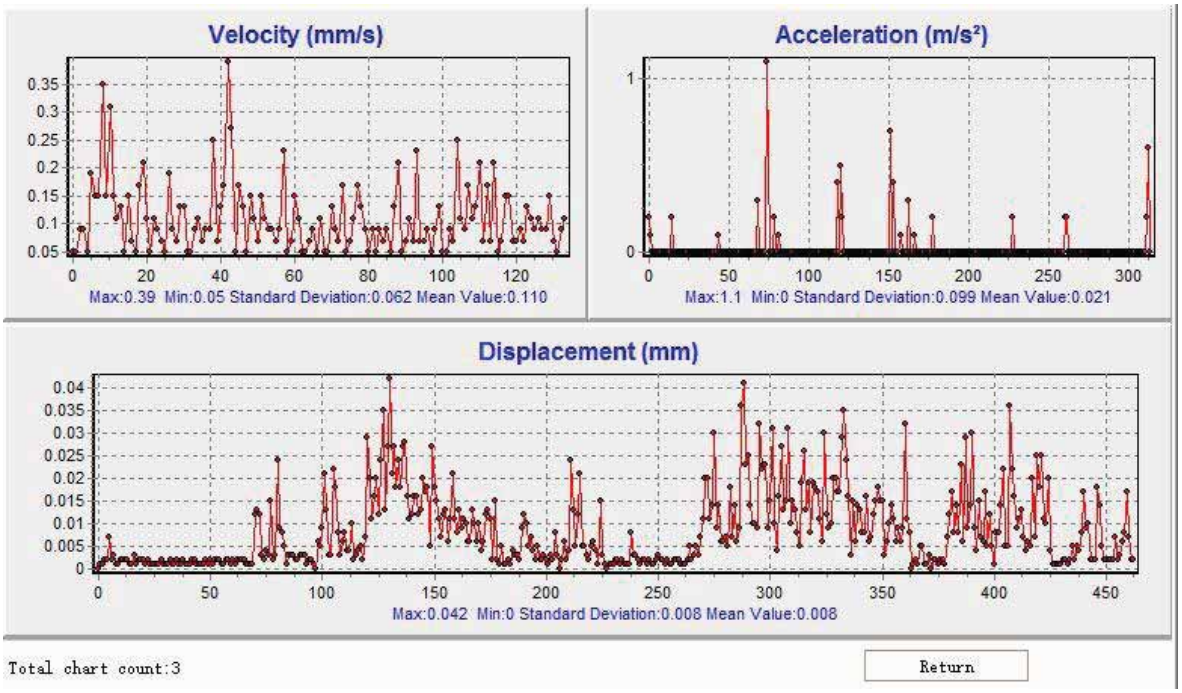
Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature
26/12/2017
মোঃ বিপ্লব হোসেন
চীফ কেমিস্ট
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
কেন্দ্রীয় পরীক্ষাগার, ঢাকা

2.) Name:
Designation:

Page 2 of 2

Vibration Level Measurement Results



Soil Quality Test Results

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)
DEPARTMENT OF CIVIL ENGINEERING
Mobile: 01819 557 964; PABX: 966 5650-60 Ext. 7226; www.buet.ac.bd/ce/
ENVIRONMENTAL ENGINEERING LABORATORY

BRTC No. : 110149055 /17-18/CE; Dt: 6/12/2017 Ref. No. : Letter; Dt: 6/12/2017
Sent by : Mr. Tonmoy Pandit, Junior Environmnetal Specialist, Development Solutions Consultants Ltd.
Project : Construction of Bus Rapid Transit Bus Depot at Gazipur
Company Address : House 734 (5-B), Road # 10, Avenue 4, DOHS Mirpur, Dhaka
Sample Id : — Source : NA Location : NA
Date of Test : 6/12/2017 - 24/12/2017

TEST REPORT (TOTAL EXTRACTION OF Soil SAMPLES : TOTAL EXTRACTION DONE BY AQUA-REGIA)

Sl. No.	Parameter	Unit	Concentration Present	EU Directive 86/278/EEC for Land Application	Method of analysis	Minimum Detection Limit (MDL)
1	Arsenic (As)	mg/kg	3.63	—	USEPA 206.2; SM 3113 B	—
2	Cadmium (Cd)	mg/kg	0	40	USEPA 213.2 ; SM 3113 B	—
3	Chromium (Cr)	mg/kg	7	—	USEPA 200.9 Rev 2.2; SM 3111 B	—
4	Zinc (Zn)	mg/kg	3	4000	USEPA 200.9 ; SM 3111 B	—
5	Ph	—	7.5	—	—	—
6	—	—	—	—	—	—
7	—	—	—	—	—	—
8	—	—	—	—	—	—
9	—	—	—	—	—	—
10	—	—	—	—	—	—

Comments : 1. Sample was collected by BUET representatives.
2. Sample was received in unsealed condition.

Note : Above is a partial analysis performed at our laboratory as per client's request. It should be noted that in order to certify a Soil sample according to EU Directive 86/278/EEC a number of additional tests have to be performed

Important Notes: Samples as supplied to us have been tested in our laboratory. BRTC does not have any responsibility as to the representative character of the samples required to be tested. It is recommended that samples are sent in a secure and sealed cover/pack

Countersigned by
Dr. Abu Siddique
Professor, Dept. of Civil Engg

Authenticity of this page is verifiable from http://verify.ce.buet.ac.bd with the QR Code or ID

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Test Performed by
Dr. Rowshan Mamtaz
Professor, Dept. of Civil Engineering

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