Environmental Monitoring Report

Project Number: 42169-013
Semi-Annual Report
June 2018

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

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.4: JANUARY – JUNE 2018






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 Asian Development Bank (ADB) is a priority project under the Bangladesh Government's Strategic Transport Plan approved in 2008.

The Project will contribute to develop 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 30 June 2018 is summarised in Table I.5.

The Contractor conducted the Baseline Monitoring of Environmental Parameters in August 2017 and the first and second Environmental Sampling as per the EMP of EIA report on November 2017 and May 2018 accordingly. The 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 documents & approved EMS and requested the comments to be addressed for other reports in a final version without delay.

Overall Progress of the Project at 30th June 2018 was assessed as 2.48% against a revised target of 7.30% indicating a lag of 4.82%. 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. Overall Progress of the Project at 30th April 2018 was assessed as 0.15%. The details of physical activity until June 2018 is not available but depending on financial status, the overall physical progress till 30th June 2018 is 0.20% against the target 1.47% with a lag of 1.27%.

The **Local Roads and Markets Contract (C03)** was awarded to Weihai International Economic & Technical Cooperative Co. Ltd (WIETC) 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 physical activity status chart is not available. It will be incorporated in next reporting period. Depending on financial status, the overall progress of the Project at 30th June 2018 was assessed as 2.00%.

The **Bus Depot Contract (C04)** the has been awarded and signed on 08 February 2016 with the Contractor SEL-UDC commenced 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 30 June 2018 is summarised in Table I.6. Overall Progress of the Project at 30th June 2018 was assessed as 74.22% against a revised target of 100% indicating a lag of 25.78%. The achieved progress of the Contractor was based on the completed quantities of physical works executed under the above Items.

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.

Environmental Monitoring

The EMP implementation status of the mitigation measures has been 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 regular environmental safeguard monitoring by environmental management officer of contractors are ongoing at sites and subsequently jointly monitoring by consultant and contractor environmental officers also ongoing at sites. The environmental monitoring checklist has been fill-up during environmental monitoring and shared with contractor representative for further necessary actions.

The second time sampling 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 17th to 21st May 2018 and subsequently at the end of October 2018 as required and the results have been analysed and included in the monthly report.

The Baseline Monitoring Sampling of Environmental Parameters (air quality, noise & vibration level, surface water and riverbed materials quality, soil quality) on the Elevated Section (C02) Contract was carried out on 14th and 15th May 2018 and baseline report submitted to consultant on 26 June 2018 for review and approval.

The baseline monitoring for Local Roads and Markets Contract (C03) not yet start but expecting to start in next reporting period. The environmental management officer has been mobilized for environmental safeguard monitoring at sites and regular monitoring is ongoing at sites.

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 June 2018 as required and the results have been analysed and included in the main report. 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 partially complied with Environmental monitoring and mitigation program as per the EMP of the EIA. The second environmental quality monitoring have been conducted during the monitoring period. The Contractor submitted the final 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 deployed their Environmental Specialist (ES) and Deputy ES for regular monitoring at sites.

Mitigation measures regarding surface water, groundwater, air quality, noise and dust pollution were fully complied. Results of the environmental quality monitoring along the project corridor shows that the values were lower than the baseline and last monitoring results but few parameters are exceeded 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 only due to construction activities.

Elevated Section including Tongi Bridge (C02)

The baseline environmental monitoring has been conducted during the monitoring period. The Contractor submitted the draft Baseline Environmental Monitoring Report for approval from the Consultant.

Local Roads and Kitchen Markets (C03)

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 and expecting to complete baseline monitoring in next reporting period.

Gazipur Bus Depot (C04)

The Contractor for C04 has 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 (61.50 dBA) was higher than the ambient standard (Leq 55 dBA) whereas the noise level was within the standard during the previous monitoring period.

Conclusions

There were some minor environmental issues has been raised during this reporting period but have been no key Environmental Safeguard issues identified to date at four contract packages sites. 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 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 March 2018 also submitted by the contractor for approval from Consultant. The EMS has approved by consultant for EMP implementation.

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 during the construction activities.

The regular environmental monitoring and monitoring checklist fill-up are continuing by consultant contractor environmental specialist. The issues have been discussed during field visit and meeting for further corrective actions. Grievance Redress Mechanism elaborated by the Consultant on the project site level and nominated contact people have to be designated by Contractor. The complaint box has been set-up at the project sites for getting complain from the stakeholders on the environmental and safety issues for further improvements.

Further Action Required

The next semi-annual Environmental Monitoring Report will cover the period from July to December 2018 during which all the Civil Works Contracts will fulfill the requirements and the procedures for implementation of the EMPs on each contract will have been established with updated baseline 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	Dhaka University
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 fourth 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 January to June 2018. This report is prepared in accordance with the environmental monitoring program as part of the EMP. As the fourth 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 motorization 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 kilometres 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.

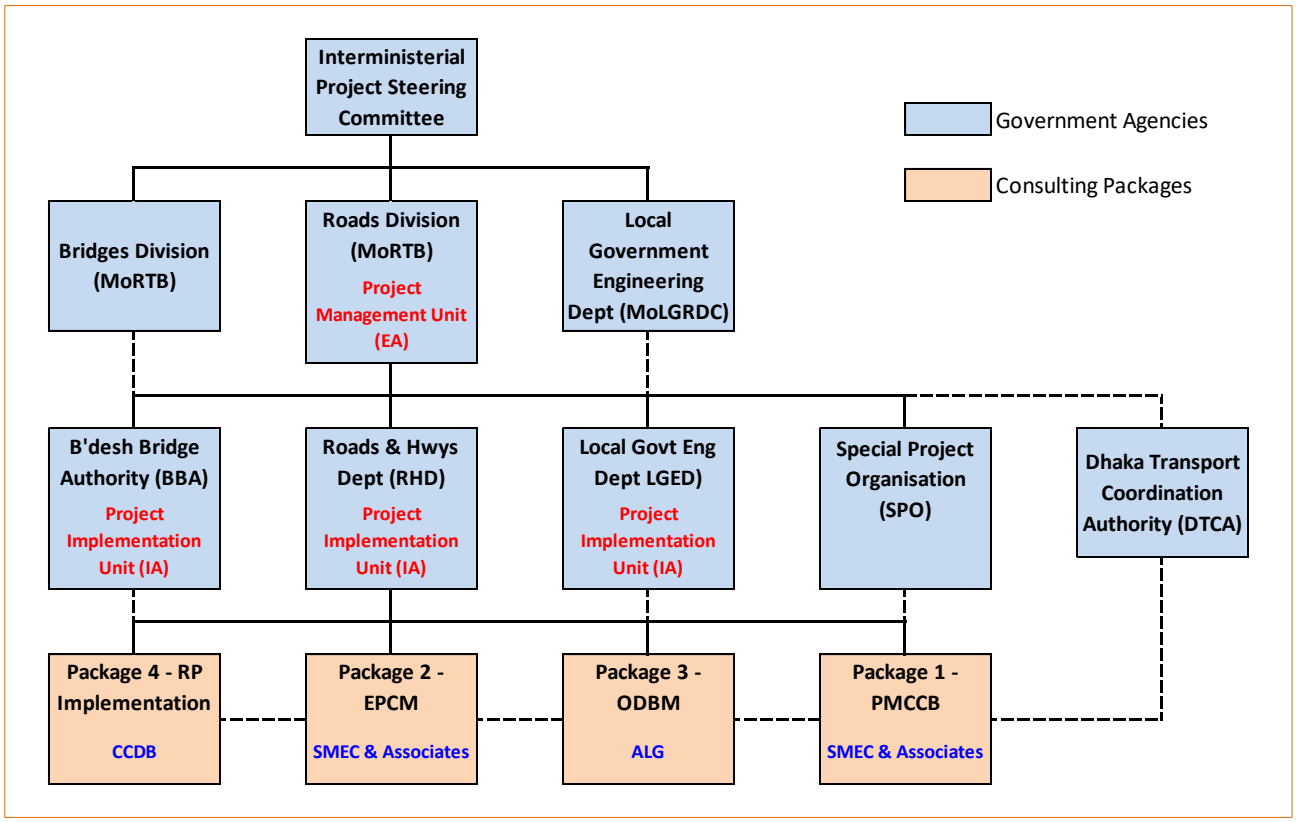
14. Consulting services to be provided under the Project are:

- 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 Joydebpur 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. As is formalised through a number of Contract packages as shown in Table I.1.

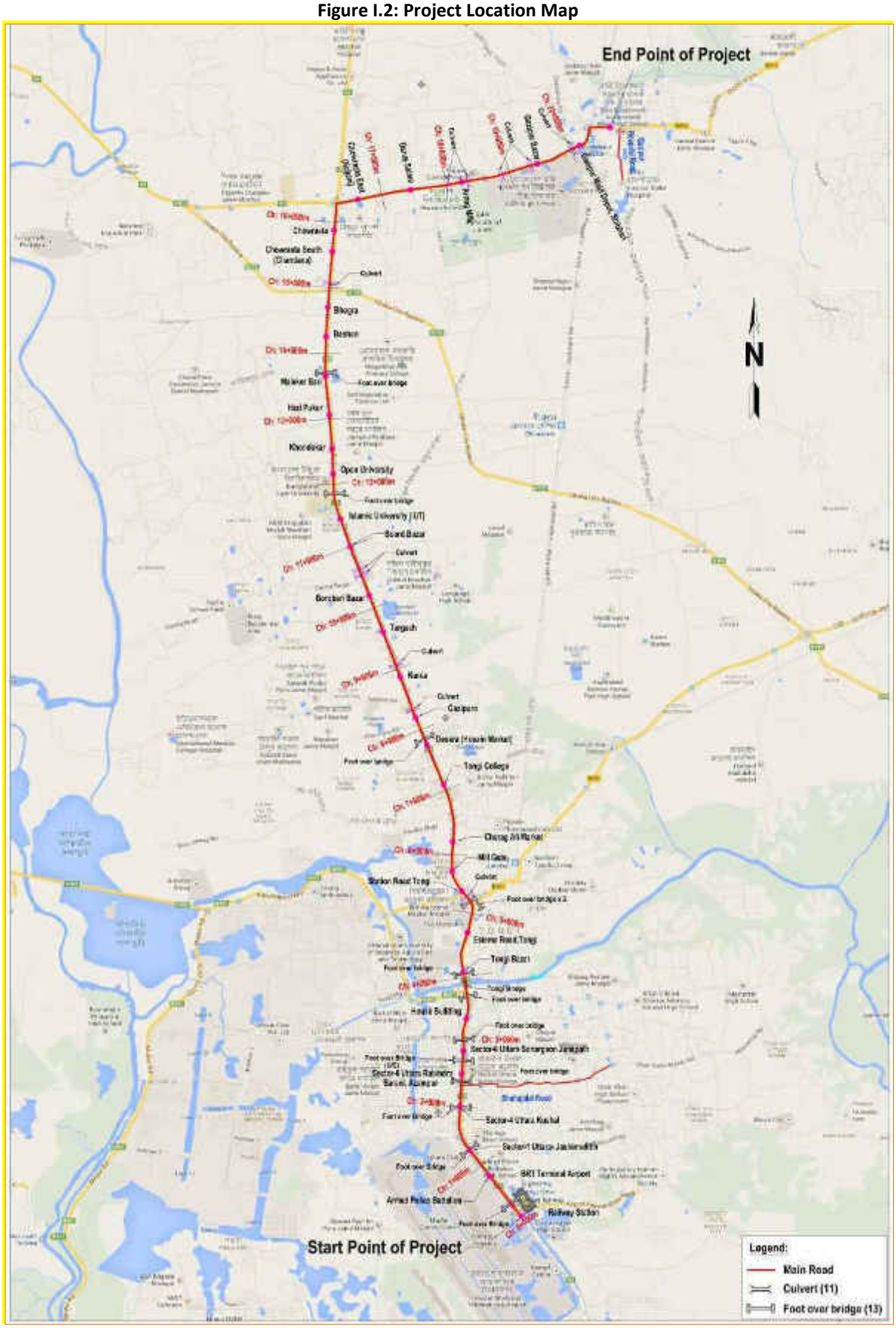
Table I.1: Contract Packages

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 I.2.

Figure I.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 was 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. Therefore, the application process was completed for ECC renewal on 23 May 2018 and now in progress for approval from DOE for another term up to 01 May 2019.

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 30 June 2018

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 March 2018 is summarised in Table I.4.

Table I.4: Status of Procurement of Contract Packages at 31 March 2018

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	05 Dec 17	23 Feb 16	
Contract Time for Completion	30 months	30 months	18 months	18 months	
Original Completion Date	16 Oct 19	18 Jun 20	01 Jun 19	21 Aug 17	
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 finalized mobilisation involving survey works and made submissions of the 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 30 June 2018 is summarised in Table I.5.

Table I.5: Summary of Progress Status – C01

Notice to Commence:	13 Apr 17	**Contract Period:**	915 days
Elapsed Time	442 days	**Completion Status (Time)**	48.31%

No.	Activity	Physical Status At 30 June 2018
1	Pavement Widening and Rehabilitation	0.0%
2	Drainage System and Culverts	1.497%
3	Bus Lanes	0.0%
4	Airport Flyovers	0.072%
5	Jasimuddin Flyover	0.001%
6	U-turn Flyover #1	0.030%
7	U-turn Flyover #2	0.030%
8	Vogra Flyover	0.047%
9	Joydepur Chowratsta Interchange	0.806%
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 30th June 2018 was assessed as 2.48% against a revised target of 7.30% indicating a lag of 4.82%. 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. 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.

41. Subsoil Investigations continued with 52 of the 165 boreholes completed. Survey activities involving centreline and Limit of Works marking were completed despite being hampered by high traffic volumes and police intervention and preparation of cross sections commenced. Arrangements for the manufacture of

RCC Pipes are in progress at the Contractor's pipe plant yard with machinery being installed. Negotiations for a site for the Contractor's Works Depot are continuing, Arrangements are still being made for pavement repair and maintenance activities to be carried out along with drainage maintenance works where required to avoid flooding during the wet season. The progress achieved on the various activities up to the end of 30 April 2018 is summarised in Table I.6.

Table I.6: Summary of Progress Status – C02

Notice to Commence:	15 Dec 17	**Contract Period:**	915 days
Elapsed Time	135 days	**Completion Status (Time)**	14.75%

No.	Activity	Physical Status At 30 April 2018
1	Pavement Widening and Rehabilitation	0.0%
2	Drainage System and Culverts	0.0%
3	El Sec 1. House	0.020%
4	El Sec 2. Abdullapur	0.060%
5	Demolish Old Tongi Bridges	0.003%
6	El Sec 3. Estema	0.024%
7	El Sec 4. Station Rd.	0.027%
8	El Sec 5. Mill Gate	0.015%
9	El Sec 6. Cherag Ali	0.0%
10	Ramps (Sth)	0.0%
11	Ramps (Nth)	0.0%
12	Bus Stations	0.0%
13	Road Marking & Traffic Signs	0.0%
14	Medians, Kerbs, Footpaths, Kerbing & Grassing	0.0%

42. Overall Progress of the Project at 30th April 2018 was assessed as 0.15%. The details of physical activity until June is not available but depending on financial status, the overall physical progress till 30th June 2018 is 0.20% against the target 1.47% with a lag of 1.27%.

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

43. 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 05 Dec 2017.

44. The physical activity status chart is not available. It will be incorporated in next reporting period. Depending on financial status, the overall progress of the Project at 30th June 2018 was assessed as 2.00%.

d) Construction of Bus Depot at Gazipur – C04

45. The Bus Depot Contract (C04) was signed on 08 February 2016 with the Contractor SEL-UDC commenced 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 30 June 2018 is summarised in Table I.7.

Table I.7: Summary of Progress Status – C04

Notice to Commence:	23 Feb 16	Contract Period:	857 days
Elapsed Time	857 days	Completion Status (Time)	100%

No.	Activity	Physical Status
		At 30 Jun 2018
1	Site Earthworks and Drain Relocation	100%
2	Boundary Wall	76.1%
3	Main Entry Gate and Guard House	71.9%
4	Administration and Maintenance Building	75.7%
5	Bus Parking Area and Footpaths	59.5%
6	Fuel Filling Station and Storage Tanks	78.0%
7	Bus Washing Area	33.7%
8	Effluent Treatment Plant	33.0%
9	Electrical Room and Substation	74.8%
10	Waste Materials Building	88.6%
11	Drainage System	100%
12	Access Road to Depot	86.8%
13	Water Reservoir and Fire System	59.9%
14	BTCL Complaints Centre and Guard House	83.4%

46. Overall Progress of the Project at 30th June 2018 was assessed as 74.22% against a revised target of 100% indicating a lag of 25.78%. The achieved progress of the Contractor was based on the completed quantities of physical works executed under the above Items.

F. Environmental Mitigation and Monitoring Requirements

Environmental Management Plan

47. 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.

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

49. 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 / Site Specific Environmental Management Plan

50. In Section 1 of the Technical Specifications for each of the Contracts the Contractors are required to prepare an Environmental Management System (EMS) or Site Specific Environmental Management Plan, 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

51. 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.

52. 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 4 and is summarised in Table I.8, I.9 and I.10 respectively in below

Table I.8: 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, 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.9: 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, 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.10: 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

Sl.	Impact	Construction		Operating Period		Parameter
		Frequency	Dur'n	Frequency	Dur'n	
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
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

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

AFD Mission on 28th January to 1st February, 2018. AFD mission was headed to supervise the implementation of technical assistance in favour of Dhaka Transport Coordination Authority (DTCA); funded by a delegation of the European Union and Greater Dhaka Urban Sustainable Transport Project which is co-financed with the Asian Development Bank. The mission was informed of the issue of illegal liquid waste dumping in the drainage system along the corridor by riparian individual and facilities. In response to the comments in Section 1.3 of the AFD Aide Memoire on the environmental and social issues (section 1.3 of AFD – Urban Transport Supervision Mission, 28 January to 01 February 2018) a subsequent meeting was held with the PIU, the EPCM Consultant, AFD & ADB representative in ADB country office to further review the related issues and the actions taken to address the problem.

II. ENVIRONMENTAL MONITORING

A. CONSTRUCTION STAGE

54. 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.

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

At Grade Section including Flyovers

Table II.1 Mitigation Measures implemented in At Grade Section including Flyovers

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
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.	Partially 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 wash down and refuelling sites • Oil and grease spill and oil-soaked materials will be sold off to authorized recyclers.	Fully complied
Riverbed Sediment	• Disturbance of riverbed sediments due to dredging activities;	• Prevent construction debris from entering drainage or irrigation canals; • Construction work close to river to be minimized especially during monsoon season;	Fully complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
	• Contamination of bottom sediments by accidental spilling of bituminous materials and other petro-chemicals.	• 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;	
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; • 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.	Partially complied
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.	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
		• Noise and vibration level monitoring to be carried out as per the schedule 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;	Fully complied
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 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 is to be used the impact of pile driving cannot be avoided. However, the force of the hammer blow can	Fully complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
		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 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.	Fully complied
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 quarry site, required environmental permits will be secured prior to operation of quarry/borrow areas.	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
		• 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 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;	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
		• 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 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 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.	Fully complied
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

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
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 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.	Partially complied
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 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.	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
		• 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

Elevated BRT Lanes including Tongi Bridge and BRT Stations (C02)

Table II.2 Mitigation Measures implemented in Elevated BRT Lanes including Tongi Bridge and BRT Stations

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
IMPLEMENTATION PHASE: CONSTRUCTION STAGE			
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 bridge" into rivers/streams. This will be done	The contractor assures for future precautions

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		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.	The contractor assures for future precautions
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.	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
Noise and Vibration	During erection of box girders high noise and vibration may result. Noise from construction vehicles, equipment and machinery. Vibration caused by construction activities.	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. 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 in the environmental monitoring plan.	Partially complied
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.	Partially complied
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 EIA (refer to Annex 2 of EIA).	Partially complied
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).	Partially complied

Environmental Parameters	Potential Impacts	Mitigation Measures	Mitigation Measures Undertaken during period
		Deep water channel to be maintained during bridge construction.	

Local Roads and Kitchen Markets (C03) and Gazipur Bus Depot (C04)

Table II.3 Mitigation Measures implemented in Local Roads and Kitchen Markets and Gazipur Bus Depot

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
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 dislocation of habitats. However, presences of threatened or endangered wildlife species were not reported at the site.	• New and good condition machinery with low noise generation characteristics to be used in construction. • Construction work not to be carried out at night.	Partially complied
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

Environmental Parameters	Potential Impacts	Mitigation Measures	Results
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
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.	Partially complied
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.	Partially 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.	Partially 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.	Partially complied

Baseline and Sampling Program Results and Analysis

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

56. The Contractor conducted the Sampling of Environmental Parameters in May 2018 and the next Environmental Sampling as per the EMP of EIA report on October / November 2018. The Contractor submitted the 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. The final EMS / SSEMP has been submitted by contractor and approved by consultant during this reporting period.

Surface Water

57. Surface Water samples were collected from two project influenced locations on 21st May, 2018 for the second routine sampling. (Figure II.1).

Figure II.1: Surface Water Sample Collection and On-site Testing

58. 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 10. 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 May, 2018		Results of November, 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	28.5	28.8	24.1	24.0	NYS	Multimeter
Turbidity	NTU	22.5	35.4	15.5	111	NYS	Turbidity Meter
pH	-	7.3	7.8	7.5	7.4	6.5-8.5	Multimeter
Total Dissolved Solids (TDS)	mg/L	2297	2204	524	1340	NYS	Multimeter
Electrical Conductivity (EC)	µs/cm	316	264	1045	2635	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	17	23	27	48	NYS	Gravity Multimeter
Iron (Fe)	mg/L	0.10	0.05	0.24	0.06	NYS	AAS
Ammonium Nitrogen (NH_4-N)	µg/ml	0.8	1.1	4.42	2.94	NYS	UVS
Arsenic (As)	mg/L	0.002	0.001	0.001	0.001	NYS	AAS
Manganese (Mn)	mg/L	0.03	0.03	0.14	0.08	NYS	AAS
Dissolved Oxygen (DO)	mg/L	1.3	2.5	4.13	5.82	5 or more	DO meter

Parameters	Unit	Results of May, 2018		Results of November, 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		
Chemical Oxygen Demand (COD)	mg/L	44	24	64	104	NYS	CRM
Biochemical Oxygen Demand (BOD_5)	mg/L	10	8	16	27	6 or less	5 days Incubation
Total Coliform (TC)	N/100ml	10	25	924	400	NYS	MFM
Faecal Coliform (FC)	N/100mL	0	10	500	235	NYS	MFM
Total Nitrogen (TN)	µg/ml	9.86	13.44	11.67	7.78	NYS	Kjeldahl Method
Total Phosphorus (TP)	µg/ml	0.702	0.289	0.208	0.180	NYS	Ascorbic acid blue color method
Oil & Grease	mg/L	70.20	79.80	19.4	9.60	NYS	5520.B

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

59. Standards for the most of the parameters for surface water have not been established by DoE. The concentrations of BOD_5 and DO in the tested samples did not comply with the national standard during the measurements. Several tested parameters for the samples decreased significantly in May 2018 compared with Nov 2017. The possible reason might be due to the samples were collected during the rainy season.

Groundwater

60. Groundwater samples were collected from three Contract influenced locations on 21st May 2018 for the second routine sampling (Figure II.2).

Figure II.2: Groundwater Sample Collection and On-site Testing

61. 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. Tests were done at the Laboratories of the DPHE, and the University of Dhaka. The laboratory test results are included in Appendix 10. A summary of the Test Results of surface water sampling of the Contract influenced area is given at Table II.4.

Table II.4: Test Result of Groundwater Sampling Analysis

Parameters	Unit	Results of May, 2018			Results of November, 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	27.4	28.1	28.6	24	24.1	24.1	20-30	Multimeter
Turbidity	NTU	0.83	0.93	1.0	1.2	0.93	1	10	Turbidity Meter
pH	-	6.95	7.43	6.8	7.1	7	6.7	6.5-8.5	Multimeter
Total Dissolved Solids (TDS)	mg/L	171	209	174	167	190	212	1000	Multimeter
Electrical Conductivity (EC)	µs/cm	270	358	296	331	82	425	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	2	2	3	11	14	13	10	Gravity Multimeter
Iron (Fe)	mg/L	0.05	0.07	0.05	0.06	0.08	0.007	0.3-1	AAS
Ammonia Nitrogen (NH_4-N)	µg/ml	0.01	0.01	0.02	2.90	2.90	2.90	0.5	UVS
Arsenic (As)	mg/L	0.002	0.002	0.001	0.001	0.002	0.001	0.05	AAS
Manganese (Mn)	mg/L	0.35	0.40	0.10	0.52	0.21	0.15	0.1	AAS
Dissolved Oxygen (DO)	mg/L	1.3	2.0	1.6	4.75	4.01	6.91	6.0	DO meter
Chemical Oxygen Demand (COD)	mg/L	4	4	4	4	4	16	4.0	CRM
Biochemical Oxygen Demand (BOD_5)	mg/L	1	1	2	2	1	6	0.2	5 days incubation
Total Coliform (TC)	N/100 ml	0	0	0	0	0	0	0	MFM
Faecal Coliform (FC)	N/100 mL	0	0	0	0	0	0	0	MFM
Total Nitrogen (TN)	µg/ml	7.06	8.86	7.06	5.83	7.78	9.72	NYS	Kjeldahl Method
Total Phosphorus (TP)	µg/ml	0.107	0.102	0.105	0.069	0.074	0.044	NYS	Ascorbic acid blue color method

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

62. The comparative analysis of the values of Mn and BOD_5 show that, for all the locations the concentration was increased than previous monitoring results. Additionally, the values of those parameters did not comply with the national standard. The reason may be from over extraction for the construction activities. On the other hand, the values of some parameters along with Mn and BOD_5 were decreased compared with the results of previous sampling of Nov, 2017. It might be happened due to the sampling activities during wet season.

Air Quality

63. 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.

64. 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

65. The air quality sampling was performed at and around the Contract location from 17th May to 21st May, 2018 for the second routine sampling (Figure II.3.). The laboratory test results are given in Appendix 10 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 May 2018			Concentration Present on November 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	82.6	91.4	189.2	115.7	104.2	270.2	150	24	Sunny	Gravimetric
SPM	µg/m³	235.04	678.51	632.84	528.04	986.51	1257.84	200	24		Gravimetric
$PM_{2.5}$	µg/m³	40.9	32.7	44.3	65.7	57.7	103.9	65	24		Gravimetric
SO_2	µg/m³	14.67	34.32	59.79	44.32	65.29	113.82	365	24		West- Geake
NOx	µg/m³	49.56	79.45	143.62	52.75	88.27	250.41	100	Annual		Jacob and Hochheiser
H_2S	µg/m³	0.012	0.005	0.045	0.013	0.004	0.071	NYS	8		Electro-Chemical Sensor
O_3	µg/m³	4.21	7.57	13.25	5.61	8.75	17.94	NYS	8		Photometric
O_2	%	17.32	18.76	17.43	16.43	19.39	17.63	NYS	8		Electro-Chemical Sensor
TVOC	µg/m³	476	645	897	528	764	1075	NYS	8		Electro-Chemical Sensor
CO*	ppm	<1	<1	<1	3	1	2	9	8		CO-Meter
CO_2	µg/m³	158.98	366.32	520.13	278.51	386.93	556.27	NYS	8		Electro-Chemical Sensor

66. The results of the air quality sampling tests show that the dust particles PM_{10} in one sampling location and SPM in all sampling locations are above the DoE standard but lower than the samples from Nov, 2017. Since it was rainy season during the monitoring period it can be said that the pollutants are due to the wet condition.

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

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 May, 2018							
AAQ_AP	Airport	23.85004°N 90.40919°E	2:00pm-3:00pm	27.65	27.62	1.1	East-South
AAQ_BB	Tongi Board Bazar	23.94732°N 90.38178°E	3:00pm-4:00pm	32.58	35.67	1.37	North-East
AAQ_GT	Gazipur Terminal	23.99717°N 90.41799°E	12:00pm-1:00pm	29.75	29.41	1.12	West-South
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

Noise

68. The Noise Level Measurements were taken at Contract influenced locations from 17th May to 21st May 2018 for the second routine sampling (Figure II.4). The laboratory test results are given in Appendix 10 of this report.

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

69. Noise level measurements taken during the day and night time are summarized in Table II. 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 May, 2018									
NM_GT	Gazipur Terminal	23.99718 N, 90.41805 E	Commercial	12:44	20:59	67.12	67.10	65	55
NM_JC	Joydebpur Chowrasta, Gazipur	23.98951 N, 90.38261 E	Commercial	12:46	21:25	77.35	73.16	65	55
NM_BhB	Bhogra Bazar, Gazipur	23.97762 N, 90.38057 E	Commercial	14:59	22:28	72.26	76.43	65	55
NM_CS	Campsite, Gazipur	23.97778 N. 90.37052 E	Residential	13:42	22:06	58.23	53.67	55	45
NM_BB	Board Bazar, Gazipur	23.94734 N, 90.38173 E	Commercial	15:54	20:10	74.24	72.76	65	55
NM_AP	Airport, Uttara, Dhaka	23.85024 N, 90.40909 E	Commercial	12:25	23:30	69.94	76.29	65	55
Results of November, 2017									
NM_GT	Gazipur Terminal	23.99717 N, 90.41799 E	Commercial	13:38	21:10	65.58	62.04	65	55
NM_JC	Joydebpur Chowrasta, Gazipur	23.98956 N, 90.38252 E	Commercial	12:30	20:40	72.13	74.53	65	55
NM_BhB	Bhogra Bazar, Gazipur	23.97767 N, 90.38057 E	Commercial	12:05	22:11	74.56	73.34	65	55
NM_CS	Campsite, Gazipur	23.97796 N. 90.37050 E	Residential	11:42	21:48	57.72	53.28	55	45

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_BB	Board Bazar, Gazipur	23.94731 N, 90.38178 E	Commercial	16:05	22:36	76.88	73.18	65	55
NM_AP	Airport, Uttara, Dhaka	23.85004 N, 90.40919 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 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

70. 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 previous monitoring it is seen that for most of the locations, the noise levels are increased during the monitoring period in November 2017.

Vibration Level

71. Vibration Levels were monitored at the Contract influenced locations from 20th May to 21st May 2018 for the second 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 10 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 May, 2018													
VB_GT	Gazipur Terminal, Gazipur	0.5	0.05	0.127	0.158	0.2	0	0.100	0.100	0.059	0	0.009	0.012
VB_JC	JoydebpurChowrasta, Gazipur	16.91	0.05	3.365	1.118	0.1	0.1	0.000	0.100	0.062	0	0.007	0.007
VB_BhB	Bhogra Bazar, Gazipur	0.73	0.05	0.139	0.185	0.115	0	0.017	0.019	0.5	0	0.147	0.192
VB_CS	Campsite, Gazipur	1.33	0.05	0.199	0.349	0	0	0.000	0.000	0.109	0.001	0.020	0.042
VB_BB	Board Bazar, Gazipur	0.65	0.05	0.127	0.180	0.1	0.1	0.000	0.100	0.094	0.00	0.015	0.018
VB_AP	Airport, Uttara, Dhaka	0.23	0.05	0.054	0.102	0.1	0.1	0.000	0.100	0.053	0	0.007	0.011
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

72. 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

73. 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

74. Soil samples were collected from all the Contract influenced locations on 17th May 2018 for the second 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 10 of this report.

Table II.9: Test Results for Soil Quality

Parameters	Unit	Results of May, 2018			Results of November, 2017			EU Directive 86/278/EEC for Land Application	Method of Analysis
		Joydebpur Chowrasta	Gazipur Terminal	Campsite	Joydebpur 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	-	7.40	7.48	7.68	6	6	6.5	-	pH Meter
Arsenic (As)	mg/kg	2.798	2.433	1.507	8.11	10.25	3.07	-	APHA-311
Lead (Pb)	mg/kg	16.25	7.75	2.50	0	217	0	1200	Aqua Regia & AAS Method
Mercury (Hg)	mg/kg	4.32	BDL	BDL	0	0	0	25	EPA SW/846
Cadmium (Cd)	mg/kg	BDL	BDL	BDL	72	78	77	40	Aqua Regia & AAS Method
Chromium (Cr)	mg/kg	20.10	11.70	1.723	128	208	40	-	Aqua Regia & AAS Method
Zinc (Zn)	mg/kg	90.75	40.25	43.00	807	1303	312	4000	Aqua Regia & AAS Method

Note: Source: DU laboratory Test, June 2018.
*BDL-Below Detection Limit

75. The standards for soil parameters have not been set by the DoE or other relevant national agencies in Bangladesh. However, all the parameters were within the EU standard and from the comparative analysis with the previous results it is seen that few parameters were increased and few were decreased during the monitoring period but the reason of increasing and decreasing of few parameters are heavy rain not for contraction activities.

Fisheries Resource

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

Wildlife

77. No information was provided regarding wildlife.

Construction of Elevated BRT Lanes including Tongi Bridge and BRT Stations (C02)

78. The Contractor conducted the Baseline Monitoring including Sampling of Environmental Parameters in May 2018 and the details results of environmental parameters are given in below:

Surface Water

79. For this contract the surface water sample were collected from 50 m U/S and 50 m D/S of the Turag River. The overall water is too much unaesthetic with bad smell. Industrial waste and effluent are dumped and discharged respectively into the river. However, these waters are used regularly for different activities of the slum dwellers such as washing, cooking, bathing etc.

Figure II.7: Surface Water Sample Collection

80. The baseline surface water samples were collected from the Contract location on 15th May 2018 (Figure II.7) and the collected samples were sent to the Bangladesh Council of Science and Industrial Research (BCSIR) for the testing of several parameters. The results of the surface water quality monitored at the two locations have been summarised in Table II.10.

Table II.10: Results for Surface Water Quality

Parameters	Unit	Test Results of May, 2018		Standards for Surface Water*	Analysis Method
		50 m U/S	50m D/S		
Temperature	°C	25.5	25.6	NYS	Thermometer
Turbidity	NTU	10.7	7.83	NYS	Turbidity Meter
pH	-	7.14	7.06	6.5-8.5	pH Meter
Total Dissolved Solids (TDS)	mg/L	172.1	170.6	NYS	TDS Meter
Electrical Conductivity (EC)	µS/cm	344	341	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	120	117	NYS	Gravity Multimeter
Iron (Fe)	mg/L	<0.1	<0.1	NYS	AAS
Ammonium-Nitrogen	mg/L	2	25	NYS	USEPA 350.1; SM 4500-NH3 B
Arsenic (As)	ppb	5.35	5.49	NYS	AAS
Manganese (Mn)	mg/L	<0.1	<0.1	NYS	AAS
Dissolved Oxygen (DO)	mg/L	2.05	3.47	5 or more	Multimeter
Chemical Oxygen Demand (COD)	mg/L	16	18.67	NYS	CRM
Biological Oxygen Demand (BOD_5)	mg/L	1.1	9.3	6 or less	5 Days Incubation
Total Coliform (TC)	N/100ml	6900		NYS	MFM
Fecal Coliform (FC)	N/100ml	4000		NYS	MFM
Total N	mg/L	65	84	NYS	Kjeldahi Method
Total P	mg/L	2.68	2.65	NYS	Ascorbic Acid Blue Color Method
Oil and grease	mg/L	<5			

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

81. Standards for the most of the parameters for surface water have not been established by DoE. The results show that the DO values for both locations and BOD_5 value at downstream location of the water is higher than the national standard. Additionally, water pollution from industries, household, hospitals, shops, shopping malls, bazaar through drainage or direct discharge, storm water, mobiles or oils from many types of boats, launches etc. were visible pollutants during the sampling activities. The Laboratory test results are included in Appendix 10 of this report.

Groundwater

82. There are two tube wells in the construction site as a source of ground water. These waters are used for specifically drinking purpose.

83. The groundwater sample are collected from the Contract location on 15th May 2018 (Figure II.8) and the collected sample was sent to the Bangladesh Council of Scientific and Industrial Research (BCSIR) and International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) for testing of several parameters. Results of the groundwater sampled at the two sites 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 May, 2018		Standards for Potable Water*	Analysis Method
		Collage Gate	Tongi Bridge Side		
Temperature	°C	25.4	25.3	20-30	Thermometer
Turbidity	NTU	2.47	3.27	10	Turbidity Meter
pH	-	6.97	6.76	6.5-8.5	pH Meter
Total Dissolved Solids (TDS)	mg/L	122.5	385	1000	TDS Meter
EC	µS/cm	245	771	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	<0.2	<0.2	10	Gravity Multimeter
Fe	mg/L	<0.1	<0.1	0.3-1.0	AAS
NH_4-N	mg/L	<0.2	<0.2	0.5	Ion Chromatograph
As	mg/L	3.66	5.44	0.05	AAS with HVG
Mn	mg/L	<0.1	<0.1	0.1	AAS
DO	mg/L	7.49	6.55	6	Multimeter
COD	mg/L	13.33	26.67	4	Potentiometric Titration followed by open reflux method
BOD_5	mg/L	2.4	6.2	0.2	BOD Tracking System
Total Coliform(TC)	N/100ml	0	4000	0	MFM
Fecal Coliform(FC)	N/100ml	0	500	0	MFM
Total N	mg/L	<0.1	<0.1	NYS	Kjeldahi Method
Total P	mg/L	0.80	0.33	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*

84. 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 most of the parameters are exceeding the

National Standard. The values of those parameters did not comply with the national standard because of the over extraction of pollutants. The concentration of As, DO, COD, BOD were found high in both of the samples. Concentrations of TC & FC were found high in the samples of Tongi bridge site. Residential (slum area), local vegetable market, Turag River, and Industries are located nearby the sampling area at Tongi Bridge site. The laboratory test results are included in Appendix 10 of this report.

Air Quality

85. Ambient air quality data at the C02 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 construction 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.

86. Air quality measurements were carried out at the C02 site on 14th and 15th May, 2018 (Figure II.3).

Figure II.9: Air Quality Monitoring at Project Site

87. The results of the air quality sampled at the C02 site have been summarised in Table II.4.

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

Sample Description		Name of the Parameters											
		SPM	$PM_{2.5}$	PM_{10}	SO_2	NO	NO_2	TVOC	CO	CO_2	O_3	H_2S	O_2
Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	ppm	µg/m³	µg/m³	µg/m³	ppm	µg/m³
Test Result for May, 2018	Abdullahpur	214.50	86	105.80	25.33	120.35	66.30	10.7	0.85	635.50	162.30	0.10	18.80
	College Gate	416.98	56	120	39.70	101.90	40.60	10.87	0.90	673	155	0.10	19.20
Duration (Hours)		8 hours duration											
Bangladesh (DoE) Standard for Ambient Air		200 (8hrs)	65 (24hrs)	150 (24hrs)	365 (24hrs)	100 (Annual)		NSE	10 (8hrs)	<1100 (24hrs)	157 (8hrs)	0.02-0.2 (24hrs)	NSE
International/World Bank Standard		NF		150	125		150	750	10	<1100	160	0.15	21%

NSE- No standards established yet

88. 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 values of SPM and NO for both locations and $PM_{2.5}$ and O_3 for one location. The results of air quality monitoring were done only for 8 hours duration. Therefore, the contractor asked to do air quality for 24 hours duration for next reporting period and convert present results to 24 hrs duration and submit again for approval. The details of the results are included in Appendix 10 of this report.

Noise

89. Noise from the machines and vibrations caused by the construction activities were expected to be the major pollutants at the elevated flyover sites.

90. Noise level data was collected both day and night time at the construction site on the 14th and 15th May, 2018 (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 and Night Time in the Project Area

Table II.13: Noise Level at the Project Location

Location	GPS Location	Land Use Category	Noise Level, (dBA) (LAeq)	Noise Level, (dBA) (LAeq)	Bangladesh Standard dB (A)** (LAeq)	
			Day	Night	Day	Night
Abdullahpur	90°23'59.789"E 23°54'30.378"N	Commercial	79.9	79.7	70	60
House building	90°24'11.357"E 23°52'47.864"N	Commercial	83.9	80.3	70	60
Tongi Bridge	90°24'10.306"E 23°52'7.714"N	Industrial	81.3	80.1	75	70
College Gate	90°24'11.214"E 23°52'51.304"N	Industrial	82.3	80.4	75	70
Station Road	90°24'13.404"E 23°53'30.355"N	Industrial	86.6	85.01	75	70

91. The result shows that time weighted average value of the sound monitored inside the elevated flyover site exceeded the standard set for the commercial and industrial area. The analysis results of the noise measurement are included in Appendix 10 of this report.

Vibration Level

92. Vibration caused by the construction activities was expected to be a major problem in the construction site of the elevated flyover site. Vibration measurement was conducted during day and night time at the construction site on 14 and 15 May, 2018 (Figure II.11). The result of the vibration measurement has been sumarised in Table II.14. The details of the results are given in Appendix 10 of this report.

Figure II.11: Vibration Level Measurement at Project Site

Table II.14: Vibration Level at the Project Location

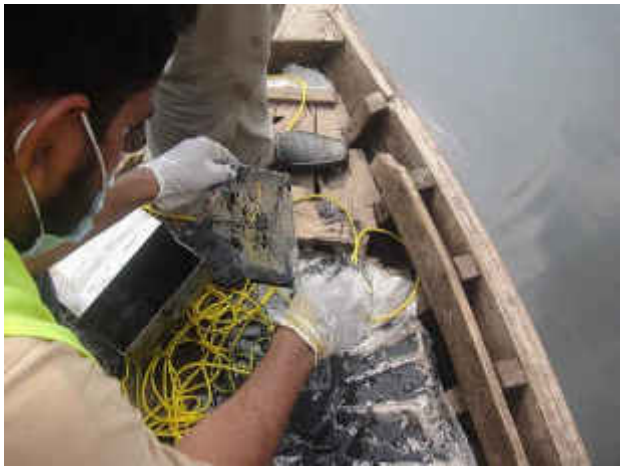
Location	GPS Location	Vibration data, Day (Velocity) mm/s	Vibration Data, Night (Velocity) mm/s
Abdullahpur	90°23'59.789"E 23°54'30.378"N	0.7	0.52
House building	90°24'11.357"E 23°52'47.864"N	0.54	0.55
Tongi Bridge	90°24'10.306"E 23°52'7.714"N	0.47	0.53
College Gate	90°24'11.214"E 23°52'51.304"N	0.68	0.65
Station Road	90°24'13.404"E 23°53'30.355"N	0.51	0.72

93. The above results show that the Maximum Velocity was 0.7 mm/s in day time and 0.72 mm/sec in night time.

Riverbed Sediment

94. Sediment samples were collected from the Turag River on 15th May, 2018 (Figure II.12). A grab sampler was used for collecting the samples. The samples were collected in zipped lock bags and kept in **ice bag**. The samples were submitted for analysis at the Bangladesh Council of Scientific and Industrial Research (BCSIR) within 72 hours of collection. The result of the Riverbed Sediment tests along with details of the sampling location has been summarised in Table II.7.

Figure II.12: Soil Sampling at Project Site



95. The details of the results are given in Appendix 10 of this report.

Table II.15: Test Result of Riverbed materials Quality Analysis

Parameters	Unit	Location		OSPAR Standard	Method of Analysis
		RBS 01 (50m upstream)	RBS 02 (50m downstream)		
As	ppm	1.83	1.81	30-80	AAS with HVG
Cd	ppm	1.94	0.88	1.0-2.5	AAS
pH	-	6.37	5.32	-	SSSA
Mercury	ppm	0.20	0.22	0.6-1.0	AAS with MVU
Lead	ppm	28.29	17.54	100-120	AAS
Iron	%	1.79	2.17	-	AAS
Chromium	ppm	36.67	33.01	150-200	AAS

Fisheries Resource

96. Disturbance to aquatic life including migration of fish due to bridge construction. The details impact and mitigation measures of aquatic life will be available in the next reporting period.

Wildlife

97. No information was provided regarding wildlife.

Construction of BRT Bus Depot (C04)

Surface Water

98. 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.
99.

Figure II.13: Surface Water Sample Collection and On-site Testing

100. Surface water samples were collected from the Contract location on 6th June 2018 (Figure II.13) 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.16.

Table II.16: Results for Surface Water Quality

Parameters	Unit	Test Results of Jun, 2018	Test Results of Dec, 2017	Standards for Surface Water*	Analysis Method
Temperature	°C	31.3	26.2	NYS	Multimeter
Turbidity	NTU	25.4	8.50	NYS	Turbidity Meter
pH	-	8.7	7.5	6.5-8.5	Multimeter
Total Dissolved Solids (TDS)	mg/L	878	135	NYS	Multimeter
Electrical Conductivity (EC)	µS/cm	287	272	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	12	3	NYS	Gravity Multimeter
Iron (Fe)	mg/L	0.36	0.49	NYS	AAS
Ammonia Nitrogen (NH_3-N)	mg/L	0.3	0.8	NYS	USEPA 350.1; SM 4500-NH3 B
Arsenic (As)	mg/L	0.001	0.003	NYS	AAS
Manganese (Mn)	mg/L	0.03	0.26	NYS	AAS
Dissolved Oxygen (DO)	mg/L	5.23	6.86	5 or more	DO Meter
Chemical Oxygen Demand (COD)	mg/L	8	4	NYS	CRM
Biological Oxygen Demand (BOD_5)	mg/L	2	2	6 or less	5 Days Incubation
Total Coliform (TC)	N/100ml	20	86	NYS	MFM
Fecal Coliform (FC)	N/100ml	12	40	NYS	MFM
Total N	micro mho/cm	2.87	5.83	NYS	Kjeldahi Method
Total P	mg/L	0.06	0.262	NYS	Ascorbic Acid Blue Color Method

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

101. 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 December, 2017 it can be seen that, the values of Temperature, Turbidity, Total Dissolved Solids, Electrical Conductivity, Manganese, Total Suspended Solids and Dissolved Oxygen has increased. This is to be expected increased and decreased values of test results since the sampling was conducted during the rainy season. The Laboratory test results are included in Appendix 10 of this report.

Groundwater

102. 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.

103. The groundwater sample was collected from the Contract location on 6th June 2018 (Figure II.14) 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.17.

Figure II.14: Groundwater Sample Collection

Table II.17: Results for Groundwater Quality

Parameters	Unit	Test Results of Jun, 2018	Test Results of Dec, 2017	Standards for Potable Water*	Analysis Method
Temperature	°C	29.6	26.3	20-30	Multimeter
Turbidity	NTU	0.4	1.29	10	Turbidity Meter
pH	-	7.2	6.7	6.5-8.5	Multimeter
Total Dissolved Solids (TDS)	mg/L	168	186	1000	Multimeter
EC	µS/cm	278	375	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	1	24	10	Gravity Multimeter
Fe	mg/L	0.05	0.07	0.3-1.0	AAS
NH_3-N	mg/L	0.4	0.01	0.5	USEPA 350.1; SM 4500-NH_3 B
As	mg/L	0.003	0.002	0.05	AAS
Mn	mg/L	0.40	0.43	0.1	AAS
DO	mg/L	3.42	5.48	6	DO Meter
COD	mg/L	4	8	4	CRM

Parameters	Unit	Test Results of Jun, 2018	Test Results of Dec, 2017	Standards for Potable Water*	Analysis Method
BOD_5	mg/L	1	6	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	3.30	3.89	NYS	Kjeldahi Method
Total P	mg/L	0.11	0.104	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*

104. The results show that except Manganese and BOD_5, all the other parameters are within the National Standard. The laboratory test results are included in Appendix 10 of this report. The comparative analysis of the values of pH, Arsenic and total P show that the concentration was increased whereas the values for TDS, EC, TSS, Iron, DO, COD, BOD_5 and Total nitrogen 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 rainy period of sampling; since during the rainy period water level changes and is higher.

Air Quality

105. 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.

106. 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).

107. 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. Air quality measurements were carried out at the C04 site on 6th June, 2018 (Figure II.15). The results of the air quality sampled at the C04 site have been summarised in Table II.4.

Figure II.15: Air Quality Monitoring at Project Site

Table II.18: 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 June, 2018	298.7	103.04	13.32	7.71	371	001	421	13.56	0.089	17.56
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

108. From the above test results, it can be seen that the level of SPM_{10} and H_2S has increased and all values of the other parameters decreased from the level of December, 2017 since air quality test done during rainy period.

Noise

109. 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).

110. Noise level data was collected during day time only at the construction site on the 6th June, 2018 (Figure II.17). The results of the noise level monitored along with details of the sampling locations have been summarised in Table II.19.

Figure II.17: Noise Level Monitoring at Day Time in the Project Area

Table II.19: Noise Level at the Project Location

Location	GPS Location	Land Use Category	Time	Noise Level (dBA) (LAeq)
Result for June, 2018				
Inside Project Area	23.99541° N 90.39645° E	Residential	11:46	61.50
Result for December, 2017				
Inside Project Area	23.99541° N 90.39645° E	Residential	12:57	49.01

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*

111. The result shows that time weighted average value of the sound monitored inside the C04 site exceed the standard set for the residential area and also increased from previous level. During the noise measurement an excavator was running, generator was on for welding activities and the laborers were working. Since the construction works were high in volume during the period which may have resulted in the increased noise level. The analysis results of the noise measurement are included in Appendix 10 of this report.

Vibration Level

112. 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 6th June, 2018 (Figure II.18). The result of the vibration measurement has been sumarised in Table II.20. The details of the results are given in Appendix 10 of this report.

Figure II.18: Vibration Level Measurement at Project Site

113. The above results show that the Maximum Velocity was 0.91 mm/s, the maximum acceleration was 0.1 m/s^2 and the maximum displacement was 0.084 mm. Again, the Mean value for velocity was 0.241 mm/s, for acceleration was 0.002 m/s^2 and for displacement was 0.011 mm.

Table II.20: 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
Results of June, 2018													
VB_BD	23.992524° N 90.39626° E (Inside Project Area)	0.91	0.05	0.192	0.241	0.1	0	0.015	0.002	0.084	0	0.11	0.011
Results of December, 2017													
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

Soil

114. Soil samples were collected at the Contract location on 06th June, 2018 (Figure II.19). 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 sample is submitted for analysis in Dhaka

University 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.21.

Figure II.19: Soil Sampling at Project Site

Table II.21: Test Result of Soil Quality Analysis

Parameters	Unit	Test Results for June, 2018	Test Results for December, 2017	EU Directive 86/278/EEC for Land Application	Method of Analysis
Arsenic (As)	mg/kg	2.052	3.63	-	USEPA 206.2; SM 3113 B
Cadmium (Cd)	mg/kg	0.09	0	40	USEPA 213.2; SM 3113 B
Chromium (Cr)	mg/kg	0.11	7	-	USEPA 200.9 Rev 2.2; SM 3111 B
Zinc (Zn)	mg/kg	35.75	3	4000	USEPA 200.9; SM 3111 B
pH	mg/kg	8.35	7.5	-	

115. 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 comparative analysis with the previous result shows that the value of Zinc was increased but all other value of remaining parameter was decreased than the result of December 2017.The details of the results are given in Appendix 10 of this report.

Fisheries Resource

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

Wildlife

117. No information was provided regarding wildlife.

B. Overall Assessment of Sampling Program

At-Grade Section including 6 Flyovers (C01)

118. The second routing environmental quality monitoring were completed within the monitoring period as defined in the EMP. 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.

Elevated Section including Tongi Bridge (C02)

119. Although the baseline environmental monitoring was delayed all field surveys were completed within the monitoring locations as defined in the EMP. Disturbance to aquatic life including migration of fish due to bridge construction. The details impact and mitigation measures of aquatic life will be available in the next reporting period. 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 along the elevated flyover sites.

Gazipur Bus Depot Contract (C04)

120. All field surveys were completed on time and as defined in the EMP. All environmental parameters of EMP 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.

C. Contractor Compliance

At Grade Section including Flyovers (C01)

121. The Contractor for the Construction of At Grade Section including Flyovers (C01) has partially complied with Environmental monitoring and mitigation program as per the EMP of the EIA. The baseline environmental monitoring and the second routine environmental quality monitoring has been conducted during the monitoring period. The Contractor received approval of 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 deployed their Environmental Management Officers (EMOs) as per requirements.

122. Mitigation measures regarding surface water, ground water, air quality, noise and dust pollution were partially 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)

123. The Contractor for the Construction of Elevated Section including Tongi Bridge (C02) has partially complied with Environmental monitoring and mitigation program as per the EMP of the EIA. The baseline environmental monitoring has been conducted during the monitoring period.

124. Mitigation measures regarding surface water, ground water, air quality, noise and dust pollution were partially 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.

125. The Contractor has not yet submitted their Environmental Management System (EMS)/Construction Environmental Management Plan (CEMP) for approval from Consultant. The Contractor has deployed their Deputy Environmental Management Officer (DEMO) but not yet not deployed their Environmental Management Officer (EMO) as per requirements.

Local Roads and Kitchen Markets (C03)

126. The Contractor for the Construction of Local Roads and Kitchen Markets (C03) has partially complied with Environmental monitoring and mitigation program as per the EMP of the EIA. The baseline environmental monitoring has not yet conducted during the monitoring period. The Contractor has not yet submitted their Environmental Management System (EMS)/Construction Environmental Management Plan (CEMP) for approval from Consultant. The Contractor has deployed their Environmental Management Officer (EMO) as per requirements.

Gazipur Bus Depot (C04)

127. The Contractor for the Construction of Bus Depot (C04) has partially 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

128. 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), Elevated Section including Tongi Bridge (C02), Local Roads and Kitchen Markets (C03) to carry out the Baseline Monitoring and the routine 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

129. 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 was up to 01 May 2018. Renewal of the ECC to 01 May 2019 is in progress.

130. 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. The Environmental Monitoring Report (EMR) along with necessary documents has been submitted to DoE on 23 May 2018 for another one-year renewable (Appendix 1).

Compliance with ADB Guidelines

131. 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.

132. 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

133. Schedule 5 of the Agreements for Loan No's 2863-BAN and 2864-BAN includes covenants for environmental issues[2]. 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.
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		**Complied.**

[2] 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
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;		
(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

134. Under the guidance of the Environmental Monitoring Expert of the EPCM Consultant regularly conducted environmental monitoring started from April 2017 for the Contract package C01 and C04. For C02 and C03 the regular monitoring has started from February and March, 2018 respectively. The regular site inspections on environmental issues were done by the consultant engineers / Environmental Monitoring Expert with assistance by the Contractor's environmental management officers at the Contract site. The Environmental Monitoring Expert has conducted meetings with the Contractor representatives (C01, C02, C03 & C04) several times for detailed discussion on the environmental requirements.

135. Periodic audits of the work camps, construction sites and different related project work sites have been conducted during the construction period and have resulted in improved conditions at the camps and project work sites. Camps and project work sites will be regularly monitored throughout the construction season and particular focus will be given to works along the entire project alignment. According to the observations during the site inspections by Environmental Monitoring Expert and consultant engineer's further improvements were done at the different project sites within this period. Joint inspections of the consultant environmental specialist / engineers with the Contractor, Joint inspections with Road Safety Engineers, and frequently meetings have helped to sort out some of the problems at the site.

136. In addition, a format for the Procedure on Environmental Monitoring Checklist was provided by the Environmental Specialist earlier to Contractor environmental specialist as a guide to facilitate regular EHS inspections and monitoring. Accordingly, the environmental monitoring checklist has been completed by consultant and contractor regularly within this period during site visit for records & further improvements. The total twenty (20) environmental monitoring checklists have been completed by consultant and sample fill-up checklist for four packages (CO1, CO2, CO3 & CO4) is given in Appendix 5-8. The following Table III.3 presents the summary of site visits in last six months from January to June 2018.

Table III.3: Summary of Major Site Visits

Date	Contract				Notes
	C01	C02	C03	C04	
06.03.2018	√	-	-	√	Site visit on Environment, Health and Safety
14.03.2018	√	-	-	√	Site visit on Environment, Health and Safety
20.03.2018	√	-	-	√	Site visit on Environment, Health and Safety
29.03.2018	-	-	√	-	Site visit on Environment, Health and Safety
03.04.2018	-	√	-	√	Site visit on Environment, Health and Safety
05.04.2018	√	-	-	-	Site visit on Environment, Health and Safety
11.04.2018	-	-	√	√	Site visit on Environment, Health and Safety

Date	Contract				Notes
	C01	C02	C03	C04	
19.04.2018	√	-	-	-	Site visit on Environment, Health and Safety
07.05.2018	-	√	√	-	Site visit on Environment, Health and Safety
09.05.2018	√	-	-	√	Site visit on Environment, Health and Safety
14.05.2018 15.05.2018	-	√	-	-	Environmental Quality Test
17.05.2018 20.05.2018 21.05.2018	√	-	-	-	Environmental Quality Test
28.05.2018	√	-	-	√	Site visit on Environment, Health and Safety
28.05.2018	√	-	√	-	Site visit on Environment, Health and Safety
06.06.2018	-	-	-	√	Environmental Quality Test
10.06.2018	-	√	-	-	Site visit on Environment, Health and Safety
11.06.2018	-	-	√	-	Site visit on Environment, Health and Safety
12.06.2018	√	-	-	-	Site visit on Environment, Health and Safety

D. CONSULTATIONS AND COMPLAINTS

137. 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. Considering volume of civil works, consultant will start consultation with local stakeholders from next reporting period for further improvements.

E. NON-COMPLIANCE NOTICES AND GENERAL LETTERS

138. During the previous six-month period, Consultant Environmental Monitoring Expert had been actively monitored the Contractor's performance in the environmental aspects. Issues were identified and communicated formally to the Contractor in the form of official letters. A listing of such letters from 01 January to June 2018 for Non-compliance notice on the environmental aspects and their status is shown in Table III.4.

Table III.4: Notices & Letters on Environmental, Health and Safety Issues

In General Letters				
Letter Ref.	Dated	From	To	Subjects
5060098/SR/C 01/07.07/1937	30 May 2018	SMEC	RHD	Section 1.3: Environmental and Social Issues under AFD – Urban Transport Supervision Mission (28 January to 01 February 2018)
5060098/SR/1 1.01/1938	28 May 2018	SMEC	RHD	Renewal of Environmental Clearance Certificate (ECC)
5060098/SR/C 01/17.02/1909	20 May 2018	SMEC	RHD	Removal of Trees by Forest Department
5060098/SR/C 01/17.02/1801	30 April 2018	SMEC	RHD	Removal of trees on LHS and RHS of Ch 00+980 and Ch 02+280 by Dhaka North City Corporation (DNCC) to construct U-turns.
5060098/SR/1 1.01/1790	15 April 2018	SMEC	RHD	Renewal of the Environmental Clearance Certificate (ECC) of the Greater Dhaka Sustainable Urban Transport Project BRT, Airport – Gazipur, Package 2 (EPCM)

Notes: SMEC: SMEC International Pty Ltd & Associates; RHD: Roads and Highways Department

At Grade Section including Flyovers (C01)				
Letter Ref.	Dated	From	To	Subjects
5060098/AB/C01 /18.02/1997	26 June 2018	SMEC	CGGC	Comment's on Monthly Environmental Safeguard Monitoring Reports from September 2017 to December 2017 and January 2018 to March 2018
5060098/AB/C01 /18.04/1950	29 May 2018	SMEC	CGGC	Observations on Workers' Environment, Health & Safety
CGGC/BRT/2018 /239	27 May 2018	CGGC	SMEC	Monthly Environmental Monitoring Report March 2018
CGGC/BRT/2018 /214	14 May 2018	CGGC	SMEC	Monthly Environmental Monitoring Report February 2018
5060098/AB/C01 /18.04/1894	13 May 2018	SMEC	CGGC	Observations on Workers' Environment, Health & Safety
CGGC/BRT/2018 /194	07 May 2018	CGGC	SMEC	Submit the Monthly Environmental Monitoring Report of January, 2018
5060098/SR/C01 /18.03/1858	03 May 2018	SMEC	CGGC	Approval of Environmental Specialist (ES) and Deputy ES
5060098/SR/C01 /18.04/1843	28 April 2018	SMEC	CGGC	Observations on Workers Environment, Health & Safety
CGGC/BRT/2018 /179	24 April 2018	CGGC	SMEC	Mobilization of Environmental specilist (ES) and Deputy ES
5060098/SR/C01 /18.03/1820	22 April 2018	SMEC	CGGC	Revised Environmental Management System
CGGC/BRT/2018 /172	19 April 2018	CGGC	SMEC	Re-submission with addressing all the comments of Monthly Environmental Monitoring Report September to December'17
5060098/SR/C01 /18.01/1793	15 April 2018	SMEC	CGGC	Mobilization of Environmental Specialist (ES) and Deputy ES– Third Reminder
5060098/SR/C01 /18.01/1792	15 April 2018	SMEC	CGGC	Mobilization of Field Team for Environmental Quality Testing during April 2018
5060098/AB/C01 /18.02/1730	27 March 2018	SMEC	CGGC	Observations on Workers Environment, Health & Safety
5060098/SR/C01 /18.03/1716	15 March 2018	SMEC	CGGC	Pending Monthly Environmental Monitoring Reports for the month of January and February 2018
5060098/SR/C01 /18.02/1715	15 March 2018	SMEC	CGGC	Observations on Workers Environment, Health & Safety
5060098/SR/C01 /18.03/1701	12 March 2018	SMEC	CGGC	Mobilization of Environmental Specialist – Second Reminder
5060098/AB/C01 /18.03/1566	11 March 2018	SMEC	CGGC	Revised Environmental Management System
5060098/RAF/C0 1/18.02/1685	06 March 2018	SMEC	CGGC	Monthly Environmental Safeguard Monitoring Reports from September to December 2017
CGGC/BRT/2018 /090	04 Mar 2018	CGGC	SMEC	Submit Revised Environmental Management System
5060098/RAF/C0 1/18.02/1649	25 February 2018	SMEC	CGGC	Service Provider for Implementation of HIV-AIDS Awareness Programme
5060098/RAF/C0 1/18.02/1459	06 February 2018	SMEC	CGGC	Observations on Workers Health & Safety
CGGC/BRT/2018 /034	29 January 2018	CGGC	SMEC	Monthly Environmental Monitoring Report from September to December 2017
5060098/SR/C01 /18.03/1566	28 January 2018	SMEC	CGGC	Revised Baseline Environmental Monitoring Report
5060098/SR/C01 /18.03/1565	28 January 2018	SMEC	CGGC	Monthly Environmental Safeguard Monitoring Reports from May to July 2017
5060098/SR/C01 /18.02/1564	28 January 2018	SMEC	CGGC	Comments on the Revised Environmental Management System

At Grade Section including Flyovers (C01)				
Letter Ref.	**Dated**	**From**	**To**	**Subjects**
5060098/SR/C01 /18.03/1563	28 January 2018	SMEC	CGGC	Pending Monthly Environmental Monitoring Reports for the month of September, October, November and December 2017
5060098/SR/C01 /18.03/1562	28 January 2018	SMEC	CGGC	Comments on Environmental Quality Test Report
CGGC/BRT/2018 /017	17 January 2018	CGGC	SMEC	Environmental Quality Test Report
5060098/RAF/C0 1/18.03/1432	10 January 2018	SMEC	CGGC	Pending Monthly Environmental Monitoring Report for the month of December 2017
5060098/SR/C01 /18.02/1459	04 January 2018	SMEC	CGGC	Observations on Workers Health & Safety

CGGC = China Gezhouba Group Co. Ltd

Elevated Section including Tongi Bridge (C02)				
Letter Ref.	**Dated**	**From**	**To**	**Subjects**
5060098/AB/C02/ 18.04/1979	11 June 2018	SMEC	JTEG	Observations on Workers' Environment, Health & Safety
5060098/AB/C02/ 18.04/1893	14 May 2018	SMEC	JTEG	Observation on Environment, Workers' Health & Safety
5060098/AB/C02/ 18.02/1892	14 May 2018	SMEC	JTEG	Inception Report for Implementation of Environmental Quality Monitoring
5060098/SR/C02/ 18.03/1861	3 May 2018	SMEC	JTEG	Comments on Inception Report for Implementation of Environmental Quality Monitoring
5060098/SR/C02/ 18.03/1860	03 May 2018	SMEC	JTEG	Approval of Deputy Environmental Management Officer (Deputy EMO)
JTEG.BD (WP-02)- SMEC-18-086	26 April 2018	JTEG	SMEC	Submission of CV OF Junior Environmental Specilist
JTEG.BD (WP-02)- SMEC-18-077	24 April 2018	JTEG	SMEC	Inception Report for Implementations of Environmental Monitoring
5060098/AB/C02/ 18.02/1759	09 April 2018	SMEC	JTEG	Approval of Subcontractor for Environmental Quality Testing and Baseline Monitoring
5060098/SR/C02/ 18.03/1747	03 April 2018	SMEC	JTEG	Approval of New Proposal for 3rd Subcontractor In place of the Approved one for the Implementation of EMP and Baseline Monitoring
JTEG.BD (WP-02)- SMEC-18-059	29 March 2018	JTEG	SMEC	Request for expediting the review and approval procedure for the Proposed Subcontractor of Environmental monitoring
5060098/SR/C02/ 18.02/1718	15 March 2018	SMEC	JTEG	Observation on Environmental Management Plan (EMP) implementation and pending Monthly Environmental Monitoring Report for the month of January and February 2018
JTEG.BD (WP-02)- SMEC-18-045	13 March 2018	JTEG	SMEC	Submission of EMP and Baseline Monitoring Plan
5060098/SR/C02/ 18.02/1700	12 March 2018	SMEC	JTEG	Baseline Monitoring, Deployment of Environmental Management Officers and Submission of Environmental Management System - Reminder
5060098/RAF/C0 2/18.03/1637	18 February 2018	SMEC	JTEG	Approval of Subcontractor for the Implementation of EMP and Baseline Monitoring
JTEG.BD (WP-02)- SMEC-18-030	12 Feb 2018	JTEG	SMEC	Proposed Subcontractor of Environmental Company for EMP and Baseline Monitoring Plan

Elevated Section including Tongi Bridge (C02)				
Letter Ref.	**Dated**	**From**	**To**	**Subjects**
5060098/SR/C02/18.02/1601	06 February 2018	SMEC	JTEG	Engagement Subcontractor for the Implementation of EMP and Baseline Monitoring – Amendment
5060098/SR/C02/18.02/1551	05 February 2018	SMEC	JTEG	Engagement Subcontractor for the Implementation of EMP and Baseline Monitoring
5060098/SR/C02/18.02/1552	25 January 2018	SMEC	JTEG	Baseline Monitoring, Deployment of Environmental Management Officers and Submission of Environmental Management System
5060098/RAF/C02/18.02/1530	17 January 2018	SMEC	JTEG	Approval of Subcontractor for the Implementation of EMP and Baseline Monitoring
JTEG.BD (WP-02)-SMEC-18-010	13 Jan 2018	JTEG	SMEC	Proposed Subcontractor Environmental Company for EMP and Baseline Monitoring Plan

JTEG = Jiangsu Provincial Transportation Engineering Group Co. Ltd

Local Roads and Kitchen Markets (C03)				
Letter Ref.	**Dated**	**From**	**To**	**Subjects**
5060098/AB/C03/18.04/1982	19 June 2018	SMEC	WIETC	Observations on Workers' Environment, Health & Safety
5060098/SR/C03/18.02/1978	11 June 2018	SMEC	WIETC	Baseline Environmental Monitoring – Third Reminder
5060098/AB/C03/18.04/1895	13 May 2018	SMEC	WIETC	Observations on Workers' Environment, Health & Safety
5060098/AB/C03/18.02/1802	18 April 2018	SMEC	WIETC	Observations on Workers Environment, Health & Safety
5060098/SR/C03/18.04/1751	05 April 2018	SMEC	WIETC	Observations on Environment, Health & Safety
5060098/SR/C03/18.02/1719	15 March 2018	SMEC	WIETC	Observation on Environmental Management Plan (EMP) implementation and pending Monthly Environmental Monitoring Report for the month of January and February 2018
5060098/SR/C03/18.02/1699	12 March 2018	SMEC	WIETC	Submission of Environmental Management System, Baseline Monitoring and Deployment of Environmental Management Officer – Second Reminder
5060098/SR/C03/18.02/1684	06 March 2018	SMEC	WIETC	Approval of Environmental Management Officer (EMO)
WIETC/BRT/2018/54	27 February 2018	WIETC	SMEC	Approval of Environmental Management Officer (EMO)
5060098/SR/C03/18.02/1641	26 February 2018	SMEC	WIETC	Submission of Environmental Management System, Baseline Monitoring and Deployment of Environmental Management Officers – Reminder
WIETC/BRT/2018/51	22 February 2018	WIETC	LGED	Approval of Supplement Environmental Management Item in BOQ
5060098/SR/C03/18.02/1554	25 January 2018	SMEC	WIETC	Submission of Environmental Management System, Baseline Monitoring and Deployment of Environmental Management Officers
5060098/SR/C03/18.06/1146	02 January 2018	SMEC	WIETC	Comments on the HIV-AIDS Awareness Program

WIETC= Weihai International Economic & Technical Cooperative Co. Ltd

Gazipur Bus Depot (C04)				
Letter Ref.	Dated	From	To	Subjects
5060098/SR/C04/18.04/1949	29 May 2018	SMEC	LGED	Mobilization of Field Team for Environmental Quality Test - Reminder 1
5060098/SR/C04/18.03/1859	03 May 2018	SMEC	LGED	Review and Check the Environmental Monitoring Reports for January, February and March 2018
5060098/SR/C04/18.04/1791	15 April 2018	SMEC	LGED	Mobilization of Field Team for Environmental Quality Test by April 2018
LGED/PD/GDSUTP/E-03/2016/357	30 April 2018	LGED	SMEC	Comments on EMP Report Mar'18
SU.GDSUTP.LGED.2018.04.820	26 April 2018	SEL UDC JV	LGED	EMP Report for Mar'18
5060098/SR/C04/18.04/1752	05 April 2018	SMEC	LGED	Observations on Environment, Health & Safety
LGED/PD/GDSUTP/E-03/2016/267	29 March 2018	LGED	SMEC	Comments on Environmental Monitoring Report Jan'18 and Feb'2018
SU.GDSUTP.LGED.2018.03.730	28 March 2018	SEL UDC JV	LGED	Submission of Environmental Monitoring Report Jan'18 and Feb'2018
5060098/SR/C04/18.03/1717	15 March 2018	SMEC	LGED	Pending Monthly Environmental Monitoring Report for the month of January and February 2018
5060098/RAF/C04/18.03/1636	18 February 2018	SMEC	LGED	Review, Check and Comments on the Environmental Monitoring Reports for November & December 2017
LGED/PD/GDSUTP/E-03/2016/81	28 Jan 2018	LGED	SMEC	Comments on Environmental Monitoring Report Nov'17 and Dec'17
SU.GDSUTP.LGED.2018.01.673	23 Jan 2018	SEL UDC JV	LGED	Submission of Environmental Monitoring Report Nov'2017 and Dec'2017
5060098/SR/C04/18.03/1527	10 January 2018	SMEC	LGED	Pending Monthly Environmental Monitoring Report including Environmental Quality Test Results (July to December 2017) for the month of December 2017.
5060098/RAF/C04/18.03/1380	10 January 2018	SMEC	LGED	Pending Monthly Environmental Monitoring Report for the month of December 2017.

LGED= Local Government Engineering Department

IV. CONCLUSION AND RECOMMENDATIONS

A. KEY ISSUES

139. There were some minor environmental issues has been raised during this reporting period but have been no key Environmental Safeguard issues identified to date at four contract packages sites. 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 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 March 2018 also submitted by the contractor for approval from Consultant. The EMS has approved by consultant for EMP implementation.

140. 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 during the construction activities.

141. The regular environmental monitoring and monitoring checklist fill-up are continuing by consultant contractor environmental specialist. The issues have been discussed during field visit and meeting for further corrective actions. Grievance Redress Mechanism elaborated by the Consultant on the project site level and

nominated contact people have to be designated by Contractor. The complaint box has been set-up at the project sites for getting complain from the stakeholders on the environmental and safety issues for further improvements.

142. 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

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

C. NEXT REPORT

144. The next semi-annual Environmental Monitoring Report will cover the period from July to December 2018 during which all the Civil Works Contracts will fulfill the requirements and the procedures for implementation of the EMPs on each contract will have been established with updated baseline information recorded.

145. 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: Received Copy from Department of Environment for the renewal of Environmental Clearance Certificates

০১৫

পরিবেশ অধিদপ্তর
ঢাকা অঞ্চল কার্যালয়
গৃহীত হলো
তারিখ 28/05/18

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
প্রকল্প পরিচালক (অঃপ্রঃপ্রঃ), সওজ এর কার্যালয়
গ্রেটার ঢাকা সাসটেইনেবল আরবান ট্রান্সপোর্ট প্রজেক্ট
(বিআরটি, গাজীপুর-এয়ারপোর্ট)
বাড়ী নং-০৪, রোড নং-২১, সেক্টর নং-০৪,উত্তরা, ঢাকা-১২৩০।

স্মারক নং-৩৫.আরএইচডি.০০০০.বিআরটি(পিডি)১৪.০২৪.২০১৫-১৪ তারিখঃ ২৩ মে, ২০১৮ খ্রিঃ

বিষয়ঃ গ্রেটার ঢাকা সাসটেইনেবল আরবান ট্রান্সপোর্ট প্রজেক্ট (বিআরটি, গাজীপুর-এয়ারপোর্ট) এর পরিবেশগত ছাড়পত্র নবায়ন প্রসঙ্গে।

সূত্রঃ ১। পরিবেশ অধিদপ্তরের স্মারক নং-DOE/Clearance/5252/2013/175, তারিখঃ ০২/০৫/২০১৬ খ্রিঃ।
২। পরিবেশ অধিদপ্তরের স্মারক নং-২২.০২.০০০.১৩১.৭২.০০৭.১৭/Renewal-01, তারিখঃ ১৬/০৫/২০১৭ খ্রিঃ।

ঢাকা শহরের জনসাধারনের উত্তর-দক্ষিন বরাবর যাতায়তের আধিক্য বিবেচনায় ও যানজট নিরসনের লক্ষ্যে এশীয় উন্নয়ন ব্যাংক (ADB), AFD, GEF ও বাংলাদেশ সরকারের আর্থিক সহায়তায় "গ্রেটার ঢাকা সাসটেইনেবল আরবান ট্রান্সপোর্ট প্রজেক্ট (বিআরটি, গাজীপুর-এয়ারপোর্ট)" শীর্ষক প্রকল্পটি ECNEC সভায় ২০ নভেম্বর ২০১২ সালে অনুমোদিত হয়। প্রকল্পটিতে এয়ারপোর্ট থেকে গাজীপুর পর্যন্ত নির্দিষ্ট লেনে বাস চলাচলের জন্য মিক্সড ট্রাফিক লেন, নন-মোটরাইজড লেন (NMT) সহ বিআরটি (বাস র‍্যাপিড ট্রানজিট-বিআরটি) সড়ক নির্মাণ ছাড়াও বিআরটি স্টেশন, বাস ডিপো, ফিডার রোড, কিচেন মার্কেট সহ অন্যান্য গুরুত্বপূর্ন অবকাঠামো নির্মাণ করা হবে। অত্র দপ্তরের আবেদনের প্রেক্ষিতে পরিবেশ অধিদপ্তর কর্তৃক সূত্রোস্থ (১) নং স্মারকের মাধ্যমে ০২/০৫/২০১৬ ইং হতে ০১/০৫/২০১৭ ইং তারিখ পর্যন্ত পরিবেশগত ছাড়পত্র প্রদান করেন এবং পরবর্তীতে সূত্রোস্থ (২) নং স্মারকের মাধ্যমে ০২/০৫/২০১৭ ইং হতে ০১/০৫/২০১৮ ইং তারিখ পর্যন্ত পরিবেশগত ছাড়পত্র নবায়ন প্রদান করে। আগামী ০১ মে, ২০১৮ ইং তারিখ উক্ত ছাড়পত্রের মেয়াদ শেষ হয়। সেই আলোকে সংশ্লিষ্ট পরিবেশগত ছাড়পত্র জরুরী ভিত্তিতে নবায়ন প্রয়োজন। অত্র প্রকল্পের পরিবেশগত ছাড়পত্র নবায়ন প্রদানের জন্য প্রয়োজনীয় দলিলাদি এতদসঙ্গে প্রেরণ করা হলো।

সংযুক্তি ঃ
১. পরিবেশগত ছাড়পত্রের অনুলিপি।
২. পরিবেশগত ছাড়পত্রের নবায়নের অনুলিপি।
৩. Annual Environmental Monitoring report (Jan-Dec'2017).
৪. একলক্ষ পঁচিশ হাজার টাকার চালানের মূলকপি
(চালান নং-৫০৪, তাং-১৬/০৫/২০১৮ ইং, সোনালী ব্যাংক, রেজিঃ কমপ্লেক্স শাখা, ঢাকা)।
৫. আঠারো হাজার সাতশত পঞ্চাশ টাকার ভ্যাটের চালানের মূলকপি
(চালান নং-৫০৫, তাং-১৬/০৫/২০১৮, সোনালী ব্যাংক, রেজিঃ কমপ্লেক্স শাখা, ঢাকা)।
৬. Online application copy.

২৩/০৫/২০১৮
(মোঃ সানাউল হক)
আইডি নং-০০১০২৮
প্রকল্প পরিচালক (অঃপ্রঃপ্রঃ), সওজ
23.05

পরিচালক (ঢাকা অঞ্চল)
পরিবেশ অধিদপ্তর
পরিবেশ ভবন, ই-১৬, আগারগাঁও
শেরে বাংলা নগর, ঢাকা-১২০৭।

অনুলিপিঃ
১. প্রধান প্রকৌশলী, সড়ক ও জনপথ অধিদপ্তর, সড়ক ভবন, তেজগাঁও, ঢাকা।
২. প্রকল্প সমন্বয়ক, জিডিএসইউটিপি (বিআরটি, গাজীপুর-এয়ারপোর্ট), উত্তরা, ঢাকা এবং অতিরিক্ত সচিব সড়ক পরিবহন ও মহাসড়ক বিভাগ, বাংলাদেশ সচিবালয়, ঢাকা।
৩. মহাপরিচালক, পরিবেশ অধিদপ্তর, পরিবেশ ভবন, ই-১৬, আগারগাঁও, শেরেবাংলা নগর, ঢাকা-১২০৭।
৪. প্রকল্প ব্যবস্থাপক-১ (নিঃপ্রঃ), সওজ, জিডিএসইউটিপি (বিআরটি, গাজীপুর-এয়ারপোর্ট), উত্তরা, ঢাকা।
৫. প্রকল্প ব্যবস্থাপক-২ (নিঃপ্রঃ), সওজ, জিডিএসইউটিপি (বিআরটি, গাজীপুর-এয়ারপোর্ট), উত্তরা, ঢাকা।
৬. সহকারী পরিচালক (ইআইএ) ও সদস্য সচিব, পরিবেশগত ছাড়পত্র বিষয়ক কমিটি, পরিবেশ অধিদপ্তর, পরিবেশ ভবন, ই/১৬, আগারগাঁও, শেরে বাংলা নগর, ঢাকা।
৭. Team Leader, EPCM, GDSUTP (BRT, Gazipur-Airport), Uttara Dhaka.

D:\Dropbox\Google Drive\BRT 2017-18\DOE\Outgoing\Environmental Clearance\PD to Director about environmental Clearance.docx

APPENDIX 2: 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;
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;

Sl. No.	Clause, S/C No.	Subject	Details
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 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.

Sl. No.	Clause, S/C No.	Subject	Details
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 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**	

Sl. No.	Clause, S/C No.	Subject	Details
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 3: 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: 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 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.	• Designs of both Cross and side drains; • Number of culverts; • Number and size of pipes	• Compliance with Design report	Drainage structure sites	Contractor	EPCM CONSULTANT/P IUs/PMU
Soil Erosion and Siltation	• Soil erosion due to construction activities, earthworks, cut and fill operations and from stockpiles.	• Adopt good construction practices. • Adjusting construction schedule for bridge during non-monsoon season. • Turfing of road shoulders to protect slopes.	• Receipt of complaint regarding sediment loss or water turbidity.	• Compliance with National/Intern ational guideline	The full length of the road alignment	Contractor	EPCM CONSULTANT/P IUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
	• Erosion and subsequent deposition in the adjacent land.	• 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.	• Bridge locations; • Retaining walls • Number of any non- compliance reports	limits for soil quality			
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 wash down and refueling sites • Oil and grease spill and oil-soaked materials will be sold off to authorized recyclers.	• 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
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.	• 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

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		• 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;					
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.	• 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
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;	• Location of stockpiles; • Number of complaints from sensitive receptors; • Heavy equipment and	• Compliance with DoE and National guideline limits for Air 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
		• 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.	machinery with air pollution control devices; • Ambient air quality found beyond the national standards	• Certification that vehicles are compliant with air quality standards.			
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	• 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
		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.					
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	• Compliance with National guideline for land use policy. • Compliance with Waste management plan	Borrow areas	Contractor	EPCM CONSULTANT/ PIUs

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
			cleared of any dust/mud				
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 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	• 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
		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 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	• 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
		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.	• 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;	• Areas for stockpiles, storage of fuels and lubricants and waste materials;	• 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	Contractor	EPCM CONSULTANT/ PIUs/DoE

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		• 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 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.	• Number of silt traps installed along trenches leading to water bodies • Records of surface water quality inspection		/ pond / ditches (Refer to Annex 2).		
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.	• Monitoring in accordance with monitoring program. • No breaches of Material Safety Data Sheet	• Compliance with National guideline limits for Ground water.	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
		• 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.	(MSDS) for hazardous substances.				
Materials Exploitation and Management of Quarry and Borrow areas	• Land use change due to borrowing of earth. • Land use change and 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 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	• Air (PM10) and noise level measurements ; • Dust pollution and complain of local residents • Number of non-compliances observed/ reported	• Compliance with Waste management plan	Materials Exploitation sites	Contractor	EPCM CONSULTANT/ PIUs/PMU

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		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 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;	• 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.	• 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
	• Contamination by Oil and lubricants from vehicle maintenance areas;	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 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					

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		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 quarantined and provided with adequate facilities to combat emergency situations complying with all the applicable statutory stipulation.					

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		• 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.	• 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
		• 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 minimum damage is caused to the trees, undergrowth and crops.	• 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
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.	• 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

Activity	Potential Impacts	Mitigation Measures	Monitoring Indicator	Performance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		• Borrow pits to be fenced to protect animals.					
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 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.	• 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
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 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).	• Traffic route during construction works including number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan (Appendix 8 of EIA); • 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
		• 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 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.	• Number of accidents; • Number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan (Appendix 5 of EIA); • Number of complaints from sensitive receptors; • Number of walkways, signage, and metal sheets	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
		• 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.	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 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;	• 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	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
		• 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.	• % 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 management and residual impacts if any.	• Availability and competency of appointed supervisor • Monthly report	Compliance with Reporting procedure	N/A	Contractor	EPCM Consultants /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 and other hazardous liquids.	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
Soil Erosion	• Visual check for soil erosion and siltation.	Government of Bangladesh (GoB) and International Standard	Material storage sites and all the water bodies near	Monthly	Contractor	EPCM CONSULTANT/PIUs

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
	• Visual inspection of erosion prevention measures and occurrence of erosion.		the project corridor			
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 bridge construction site to be stored and handled safely; and	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
	• 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
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: 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 might be disturbed due to noise and vibration at construction sites and tree felling to cause dislocation of habitats. However, presences of threatened or	• New and good condition machinery with low noise generation characteristics to be used in construction. • Construction work not to be carried out at night.	• Number of complaints from sensitive receptors on disturbance of poaching. • Illegal hunting	Compliance with National/Intern ational guideline for wildlife	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
	endangered wildlife species were not reported at the site.						
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. • Wastes to be collected, stored and taken to approve disposal sites.	• 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
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	• Number of accidents; • Number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan (Appendix 5 of EIA);	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
		community integrity and social links. • Provision of proper safety and diversion signage.	• 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.				

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;	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
	• Check liquid waste is carried out by experienced personnel and in 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

Environmental Component	Parameters	Standards / Guidelines	Locations	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
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						
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
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 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.	• 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
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/International guideline limits for Riverbed sediment.	At and around the bridge site	Contractor	EPCM CONSULTANT/PIU/BBA/DoE
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	• 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

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		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	• During erection of box girders high noise and vibration may result. • Noise from construction vehicles, equipment and machinery. • Vibration caused by construction activities.	• 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. • 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,	• 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

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
		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 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.	• Permits/NOC to be obtained, from relevant authority such as BIWTA prior to extraction • While dredging, special care to be given to prevent any	• Results of Dredged Materials quality analysis • Bridge locations;	• Compliance with National/ International guideline limits	At and around the bridge site	Contractor	EPCM CONSULTANT/PIU/BBA/ BWTA/DoE

Environmental Parameters	Potential Impacts	Mitigation Measures	Monitoring Indicator	Perform-ance Target	Location	Institutional Responsibility	
						Implementation	Supervision & Monitoring
	• Increase in sedimentation and dispersion of pollutants in dredged material	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).		for Dredged Materials.			
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

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	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
	• 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	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 4: 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
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	-		Measurement Period: 8 hours (dry 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 5: Sample Compliance Monitoring Checklist – At Grade Section Including Flyovers (C01)

BRT, Airport – Gazipur, Package 2 (EPCM) – Greater Dhaka Sustainable Urban Transport Project

Environmental Safeguard Monitoring Checklist

Date: 09.05.2018	Time: 11.00–6.00	Name of the Contract: Contract 01
Weather Conditions: 26°C., Heavy Rainfall		Work in progress: Piling at Chowrasta

Environmental Problems	Possible Causes	Proposed Mitigations
No safety barrier	Absence of safety officer	Regular presence at worksite

Environmental Audit carried out by:
Anwa Bhowmick
Environmental Specialist
Anwa

Representative of contractor: Mahfuzul Alam
DES, CGGC, ACL, BRT-1
09.05.2018

No.	Aspects of Environmental issues	Compliance Status FC	PC	NC	Remarks
Conditions at project sites					
A.	**General**				
1.	Site Office and camp sites locations appropriate	✓			The site office reas within the ~~site~~ work
2.	Environment, Health and Safety Officer designated	✓			Senior environmental specialist is appointed
3.	Employment Record keeping arrangement		✓		Recorded manually
4.	Payment Record keeping arrangement		✓		Maintained in a register book
5.	Legal working hours approval		✓		The workers work for 10 hours a day with brk
6.	Provision for monthly meeting for inspection of site activities		✓		Meetings are organised about regular update

Environmental Safeguard Monitoring Checklist Page | 1

No.	Aspects of Environmental issues	Compliance Status FC	PC	NC	Remarks
B.	**Health and Sanitation**				
B1	**Public Health & Safety**				
1.	Hygienic labor sheds kitchens and sanitation facilities at camp and work sites		✓		The sanitation was not that good. After a discussion with contractor action was taken
2.	Sanitary toilets construction with septic tanks		✓		Provided pro but not properly maintained
3.	Safe water supply arrangements	✓			Properly supplied. Source is groundwater
4.	Emergency medical facilities and First Aid Box at Field Office and work sites		✓		First aid box is there but there is no medical officer
5.	Waste disposal arrangement at camp and work sites		✓		There is no specific place of waste disposal.
6.	Adequate traffic signs and warning notices provided on site and dangerous areas		✓		Maintained properly but due to some reason like VIP movement it can not be maintai
B2	**Occupational Health and Safety**				
1.	First-Aid Box availability at work sites	✓			Available at the site
2.	Fire extinguishers/fighting facilities properly maintained and not expired		✓		Was in progress
3.	Provision of personal protection equipment's (PPEs) and working clothing to workers		✓		PPEs are available but awareness about using them need to be circulated
4.	Handling of cement and other hazardous materials by workers		✓		Hazardous materials were not handled during monitoring period.
5.	Working hour and vacation days maintained		✓		Partially maintained considering workload
6.	Provision of recreational facilities at camp sites			✓	Not that much facilities provided
7.	Workers' complains taken care of by the supervisor		✓		Not always maintained
8.	Provision leaves (national and emergency)		✓		Provided
9.	Children below 15 employment	✓			No worker (Child) was working

No.	Aspects of Environmental issues	Compliance Status FC	PC	NC	Remarks
C.	**Environmental Pollution**				
C1	**Dust and emission control**				
1.	Proper storage of materials and regular watering of dust blowing construction area.		✓		Watering is done during construction activities, more 2 times a day
2.	Dropping of fill material everywhere during transportation is avoided		✓		Covered with plastic to avoid dropping
3.	Construction vehicles and plants maintained properly to reduce emissions		✓		Vehicles are sometimes not maintained due to work load.
C2	**Noise Pollution**				
1.	Movement of vehicles and operation of plants fixed at desired hours	✓			
2.	Heavy equipment maintained properly and operated at scheduled hours	✓			
3.	Noise control measures at sensitive sites		✓		During hay works workers are provided with cotton balls and air plugs
C3	**Water Pollution**				
1.	Wastes, cement, effluents and junks not disposed in water		✓		Try to maintain but not always possible.
2.	Sanitary, kitchen and other organic wastes not disposed in water bodies		✓		Same as previous remark
C4	**Flora and Fauna**				
1.	Trees and bushes outside the construction area preserved from damages		✓		Sometimes happening due to dust
2.	No old trees cut down or impacted by the construction or operation	✓			
3.	Cutting down has not taken place without the prior approval of the relevant local authorities	✓			

Environmental Safeguard Monitoring Checklist

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No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
4.	Disturbance to terrestrial fauna minimized	✓			
C5	**Waste Management**				
1.	Waste disposal arrangement at camp and work sites		✓		No specific site of disposal
2.	Separated labelled containers/areas provided for facilitating recycling and waste segregation		✓		No labelled containers
3.	Construction wastes/recyclable wastes and general refuse removed off site regularly		✓		kept in separate place and disposed on the work date or next day
4.	Chemical wastes, if any, collected and disposed of properly	✓			
E.	**Environmental documents at Field Office and Project sites**				
1.	Field Office possesses copies of EMP, contract document and Technical Specifications	✓			
2.	All accidents at work sites recorded and reported	✓			
3.	Heavy equipment maintenance records	✓			

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

APPENDIX 6: Sample Compliance Monitoring Checklist – Elevated Section including Tongi Bridge (C02)

BRT, Airport – Gazipur, Package 2 (E. ..M) – Greater Dhaka Sustainable Urban Transport Project

Environmental Safeguard Monitoring Checklist

Date: 07.05.2018	Time: 11.30 – 5.30	Name of the Contract: Contract 02
Weather Conditions:		Work in progress:

Environmental Problems	Possible Causes	Proposed Mitigations
No workers were found at the site	Lack of proper communication	Communication skill need to be developed

Environmental Audit carried out by:
Anuva Bhowmick
Environmental Specialist

Representative of contractor:
Md. Kawser uddin
Deputy Environmental Monitoring officer, JTEG

No.	Aspects of Environmental issues	Compliance Status FC	PC	NC	Remarks
Conditions at project sites					
A.	**General**				
1.	Site Office and camp sites locations appropriate			✓	No site office
2.	Environment, Health and Safety Officer designated		✓		Senior position is not occupied
3.	Employment Record keeping arrangement		✓		Recorded Manually
4.	Payment Record keeping arrangement		✓		Recorded Manually
5.	Legal working hours approval	✓			Maintained properly
6.	Provision for monthly meeting for inspection of site activities		✓		Not started properly

SMEC GDSUTP (E... BRT AIRPO... DATE IN/OUT 29-5-18 / 22/18.04 DISTRIBUTION TL ✓ AE ✓ MHR ✓ SR ✓ AB ✓

Environmental Safeguard Monitoring Checklist

Page | 1

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
B.	**Health and Sanitation**				
B1	**Public Health & Safety**				
1.	Hygienic labor sheds kitchens and sanitation facilities at camp and work sites		✓		At sheds there is kitchen and sanitation facilities but at site not maintained
2.	Sanitary toilets construction with septic tanks		✓		At sheds maintained
3.	Safe water supply arrangements		✓		Similar as same previous remarks 2
4.	Emergency medical facilities and First Aid Box at Field Office and work sites		✓		Aid box provided but no medical officer is appointed.
5.	Waste disposal arrangement at camp and work sites		✓		Need to be improved
6.	Adequate traffic signs and warning notices provided on site and dangerous areas		✓		Always maintained except few VIP Cosmos
B2	**Occupational Health and Safety**				
1.	First-Aid Box availability at work sites		✓		Provided at site
2.	Fire extinguishers/fighting facilities properly maintained and not expired		✓		Provided
3.	Provision of personal protection equipment's (PPEs) and working clothing to workers	✓			
4.	Handling of cement and other hazardous materials by workers	✓			Maintained
5.	Working hour and vacation days maintained	✓			
6.	Provision of recreational facilities at camp sites		✓		
7.	Workers' complains taken care of by the supervisor		✓		
8.	Provision leaves (national and emergency)		✓		Depending on work load.
9.	Children below 15 employment	✓			

No.	Aspects of Environmental issues	Compliance Status FC	PC	NC	Remarks
C.	**Environmental Pollution**				
C1	**Dust and emission control**				
1.	Proper storage of materials and regular watering of dust blowing construction area.		✓		Need to be Comproved
2.	Dropping of fill material everywhere during transportation is avoided	✓			
3.	Construction vehicles and plants maintained properly to reduce emissions		✓		Vehicles are kept in aperate place but plants are seen with dust
C2	**Noise Pollution**				
1.	Movement of vehicles and operation of plants fixed at desired hours	✓			
2.	Heavy equipment maintained properly and operated at scheduled hours	✓			
3.	Noise control measures at sensitive sites		✓		Use air bud plugs and cotton balls
C3	**Water Pollution**				
1.	Wastes, cement, effluents and junks not disposed in water		✓		Except due to rain try to maintain properly
2.	Sanitary, kitchen and other organic wastes not disposed in water bodies		✓		Always try to maintain
C4	**Flora and Fauna**				
1.	Trees and bushes outside the construction area preserved from damages		✓		Sometimes not possible due to dust
2.	No old trees cut down or impacted by the construction or operation	✓			
3.	Cutting down has not taken place without the prior approval of the relevant local authorities	✓			

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
4.	Disturbance to terrestrial fauna minimized	✓	-		
C5	**Waste Management**				
1.	Waste disposal arrangement at camp and work sites		✓		No specific place.
2.	Separated labelled containers/areas provided for facilitating recycling and waste segregation		✓		Depending on site maintained seperate places
3.	Construction wastes/recyclable wastes and general refuse removed off site regularly		✓		Sometimes not possible to remove
4.	Chemical wastes, if any, collected and disposed of properly	✓			
E.	**Environmental documents at Field Office and Project sites**				
1.	Field Office possesses copies of EMP, contract document and Technical Specifications	✓			
2.	All accidents at work sites recorded and reported	✓			
3.	Heavy equipment maintenance records	✓			

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

APPENDIX 7: Sample Compliance Monitoring Checklist – Local Roads and Kitchen Markets (C03)

BRT, Airport – Gazipur, Package 2 (EPCM) – Greater Dhaka Sustainable Urban Transport Project

Environmental Safeguard Monitoring Checklist

Date: 31.05.2018	Time: 10·00 – 4·30	Name of the Contract: C03
Weather Conditions: 36°C,		Work in progress: T01, T64, T06, GA20, GA57, C03 Chainage: 4+000, 7+000, 8+000, 10+000~10+500, 11+000 16+500~17+000 Respectively.

Environmental Problems	Possible Causes	Proposed Mitigations
Most of the location don't have the safety sign and barrier	Unable to interact with local people to inform them about the usefulness of safty issues	Talk with local communities

Environmental Audit carried out by:
Shuva Bhaomick
Environmental Specialist
31.05.2018

Representative of contractor: Tonmoy Pandit
Environmental Management Officer
WIETC
31-05-2018

No.	Aspects of Environmental Issues	Compliance Status FC	PC	NC	Remarks
Conditions at project sites					
A.	General				
1.	Site Office and camp sites locations appropriate				No site office
2.	Environment, Health and Safety Officer designated		✓		Senior Environmentalist is not mobilized
3.	Employment Record keeping arrangement	✓			"
4.	Payment Record keeping arrangement	✓			
5.	Legal working hours approval		✓		Not followed properly
6.	Provision for monthly meeting for inspection of site activities		✓		Not started as regular

SMEC GDSUTP BRT Airport
DATE IN/OUT 4-6-18
FILE NO: C03/ESC
DISTRIBUTION: ACT INF
TL –
MHR –
Lasa AF –
SR –
AB –

Environmental Safeguard Monitoring Checklist
Page | 1

No.	Aspects of Environmental issues	Compliance Status FC	PC	NC	Remarks
B.	**Health and Sanitation**				
B1	**Public Health & Safety**				
1.	Hygienic labor sheds kitchens and sanitation facilities at camp and work sites		✓		Labor sheds are hygenic in respect of kitchen and sanitation
2.	Sanitary toilets construction with septic tanks		✓		At worker shed provided properly
3.	Safe water supply arrangements		✓		At shed. it is satisfactory
4.	Emergency medical facilities and First Aid Box at Field Office and work sites		✓		Medical facilities are not available
5.	Waste disposal arrangement at camp and work sites		✓		There is no specific campsite but work site is satisfactory.
6.	Adequate traffic signs and warning notices provided on site and dangerous areas		✓		Need to be improved
B2	**Occupational Health and Safety**				
1.	First-Aid Box availability at work sites	✓			
2.	Fire extinguishers/fighting facilities properly maintained and not expired	✓			
3.	Provision of personal protection equipment's (PPEs) and working clothing to workers		✓		Need to be improved
4.	Handling of cement and other hazardous materials by workers		✓		Maintained. Need to continue this practice
5.	Working hour and vacation days maintained		✓		Depending on work pressure it is followed
6.	Provision of recreational facilities at camp sites		✓		Sometimes due to workload cannot be maintained
7.	Workers' complains taken care of by the supervisor		✓		Improvement is needed
8.	Provision leaves (national and emergency)		✓		Depending on work load it is followed
9.	Children below 15 employment	✓			

No.	Aspects of Environmental Issues	Compliance Status FC	PC	NC	Remarks
C.	**Environmental Pollution**				
C1	**Dust and emission control**				
1.	Proper storage of materials and regular watering of dust blowing construction area.		✓		Materials storage need to be improved
2.	Dropping of fill material everywhere during transportation is avoided				
3.	Construction vehicles and plants maintained properly to reduce emissions		✓		Improvement is needed
C2	**Noise Pollution**				
1.	Movement of vehicles and operation of plants fixed at desired hours				
2.	Heavy equipment maintained properly and operated at scheduled hours		✓		Sometimes can not be maintained due to work pressure
3.	Noise control measures at sensitive sites		✓		Workers are provided with cotton ball and ear plug
C3	**Water Pollution**				
1.	Wastes, cement, effluents and junks not disposed in water		✓		Except due to rainfall it is maintain
2.	Sanitary, kitchen and other organic wastes not disposed in water bodies		✓		Improved but due to rainfall it can not be maintained
C4	**Flora and Fauna**				
1.	Trees and bushes outside the construction area preserved from damages				Trees are polluted by dust, water sprayer is used
2.	No old trees cut down or impacted by the construction or operation	✓			
3.	Cutting down has not taken place without the prior approval of the relevant local authorities	✓			

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No.	Aspects of Environmental Issues	Compliance Status			Remarks
		FC	PC	NC	
4.	Disturbance to terrestrial fauna minimized	✓			
C5	**Waste Management**				
1.	Waste disposal arrangement at camp and work sites		✓		Not always possible to maintained due to work load
2.	Separated labelled containers/areas provided for facilitating recycling and waste segregation		✓		Need to be improved
3.	Construction wastes/recyclable wastes and general refuse removed off site regularly		✓		Not maintained everyday
4.	Chemical wastes, if any, collected and disposed of properly	✓			
E.	**Environmental documents at Field Office and Project sites**				
1.	Field Office possesses copies of EMP, contract document and Technical Specifications	✓			
2.	All accidents at work sites recorded and reported	✓			
3.	Heavy equipment maintenance records	✓			

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

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

BRT, Airport – Gezipur, Package 2 (EPCM) – Greater Dhaka Sustainable Urban Transport Project

Environmental Safeguard Monitoring Checklist

Date: 28.05.2018	Time: 11.00-3.15	Name of the Contract: Contract 04
Weather Conditions: 35°c		Work in progress:

Environmental Problems	Possible Causes	Proposed Mitigations
Not using PPEs	No proper monitoring and enforcement	Regular monitoring

Environmental Audit carried out by:
Anuva Bhowmick
Environmental Specialist,
Lehara

Representative of contractor:
Shafayat Hossain
ME
28.05.18

SMEC GDSUTP BRT AIRP
DATE IN/OUT 29-5-18
FILE NO C04/18.04
DISTRIBUTION ACT
TL
AF.
MHR
SR.
AB.

No.	Aspects of Environmental issues	Compliance Status FC	PC	NC	Remarks
Conditions at project sites					
A.	**General**				
1.	Site Office and camp sites locations appropriate		✓		
2.	Environment, Health and Safety Officer designated	✓			
3.	Employment Record keeping arrangement		✓		
4.	Payment Record keeping arrangement	✓			
5.	Legal working hours approval		✓		10 hours of work with 1 hour of lunch break
6.	Provision for monthly meeting for inspection of site activities		✓		Meeting is organised regarding work update

Environmental Safeguard Monitoring Checklist

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No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
B.	**Health and Sanitation**				
B1	**Public Health & Safety**				
1.	Hygienic labor sheds kitchens and sanitation facilities at camp and work sites		✓		Needs to improved and clean
2.	Sanitary toilets construction with septic tanks		✓		Needs to improved clean
3.	Safe water supply arrangements		✓		
4.	Emergency medical facilities and First Aid Box at Field Office and work sites	✓			
5.	Waste disposal arrangement at camp and work sites		✓		No specific place of disposal
6.	Adequate traffic signs and warning notices provided on site and dangerous areas		✓		Needs to be improved
B2	**Occupational Health and Safety**				
1.	First-Aid Box availability at work sites	✓			
2.	Fire extinguishers/fighting facilities properly maintained and not expired	✓			
3.	Provision of personal protection equipment's (PPEs) and working clothing to workers		✓		Workers are not that much aware of using PPEs. Need to be improved
4.	Handling of cement and other hazardous materials by workers		✓		Workers are provided with proper equipments. Need to improve the awareness
5.	Working hour and vacation days maintained	✓			Maintained properly
6.	Provision of recreational facilities at camp sites		✓		Not that much fasitities are provided
7.	Workers' complains taken care of by the supervisor		✓		Supervisor is taking care of it.
8.	Provision leaves (national and emergency)	✓			
9.	Children below 15 employment	✓			

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
C.	**Environmental Pollution**				
C1	**Dust and emission control**				
1.	Proper storage of materials and regular watering of dust blowing construction area.		✓		Watering is done on a regular basis
2.	Dropping of fill material everywhere during transportation is avoided	✓			
3.	Construction vehicles and plants maintained properly to reduce emissions	✓			
C2	**Noise Pollution**				
1.	Movement of vehicles and operation of plants fixed at desired hours	✓			
2.	Heavy equipment maintained properly and operated at scheduled hours	✓			
3.	Noise control measures at sensitive sites			✓	Labors are provided with proper equipments
C3	**Water Pollution**				
1.	Wastes, cement, effluents and junks not disposed in water		✓		Due to rainfall sometimes mixed with water
2.	Sanitary, kitchen and other organic wastes not disposed in water bodies	✓			
C4	**Flora and Fauna**				
1.	Trees and bushes outside the construction area preserved from damages		✓		Dust emmision sometimes harm the trees
2.	No old trees cut down or impacted by the construction or operation	✓			
3.	Cutting down has not taken place without the prior approval of the relevant local authorities	✓			

No.	Aspects of Environmental issues	Compliance Status			Remarks
		FC	PC	NC	
4.	Disturbance to terrestrial fauna minimized	✓			
C5	**Waste Management**				
1.	Waste disposal arrangement at camp and work sites		✓		Different wastes are disposed seperately
2.	Separated labelled containers/areas provided for facilitating recycling and waste segregation		✓		Waste are disposed seperately but not in labelled containers
3.	Construction wastes/recyclable wastes and general refuse removed off site regularly		✓		kept in specific place but not possible to remove sometimes
4.	Chemical wastes, if any, collected and disposed of properly	✓			
E.	**Environmental documents at Field Office and Project sites**				
1.	Field Office possesses copies of EMP, contract document and Technical Specifications	✓			
2.	All accidents at work sites recorded and reported	✓			
3.	Heavy equipment maintenance records	✓			

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

APPENDIX 9: Photographs

Road and Traffic Maintenance (CO2)

Labourers wearing PPE (CO2)

General View of Works in progress (C01)

Project Site Visit by Environmental Monitoring Expert (CO1)

Cooking arrangements for the labourers (CO1)

Living arrangements for the labourers (CO1)

	
Water supply arrangements for the labourers (CO1)	Sanitary Latrines for labourers (CO1)
	
Meeting with workers and local people at Site Office (CO4)	General View of Works in progress (C02)
	
General View of Works in progress (C03)	General View of Works in progress (C04)

APPENDIX 10: The Laboratory Test Report

At Grade Section including Flyovers – C01

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: 782/ CC, DPHE, CL, Dhaka.

Date: 31-05-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018050174	Sample Receiving date: 22-05-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 22-05-2018	Sample Source: Suface Water
Sent by:Tonmoy Pandit ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (Sample- SW_HF)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 22-05-2018	Date of Testing: 22/05/2018-30/05/2018

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	10	mg/L	5 days Incubation	0.1
3	Chemical Oxygen Demand (COD)	4.0	44	mg/L	CRM	-
4	Coliform (Faecal)	0	0	N/100ml	MFM	-
5	Coliform (Total)	0	10	N/100ml	MFM	-
6	Iron (Fe)	0.3-1	0.10	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
8	Nitrogen (Ammonia)	0.50	0.8	mg/L	UVS	0.01
9	Total Suspended Solid (TSS)	10	17	mg/L	Gravity Multimeter	-
10	Turbidity	10	22.5	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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	31.05.18 Sample Analyzer DPHE Central Laboratory Mohakhali, Dhaka.	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	31/05/2018 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka.
2.) Name: Taslima Akhter Designation: Sample Analyzer	31.05.18	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: 782/ CC, DPHE, CL, Dhaka. Date: 31-05-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018050173	Sample Receiving date: 22-05-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 22-05-2018	Sample Source: Suface Water
Sent by:Tonmoy Pandit ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (Sample- SW_SH)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 22-05-2018	Date of Testing: 22/05/2018-30/05/2018

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	8	mg/L	5 days Incubation	0.1
3	Chemical Oxygen Demand (COD)	4.0	24	mg/L	CRM	-
4	Coliform (Faecal)	0	10	N/100ml	MFM	-
5	Coliform (Total)	0	25	N/100ml	MFM	-
6	Iron (Fe)	0.3-1	0.05	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
8	Nitrogen (Ammonia)	0.50	1.1	mg/L	UVS	0.01
9	Total Suspended Solid (TSS)	10	23	mg/L	Gravity Multimeter	-
10	Turbidity	10	35.4	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.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	31.05.18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	31/05/2018
2.) Name: Taslima Akhter Designation: Sample Analyzer	31.05.18	2.) Name: Designation:	

Sample Analyzer
DPHE Central Laboratory
Mohakhali, Dhaka

Md. Biplab Hossain
Chief Chemist
Department of Public Health Engineering
Central Laboratory Mohakhali, Dhaka

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মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা-১০০০
বাংলাদেশ

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

Date: 03. 06. 2018

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

Re.: Environmental Quality Test for Bus Rapid Transit Project (Package-01)

Sample Title: Surface water quality test for oil and grease

Analytical Results:

Serial No.	Water Source	Sample ID	Test Parameters	Test Method (APHA)
			Oil and Grease (mg/L)	
1	Surface Water	SW_SH	79.80	5520.B
2	Surface Water	SW_HF	70.20	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

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: 03. 06. 2018

Report of Analysis

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

Re.: Environmental Quality Test for Bus Rapid Transit Project (Package-01)

Sample Title: Surface water quality test

Analytical Results:

Sl. No.	Water Source	Test Parameters	Units	Sample ID	
				SW_SH	SW_HF
				Test Results	
1	Surface Water	Total Nitrogen (TN)	mg/L	13.44	9.86
2	Surface Water	Total Phosphorus (TP)	mg/L	0.289	0.702

Methods Used:

1. Total Nitrogen : Micro-kjeldahl digestion and distillation method
2. Total Phosphorus : 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: swerl@du.ac.bd

Ground 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: 88-02-9861927, Fax: 88-02-9882003 , Email: wqmsc_central_lab@yahoo.com

Lab Memo: 782/ CC, DPHE, CL. Dhaka.

Date: 31-05-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018050175	Sample Receiving date: 22-05-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 22-05-2018	Sample Source: Ground Water
Sent by:Tonmoy Pandit ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (Sample- GW_GT)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 22-05-2018	Date of Testing: 22/05/2018-30/05/2018

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	0.1
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	Iron (Fe)	0.3-1	0.05	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.35	mg/L	AAS	0.03
8	Nitrogen (Ammonia)	0.50	0.01	mg/L	UVS	0.01
9	Total Suspended Solid (TSS)	10	2	mg/L	Gravity Multimeter	-
10	Turbidity	10	0.83	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.

Test Performed by:

1.) Name: Md. Saiful Alam Khosru
Designation: Sample Analyzer
Signature
31.05.18

2.) Name: Taslima Akhter
Designation: Sample Analyzer
31.05.18

Sample Analyzer
DPHE, Central Laboratory
Mohakhali, Dhaka

Countersigned/Approved by:

1.) Name: Md. Biplab Hossain
Designation: Chief Chemist
Signature
31/05/2018
Md. Biplab Hossain
Chief Chemist
Department of Public Health Engineering
Central Laboratory Mohakhali, Dhaka

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
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Lab Memo: 782/ CC, DPHE, CL, Dhaka. Date: 31-05-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018050176	Sample Receiving date: 22-05-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 22-05-2018	Sample Source: Ground Water
Sent by:Tonmoy Pandit ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (Sample- GW_CS)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 22-05-2018	Date of Testing: 22/05/2018-30/05/2018

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	0.1
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	Iron (Fe)	0.3-1	0.05	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.10	mg/L	AAS	0.03
8	Nitrogen (Ammonia)	0.50	0.02	mg/L	UVS	0.01
9	Total Suspended Solid (TSS)	10	3	mg/L	Gravity Multimeter	-
10	Turbidity	10	1.0	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.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	31.05.18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	31/05/2018 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
2.) Name: Taslima Akhter Designation: Sample Analyzer	31.05.18 Sample Analyzer DPHE, Central Laboratory Mohakhali, Dhaka	2.) Name: Designation:	

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Lab Memo: 782/ CC, DPHE, CL, Dhaka.

Date: 31-05-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018050177	Sample Receiving date: 22-05-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 22-05-2018	Sample Source: Ground Water
Sent by:Tonmoy Pandit ,Jr. Environmental Specialist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Dhaka, Upa:
Care Taker: DSCL (Sample- GW_GZ)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date: 22-05-2018	Date of Testing: 22/05/2018-30/05/2018

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	0.1
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	Iron (Fe)	0.3-1	0.07	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.40	mg/L	AAS	0.03
8	Nitrogen (Ammonia)	0.50	0.01	mg/L	UVS	0.01
9	Total Suspended Solid (TSS)	10	2	mg/L	Gravity Multimeter	-
10	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.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	31.05.18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	31/05/2018 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka
2.) Name: Tasima Akhter Designation: Sample Analyzer	31.05.18 Sample Analyzer DPHE, Central Laboratory Mohakhali, Dhaka.	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: 03. 06. 2018

Report of Analysis

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

Re.: Environmental Quality Test for Bus Rapid Transit Project (Package-01)

Sample Title: Ground water quality test

Analytical Results:

Sl. No.	Water Source	Test Parameters	Units	Sample ID		
				GW_CS	GW_GT	GW_GZ
				Test Results		
1	Ground Water	Total Nitrogen (TN)	mg/L	8.86	7.06	7.06
2	Ground Water	Total Phosphorus (TP)	mg/L	0.102	0.107	0.105

Methods Used:

a. Total Nitrogen : Micro-kjeldahl digestion and distillation method
b. Total Phosphorus : 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

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	17th -21st May, 2018

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Concentration Present			Bangladesh Standard**	Duration (hours)	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}	$\mu g/m^3$	82.6	91.4	189.2	150	24	Gravimetric
SPM	$\mu g/m^3$	235.04	678.51	1032.84	200	24	Gravimetric
$PM_{2.5}$	$\mu g/m^3$	40.9	32.7	94.3	65	24	Gravimetric
SO_2	$\mu g/m^3$	14.67	34.32	101.79	365	24	West- Geake
NOx	$\mu g/m^3$	49.56	79.45	143.62	100	Annual	Jacob and Hochheiser
H_2S	$\mu g/m^3$	0.012	0.005	0.045	NYS	8	Electro-Chemical Sensor
O_3	$\mu g/m^3$	4.21	7.57	13.23	NYS	8	Photometric
O_2	%	17.32	18.76	15.43	NYS	8	Electro-Chemical Sensor
TVOC	$\mu g/m^3$	476	645	897	NYS	8	Electro-Chemical Sensor
CO*	ppm	<1	<1	<1	9	8	CO Meter
CO_2	$\mu g/m^3$	158.98	366.32	520.13	NYS	8	Electro-Chemical Sensor
Weather Condition	-	Cloudy	Sunny	Cloudy	-	-	-

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

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DSCL

Multidisciplinary Development Consultants

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	2:00pm-3:00pm	27.65	27.62	1.1	East-South
AAQ_BB	Tongi Board Bazar	23.94732°N 90.38178°E	3:00pm-4:00pm	32.58	35.67	1.37	North-East
AAQ_GT	Gazipur Terminal	23.99717°N 90.41799°E	12:00pm-1:00pm	29.75	29.41	1.12	West-South

Location	Sample Site Description
AAQ_AP	➢ Airport area was busy with a lot of vehicles. ➢ Low amount of dust particles were present in the area because rain has occurred in this area. ➢ Huge smoke was coming from vehicles ➢ The weather was mostly cloudy. ➢ People movement was high.
AAQ_BB	➢ Highway was busy with a lot of vehicles. ➢ Low amount of dust particles were present in the area because rain has occurred the day before. ➢ Huge smoke was coming from vehicles ➢ The weather was mostly sunny. ➢ People movement was high.
AAQ_GT	➢ It was a bus stand area, so vehicle load was a lot. ➢ Low amount of dust particles were present in the area because rain has occurred in this area. ➢ The weather was mostly cloudy. ➢ People movement was high.

Test Performed By:
Tonmoy Pandit
Jr. Environmental Specialist

Development Solutions Consultant Limited * DSCL *

Checked By:
Israt Jahan Sumi
Director

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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	17th May -21st May, 2018

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	23.99718 N, 90.41805 E	Commercial	12:44	20:59	67.12	67.10
NM_JC	JoydebpurChowrasta, Gazipur	23.98951 N, 90.38261 E	Commercial	12:46	21:25	77.35	73.16
NM_BhB	Bhogra Bazar, Gazipur	23.97762 N, 90.38057 E	Commercial	14:59	22:28	72.26	76.43
NM_CS	Campsite, Gazipur	23.97778 N. 90.37052 E	Residential	13:42	22:06	58.23	53.67
NM_BB	Board Bazar, Gazipur	23.94734 N, 90.38173 E	Commercial	15:54	20:10	74.24	72.76
NM_AP	Airport, Uttara, Dhaka	23.85024 N, 90.40909 E	Commercial	12:25	23:30	69.94	76.29

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

Development Solutions Consultant Limited DSCL

Test Performed By:	Checked By:
Tonmoy Pandit Junior Environmental Specialist	Israt Jahan Sumi Director

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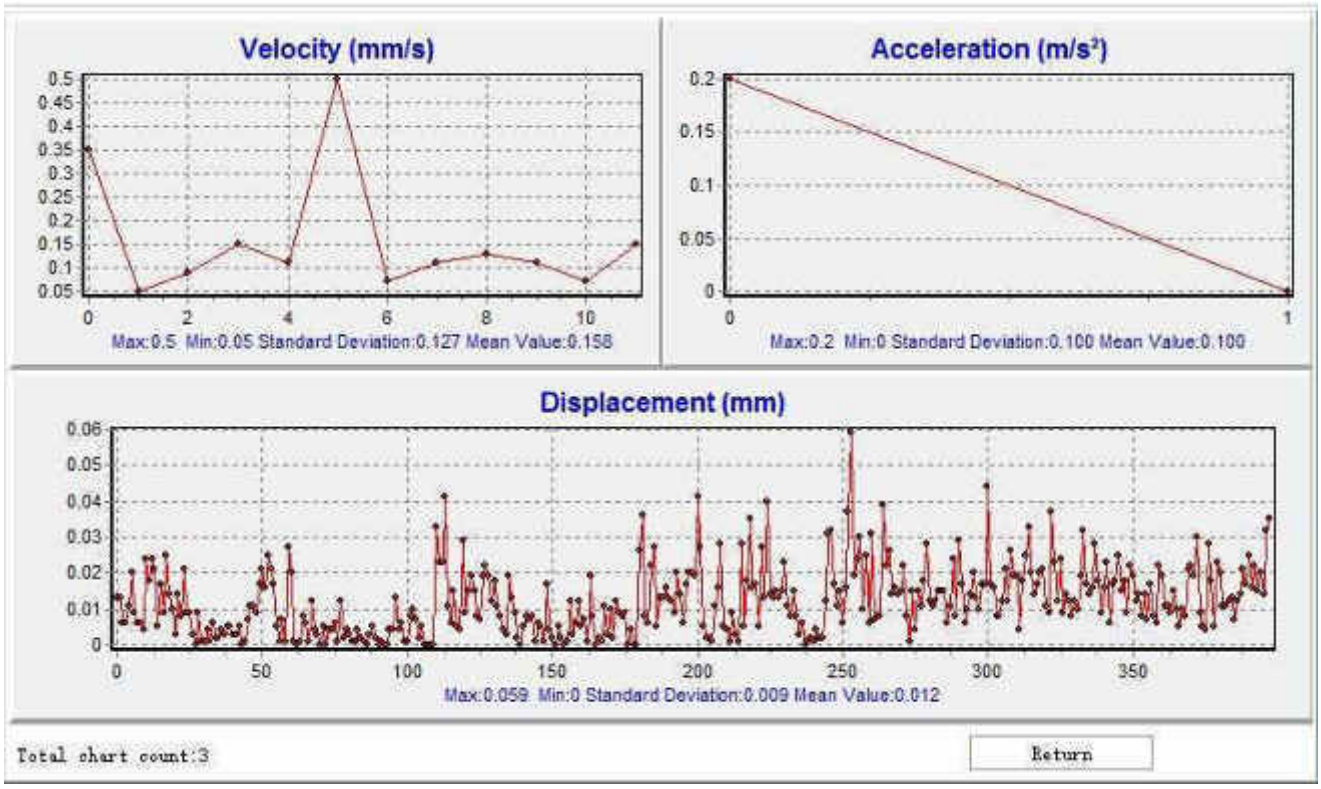
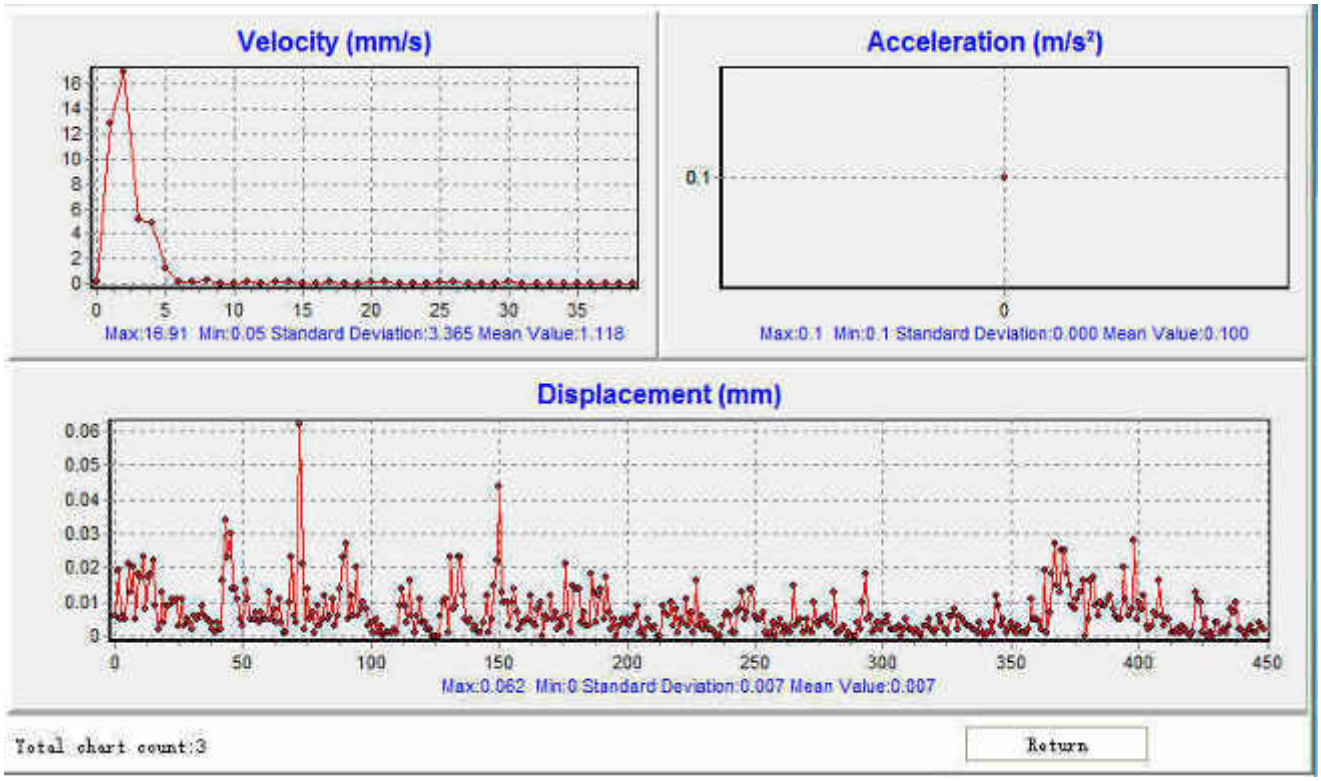
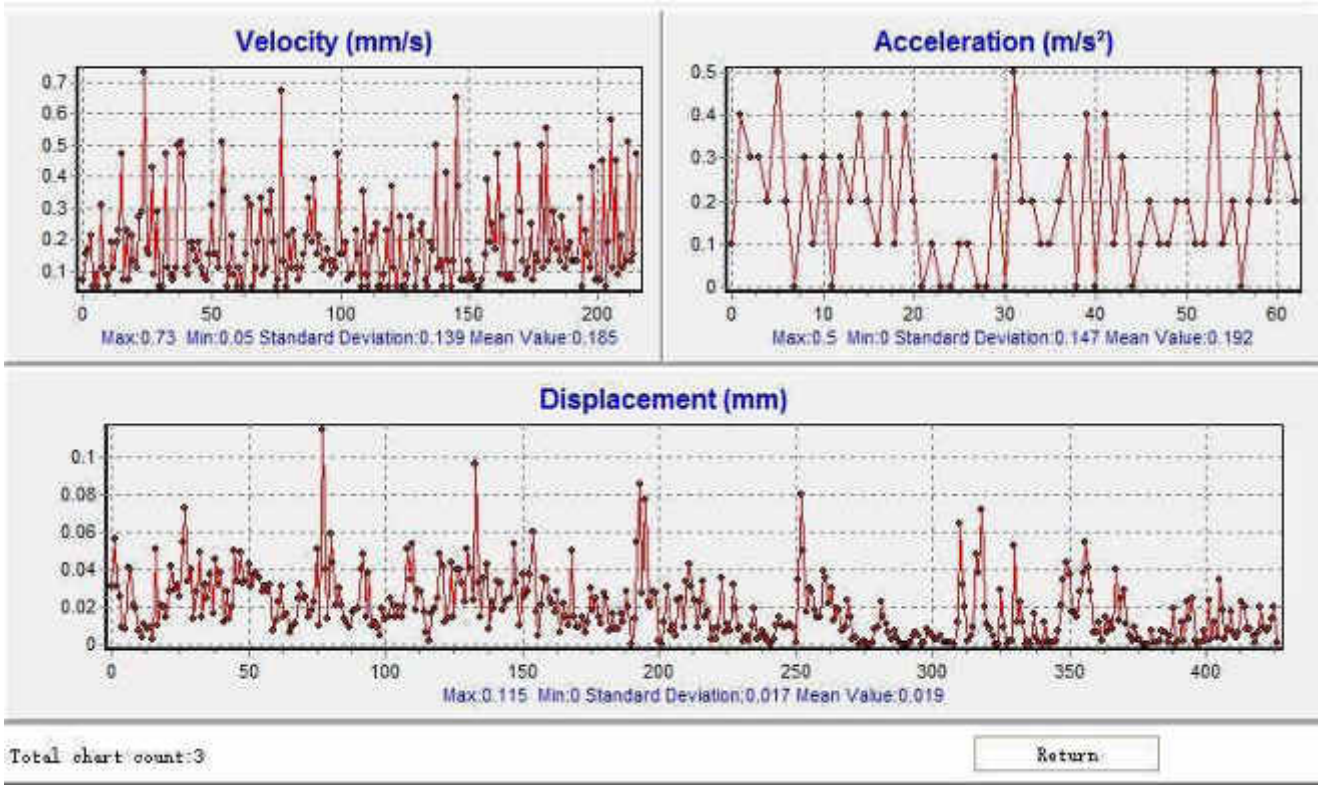
Vibration Level Measurement Results



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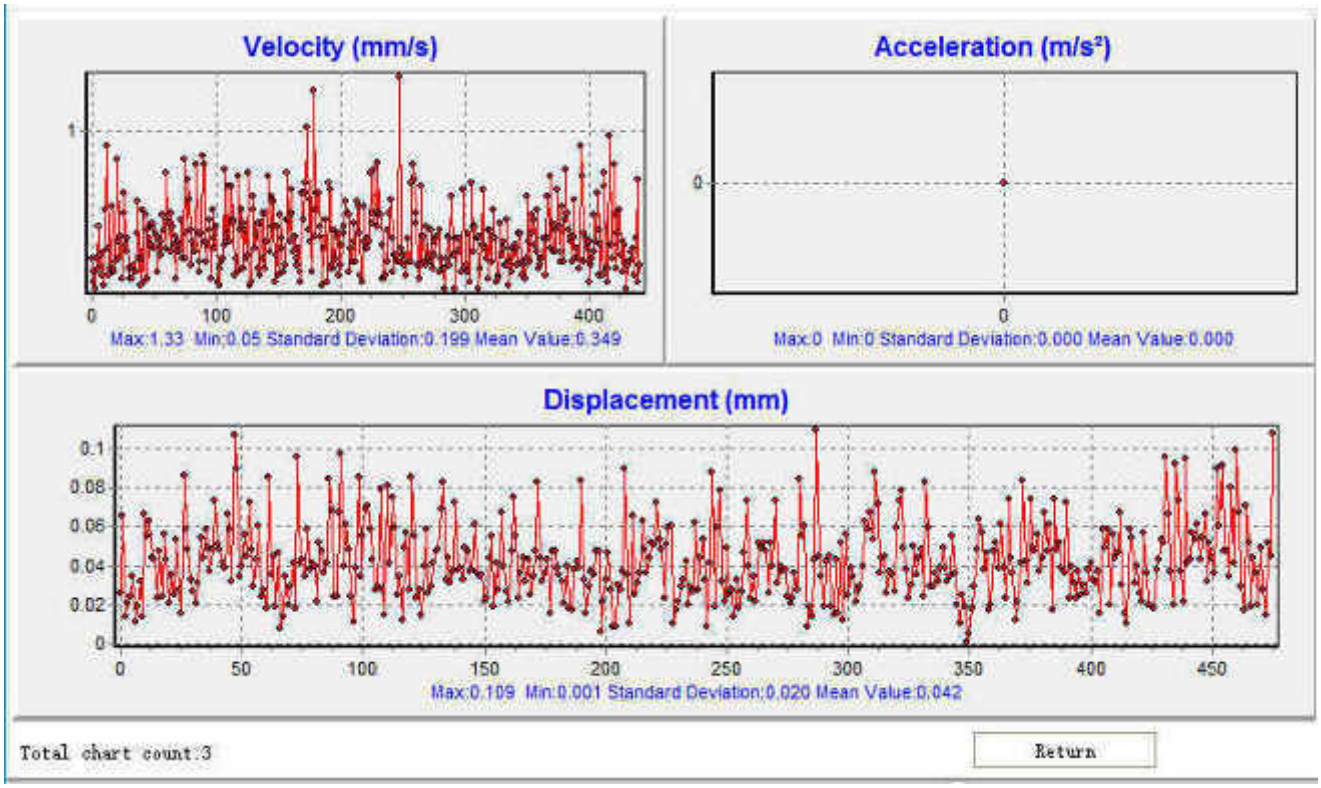
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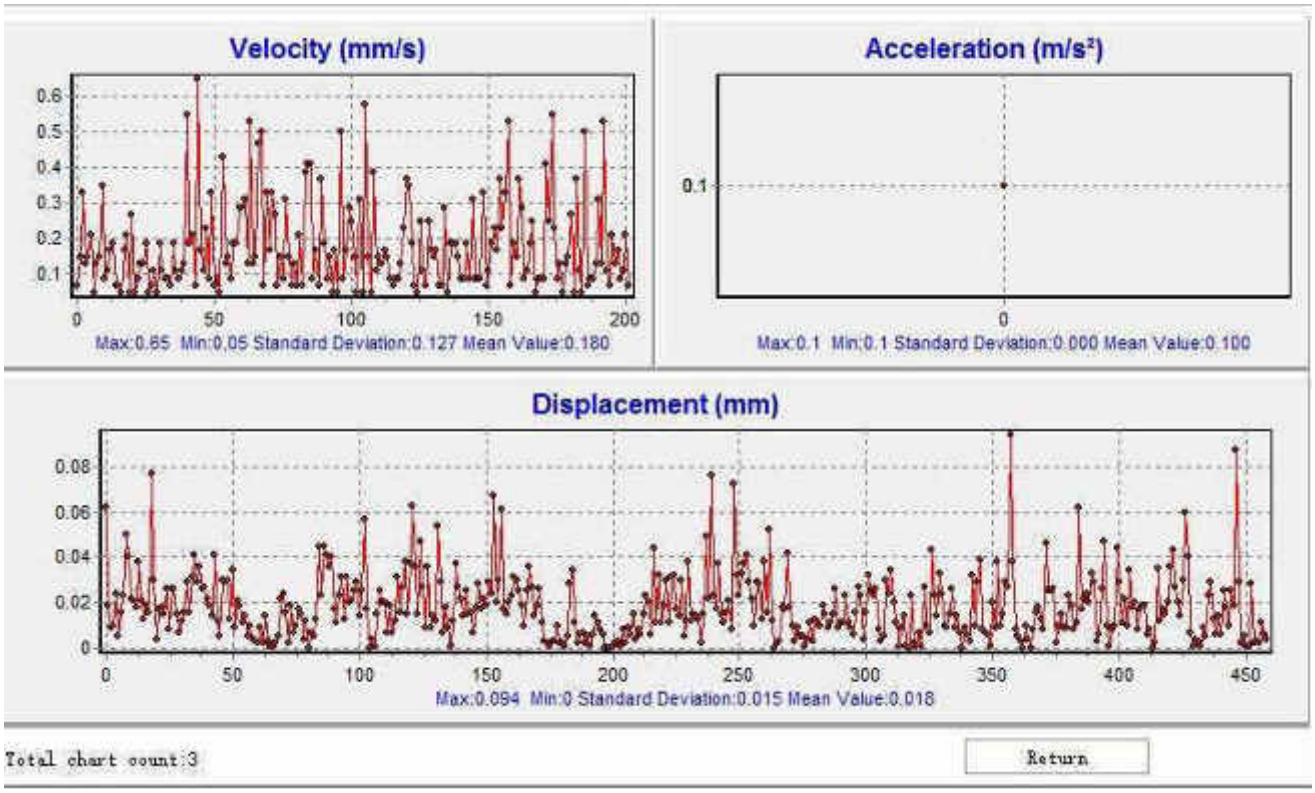
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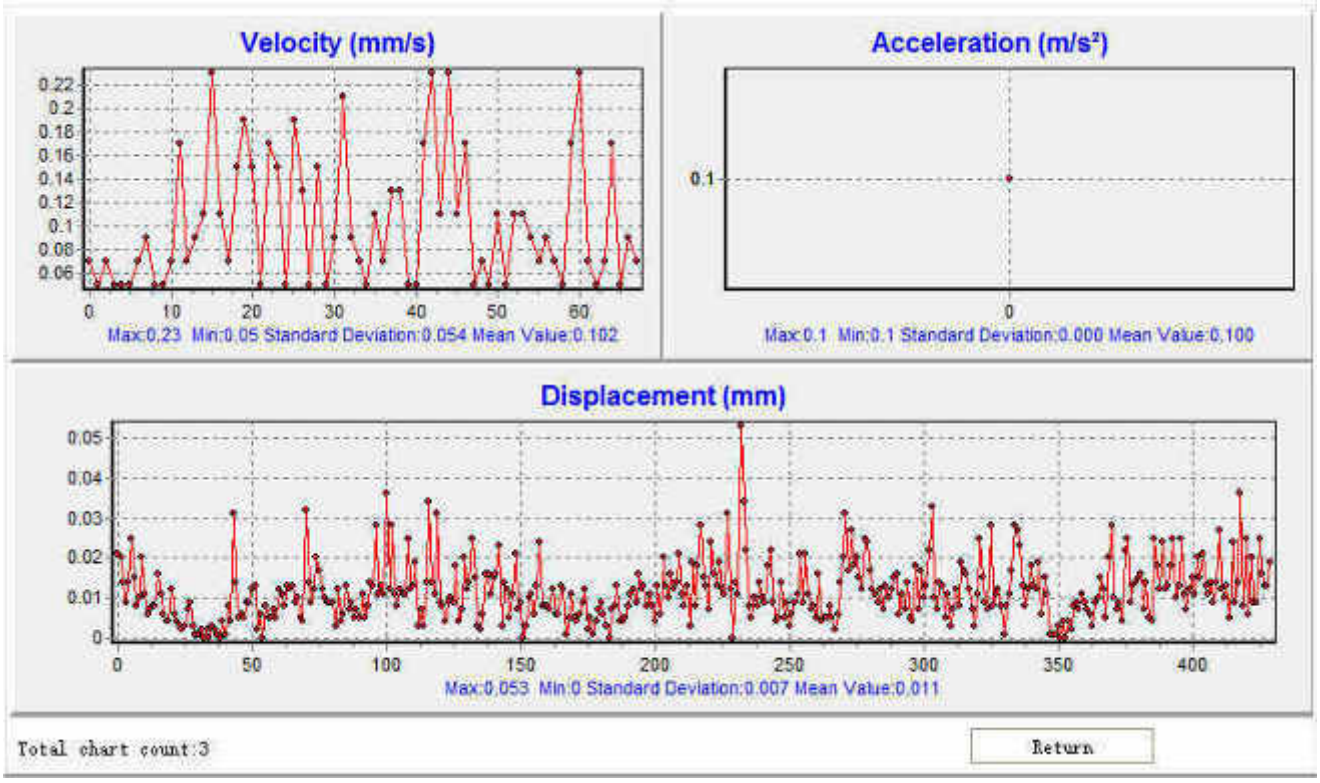
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Acceleration (m/s²)
Max:0.1 Min:0.1 Standard Deviation:0.000 Mean Value:0.100
Displacement (mm)
Max:0.053 Min:0 Standard Deviation:0.007 Mean Value:0.011
Total chart count:3
Return

Soil 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: 31. 05. 2018

Report of Analysis

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

Re.: Environmental Quality Test for Bus Rapid Transit Project (Package-01)

Sample Title: Soil quality test

Analytical Results:

Sl. No.	Test Parameters	Units	Sample ID		
			SL_CS	SL_GT	SL_JC
			Test Results		
1	pH	1 : 2.5	7.68	7.48	7.40
2	Lead (Pb)	(mg/kg)	2.50	7.75	16.25
3	Cadmium (Cd)	(mg/kg)	BDL	BDL	BDL
4	Chromium (Cr)	(mg/kg)	1.723	11.70	20.10
5	Nickel (Ni)	(mg/kg)	16.18	15.78	27.85
6	Zinc (Zn)	(mg/kg)	43.00	40.25	90.75
7	Arsenic (As)	(mg/kg)	1.507	2.433	2.798
8	Mercury (Hg)	(ppb)/(µg/kg)	BDL	BDL	4.32

BDL- below detection limit

Methods Used:

1. **Arsenic**: Hydride Generation Atomic Absorption Spectrometry (HG-AAS)- **APHA 3114**
2. **Mercury**: Cold Vapor Atomic Absorption- **EPA/SW-846 Methods - 7000A/7470A/7471A**
3. **Pb, Cd, Cr, Ni, Zn**: Aqua-regia digestion and AAS method
4. **pH**: pH meter

(Professor Dr. Sirajul Hoque)
Chairman

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

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

Construction of Elevated BRT Lanes including Tongi Bridge and BRT Stations

Surface Water Quality Test Results

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)
BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: BCSIR Laboratories, Dhaka (Dhaka Lab)

Analysis Report

Analytical Service Cell Ref No: May2018010114 | Unit (Lab/Inst.) Ref No: D-166
Lab ID: SE-840 | Sample Receiving Date: 21/05/2018
Sample ID: Test Sample of Surface Water | Submission Date: 21/May/2018
Report Delivery Date: 10/06/2018
Sample Description: Test Sample of Surface Water (SW-1, SW-2)
Client's Details: Tahsin-Uz-Zaman
IFNRM
House#464/C (Ground Floor), Khilgaon, Dhaka-1219
Number of Sample: 2

Report Details:

Lab ID	Sample Description as mentioned	Parameters	Method	Results	
				SW-1	SW-2
SE-840	Test Sample of Surface Water (SW-1, SW-2)	Ammonia (NH_3-N), mg/L	In House	2.0	25.0
		BOD (Biological Oxygen Demand), mg/L	In House	1.1	9.3
		COD (Chemical Oxygen Demand), mg/L	In House	16.0	18.67
		DO (Dissolved Oxygen), mg/L	In House	2.05	3.47
		Electrical Conductivity (EC), µS/cm	In House	344	341
		pH	In House	7.14	7.06

10.6.18 10.06.18

Note:
a. The results reported here pertained to the sample received in this laboratory only.
b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory.
d. The report shall not be reproduced/published partly or fully without prior approval of the authority.

Analytical Service Cell
Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205 Bangladesh
Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

Pages 1 of 2

10th of June 2018 10:05 AM

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)
BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH (BCSIR)

Lab ID	Sample Description as mentioned	Parameters	Method	Results	
				SW-1	SW-2
SE-840	Test Sample of Surface Water(SW-1, SW-2)	Iron (Fe), mg/L	In House	Less than 0.1	Less than 0.1
		Manganese (Mn), mg/L	In House	Less than 0.1	Less than 0.1
		phosphate, mg/L	In House	2.68	2.65
		TDS (Total Dissolved Solids), mg/L	In House	172.1	170.6
		Temperature (°C)	In House	25.5	25.6
		TSS (Total Suspended Solids), mg/L	In House	120	117
		Turbidity, NTU	In House	10.7	7.83
		Total Nitrogen, mg/L	In House	65.0	84.0
		Arsenic (As), ppb	In House	5.35	5.49

10.6.18
Analyst

Dr. Md. Kamal Hossain
Senior Scientific Officer
Soil and Environment Section
Biological Research Division
BCSIR Laboratories, Dhaka
Dhaka-1205, Bangladesh

10.06.18
Section/Division In-Charge

MOHAMMAD MOHIUZZAMAN
Senior Scientific Officer
Soil and Environment Section
Biological Research Division
BCSIR Laboratories, Dhaka
BCSIR, Dhanmondi, Dhaka-1205

10.6.18
In-Charge/Director

Dr. Md. Sarwar Jahan
Director (Addl.-Charge)
BCSIR Laboratories, Dhaka
Dr. Qudrat-e-Khuda Road
Dhaka-1205

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Pages 2 of 2

10th of June 2018 10:05 AM

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Phone : +880-2-9827001-10/2405
Web : http://www.icddrb.org
Environmental Microbiology Laboratory

Test Report

Lab. ID No.2018052485
Receipt No: MAY1809906

Date of Reporting: 21.05.2018
Date of Sample Tested: 17.05.2018
Date of Sample Received: 17.05.2018

Particular of Sample: Drinking Water

Client Address: ENRAC Ltd., SW 01, Tongi Bridge, Gazipur.

Sl. No.	Water Quality Parameters	Unit	Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
1	Faecal coliforms	CFU /100mL	4000	0	0	Membrane Filtration

Comment: The supplied water sample is contaminated with faecal coliforms.

N.B: This report is valid only for particular sample tested and cannot be used for publicity.

Dr. Zahid Hayat Mahmud
Associate Scientist and Head
Environmental Microbiology Lab, LSSD, icddr,b

Tested By (Code No.): 7, 8
EM.FM.007.01 Effective Date 30/03/2016

Checked By (Code No.): 2
End of the Report

Page 1 of 1

icddr,b
Laboratory Sciences and Services Division
Mohakhali, Dhaka-1212
Phone : +880-2-9827001-10/2405
Web : http://www.icddrb.org
Environmental Microbiology Laboratory

Test Report

Lab. ID No.20180524B4
Receipt No: MAY1809904

Date of Reporting: 21.05.2018
Date of Sample Tested: 17.05.2018
Date of Sample Received: 17.05.2018

Particular of Sample: Drinking Water

Client Address: ENRAC Ltd., SW 01, Tongi Bridge, Gazipur.

Sl. No.	Water Quality Parameters	Unit	Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
1	Total coliforms	CFU/100mL	6900	0	0	Membrane Filtration

Comment: The supplied water sample is contaminated with total coliforms.

N.B: This report is valid only for particular sample tested and cannot be used for publicity.

Dr. Zahid Hayat Mahmud
Associate Scientist and Head
Environmental Microbiology Lab, LSSD, icddr,b

Tested By (Code No.): 7, 8
EM.FM.007.01 Effective Date 30/03/2016

Checked By (Code No.): 2
End of the Report

Page 1 of 1

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)
BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: Institute of National Analytical Research & Service (INARS)

Analysis Report

Analytical Service Cell Ref No: May2018010154
Unit (Lab/Inst.) Ref No: A-379
Lab ID: INS-379
Sample Receiving Date: 21/05/2018
Sample ID: A-379
Submission Date: 21/May/2018
Report Delivery Date: 24/05/2018

Sample Description: Test Sample of Surface Water

Client's Details: Tahsin-Uz-Zaman
ENRAC
House#464/C (Ground Floor), Khilgaon, Dhaka-1219

Number of Sample: 1

Report Details:

Lab ID	Particulars of supplied Sample	Parameters	Concentration	Test Method (APHA)
A-379	Surface Water	Oil and Grease	Less than 5 mg/L	5520.B

24-05-18
Analyst
A.H.M. Shofiul Islam Molla Jamal
Scientific Officer
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka

24-05-18
Section/Division In-Charge
শামীম আহমেদ
উর্ধ্বতন বৈজ্ঞানিক কর্মকর্তা
ইন্সটিটিউট অব ন্যাশনাল এনালাইটিক্যাল
রিসার্চ এন্ড সার্ভিস (আইএনএআরএস)
বিসিএসআইআর, ঢাকা

24-05-2018
In-Charge/Director
Md. Aminul Ahsan
Director (Addl. Charge)
Institute of National Analytical Research & Service (INARS)
BCSIR, Dhaka.

Note:
a. The results reported here pertained to the sample received in this laboratory only.
b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory.
d. The report shall not be reproduced/published partly or fully without prior approval of the authority.

Analytical Service Cell
Dr. Qudrat-i-Khuda Road, Dhanmondi, Dhaka-1205,Bangladesh
Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

Pages 1 of 1

24th of May 2018 10:01 AM

Groundwater Quality Test Results

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)
BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: BCSIR Laboratories, Dhaka (Dhaka Lab)

Analysis Report

Analytical Service Cell Ref No: May2018010115	Unit (Lab/Inst.) Ref No: D-165
Lab ID: ST-841	Sample Receiving Date: 21/05/2018
Sample ID: Test Sample of Ground Water	Submission Date: 21/May/2018
	Report Delivery Date: 10/06/2018

Sample Description: Test Sample of Ground Water (GW-1, GW-2)

Client's Details: Tahsin-Uz-Zaman
ENRAC
House#454/C (Ground Floor), Khilgaon, Dhaka-1219

Number of Sample: 2

Report Details:

Sample Details (as mentioned)	Sl. No.	Parameters	Methodology/Instrument	Results GW-1	Results GW-2
Ground Water	01	Ammonium-Nitrogen (NH_4-N)	In-House Method (Ion Chromatograph)	Less than 0.2 mg/L	Less than 0.2 mg/L
	02	Arsenic (As)	In-House Method (Atomic Absorption Spectrophotometer with HVG)	3.56 ppb	5.44 ppb
	03	Biochemical Oxygen Demand (BOD)	In-House Method (BOD Tracking System).	2.4 mg/L	6.2 mg/L
	04	Chemical Oxygen Demand (COD)	In-House Method (Potentiometric Titration followed by open reflux method)	13.33 mg/L	26.67 mg/L
	05	Dissolved Oxygen (DO)	In-House Method (DO Measuring Meter)	7.49 mg/L	6.55 mg/L
	06	Electrical conductivity (EC)	In-House Method (EC Measuring Meter)	245 µS/cm	771 µS/cm
	07	Iron (Fe)	In-House Method (Atomic Absorption Spectrophotometer)	Less than 0.1 mg/L	Less than 0.1 mg/L
	08	Manganese (Mn)	In-House Method (Atomic Absorption Spectrophotometer)	Less than 0.1 mg/L	Less than 0.1 mg/L

10.06.2018 10.06.18

Note:
a. The results reported here pertained to the sample received in this laboratory only.
b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory.
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Analytical Service Cell
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Telephone:8671108,Fax: 88-02-8671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

Pages 1 of 2

10th of June 2018 01:26 PM

icddr,b

Laboratory Sciences and Services Division
Mohakhali, Dhaka-1212
Phone : +880-2-9827001-10/2405
Web : http://www.icddrb.org

Environmental Microbiology Laboratory

Test Report

Lab. ID No.2018052487
Receipt No: MAY1809912

Date of Reporting: 21.05.2018
Date of Sample Tested: 17.05.2018
Date of Sample Received: 17.05.2018

Particular of Sample: Drinking Water

Client Address: ENRAC Ltd., GW 01, Station Road, Tongi, Gazipur.

Sl. No.	Water Quality Parameters	Unit	Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
1	Faecal coliforms	CFU /100mL	0	0	0	Membrane Filtration

N.B: This report is valid only for particular sample tested and cannot be used for publicity.

Dr. Zahid Hayat Mahmud
Associate Scientist and Head
Environmental Microbiology Lab, LSSD, icddr,b

Tested By (Code No.): 7, 8
EM.FM.007.01 Effective Date 30/03/2016

Checked By (Code No.): 2
End of the Report

Page 1 of 1

icddr,b
Laboratory Sciences and Services Division
Mohakhali, Dhaka-1212
Phone : +880-2-9827001-10/2405
Web : http://www.icddrb.org

Environmental Microbiology Laboratory

Test Report

Lab. ID No.2018052464
Receipt No: MAY1809916

Date of Reporting: 21.05.2018
Date of Sample Tested: 17.05.2018
Date of Sample Received: 17.05.2018

Particular of Sample: Drinking Water

Client Address: ENRAC Ltd., GW 02, College Gate, Tongi, Gazipur.

Sl. No.	Water Quality Parameters	Unit	Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
1	Faecal coliforms	CFU /100mL	500	0	0	Membrane Filtration

Comment: The supplied water sample is contaminated with faecal coliforms.

N.B: This report is valid only for particular sample tested and cannot be used for publicity.

Dr. Zahid Hayat Mahmud
Associate Scientist and Head
Environmental Microbiology Lab, LSSD, icddr,b

Tested By (Code No.): 7, 8
EM.FM.007.01 Effective Date 30/03/2016

Checked By (Code No.): 2
End of the Report

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Laboratory Sciences and Services Division
Mohakhali, Dhaka-1212
Phone : +880-2-9827001-102405
Web : http://www.icddrb.org

Environmental Microbiology Laboratory

Test Report

Lab. ID No.2018052486 | Receipt No: MAY1809907 | Date of Reporting: 21.05.2018
Date of Sample Tested: 17.05.2018
Date of Sample Received: 17.05.2018

Particular of Sample: Drinking Water

Client Address: ENRAC Ltd., GW 01, Station Road, Tongi, Gazipur.

Sl. No.	Water Quality Parameters	Unit	Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
1	Total coliforms	CFU/100mL	0	0	0	Membrane Filtration

N.B: This report is valid only for particular sample tested and cannot be used for publicity.

Dr. Zahid Hayat Mahmud
Associate Scientist and Head
Environmental Microbiology Lab, LSSD, icddr,b

Tested By (Code No.): 7, 8
EM.FM.007.01 Effective Date 30/03/2016

Checked By (Code No.): 2
End of the Report

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Laboratory Sciences and Services Division
Mohakhali, Dhaka-1212
Phone : +880-2-9827001-10/2405
Web : http://www.icddrb.org

Environmental Microbiology Laboratory

Test Report

Lab. ID No.2018052488
Receipt No: MAY1809913

Date of Reporting: 21.05.2018
Date of Sample Tested: 17.05.2018
Date of Sample Received: 17.05.2018

Particular of Sample: Drinking Water

Client Address: ENRAC Ltd., GW 02, College Gate, Tongi, Gazipur.

Sl. No.	Water Quality Parameters	Unit	Results	Bangladesh Standard for Drinking Water (ECR'97)	WHO Guideline for Drinking Water, 2004	Method
1	Total coliforms	CFU/100mL	4000	0	0	Membrane Filtration

Comment: The supplied water sample is contaminated with total coliforms.

N.B. This report is valid only for particular sample tested and cannot be used for publicity.

Dr. Zahid Hayat Mahmud
Associate Scientist and Head
Environmental Microbiology Lab, LSSD, icddr,b

Tested By (Code No.): 7, 8
EM.FM.007.01 Effective Date 30/03/2016

Checked By (Code No.): 2
End of the Report

Page 1 of 1

Ambient Air Quality Monitoring Result

ENRAC

Environment and Resource Analysis Center Ltd. (ENRAC)

Block-G, Road-13, House-19, Flat-B1, Niketon, Gulshan-1, Dhaka-1212
Cell: +8802488810445, E-mail: info@enrac.com.bd

ENRAC REF. : ENRAC 0020/18

AMBIENT AIR QUALITY TESTING REPORT

COMPANY NAME : Jiangsu Provincial Transportation Engineering Group Co. Ltd (JTEG)
PROJECT NAME : Upgrading and Widening of Pavement, Construction of Elevated BRT Lanes Including Tongi Bridge and BRT Stations (From Km 2+600 to Km 7+100)
CLIENT REF. : N/A
CLIENT ADDRESS : Sector-7, Uttara, Dhaka
SAMPLE COUNT : 08 hour
SAMPLING DATE :14/05/2018
ANALYSIS DATE : 20/05/2018
SAMPLING ID : AAQ_01_Abdullahpur
GPS COORDINATES : 90°23'50.628"E 23°54'31.933"N

Sampling Site Description	Description of Parameters	Unit	Result of Ambient Air Quality Average (08 hours)	GoB Air Quality Standards*
• Environmental Perimeter Air Station (EPAS) was set to nearby The turag river and tongi bridge • Households, mosque and a market and industries were located along the sampling location. • Emission from the nearby industries and vehicles on the road. • High amount of dust and smoke were observed during the sampling	Carbon Monoxide (CO)	µg/m³	0.85	10 (8 hour)
	Nitric Oxide (NO)	µg/m³	120.35	100 (Annual)
	Nitrogen Dioxide (NO_2)	µg/m³	66.30	
	Sulphur Dioxide (SO_2)	µg/m³	25.33	365 (24 hour)
	Ozone (O_3)	µg/m³	162.30	157 (8 hour)
	Particulate Matter (PM_{10})	µg/m³	105.80	150 (24 hour)
	Particulate Matter ($PM_{2.5}$)	µg/m³	88.00	65 (24 hour)
	Oxygen(O_2)	%	18.80	NSE**
	Hydrogen Sulphide (H_2S)	ppm	0.10	0.02-0.2 (24 Hour)
	Carbon Dioxide (CO_2)	µg/m3	635.50	<1100 (24 hour)
	Suspended Particulate Matters (SPM)	µg/m3	214.50	200 (8 hour)
	Total Volatile Organic Compounds (TVOC)	ppm	10.7	NSE**
	Air Temperature	°C	33.37	NSE**
	Relative Humidity	%	55.40	NSE**
	Wind Speed	kph	0.50	NSE**
	Wind Direction	Degree	184 (blowing from SSW)	NSE**

* The amended Schedule-2, 2005, of (Air Quality Standard) Environmental Conservation Rules, 1997
** NSE- No standards established yet

Prepared by
Md. Kawser Uddin
Jr. Environmental Specialist

Environment and Resource Analysis Center Ltd. ENRAC

Approved by
Mehedi Hasan
Environmental Specialist

Environment and Resource Analysis Center Ltd.
Flat B1, House 19, Road 13, Block G, Niketon, Gulshan 1,
Dhaka-1213, Bangladesh
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ENRAC

Environment and Resource Analysis Center Ltd. (ENRAC)

Block-G, Road-13, House-19, Flat-B1, Niketon, Gulshan-1, Dhaka-1213
Cell: +8802458104445, E-mail: info@enrac.com.bd

ENRAC REF. : ENRAC 002/18

AMBIENT AIR QUALITY TESTING REPORT

COMPANY NAME : Jiangsu Provincial Transportation Engineering Group Co. Ltd (JTEG)
PROJECT NAME : Upgrading and Widening of Pavement, Construction of Elevated BRT Lanes Including Tongi Bridge and BRT Stations (From Km 2+600 to Km 7+100)
CLIENT REF. : N/A
CLIENT ADDRESS : Sector-7, Uttara, Dhaka
SAMPLE COUNT : 08 hour
SAMPLING DATE :14/05/2018
ANALYSIS DATE : 20/05/2018
SAMPLING ID : AAQ_02_College gate
GPS COORDINATES : 90°24'2.177"E 23°52'47.84"N

Sampling Site Description	Description of Parameters	Unit	Result of Ambient Air Quality Average (8 hours)	GoB Air Quality Standards*
• Environmental Perimeter Air Station (EPAS) was set to nearby the tongi college • Households, mosque and industries were located along the sampling location. • Emission from the nearby industries and vehicles on the highway road. • High amount of dust and smoke were observed during the sampling	Carbon Monoxide (CO)	µg/m³	0.90	10 (8 hour)
	Nitric Oxide (NO)	µg/m³	101.90	100 (Annual)
	Nitrogen Dioxide (NO_2)	µg/m³	40.60	
	Sulphur Dioxide (SO_2)	µg/m³	39.70	365 (24 hour)
	Ozone (O_3)	µg/m³	155.00	157 (8 hour)
	Particulate Matter (PM_{10})	µg/m³	120.00	150 (24 hour)
	Particulate Matter ($PM_{2.5}$)	µg/m³	56.00	65 (24 hour)
	Oxygen(O_2)	%	19.20	NSE**
	Hydrogen Sulphide (H_2S)	ppm	0.10	0.02-0.2 (24 Hour)
	Carbon Dioxide (CO_2)	µg/m3	673.00	<1100 (24 hour)
	Suspended Particulate Matters (SPM)	µg/m3	416.98	200 (8 hour)
	Total Volatile Organic Compounds (TVOC)	ppm	10.8	NSE**
	Air Temperature	°C	36.04	NSE**
	Relative Humidity	%	55.40	NSE**
	Wind Speed	kph	0.40	NSE**
	Wind Direction	Degree	211 (blowing from SSW)	NSE**

* The amended Schedule-2, 2005, of (Air Quality Standard) Environmental Conservation Rules, 1997
** NSE- No standards established yet

Prepared by
Md. Kawser Uddin
Jr. Environmental Specialist

Environment and Resource Analysis Center Ltd. ENRAC

Approved by
Mehedi Hasan
Environmental Specialist

Environment and Resource Analysis Center Ltd.
Flat B1, House 19, Road 13, Block G, Niketon, Gulshan 1,
Dhaka-1213, Bangladesh
Phone: +8801811 446974, Email : info@enrac.com.bd

Noise and Vibration Level Measurement Results

ENRAC

Environment and Resource Analysis Center Ltd. (ENRAC)

Block-G, Road-13, House-19, Flat-B1, Niketon, Gulshan-1, Dhaka-1213
Cell: +8802488810445, E-mail: info@enrac.com.bd

ENRAC REF. : ENRAC 0014/18

NOISE & VIBRATION TESTING REPORT

COMPANY NAME : Jiangsu Provincial Transportation Engineering Group Co. Ltd (JTEG)
PROJECT NAME : Upgrading and Widening of Pavement, Construction of Elevated BRT Lanes
CLIENT REF. : N/A
CLIENT ADDRESS : Sector-7, Uttara, Dhaka
SAMPLE COUNT : 02 hour
SAMPLING DATE :14 &15/05/2018
ANALYSIS DATE : 20/05/2018

- Highway road, mosque, market and industries were located along the sampling location.
- Noise from the nearby vehicles on the road.
- Sampling area were crowded and heavy vehicle traffic area

Noise & Vibration Measurement (N&V) Results

Sampling ID	Location	GPS Coordinates	Noise Measurement Data (dBA) L_{eq}		Vibration Data (Velocity) mm/s	
			Day	Night	Day	Night
N&V_1	Abdullahpur	90°23'59.789"E 23°54'30.378"N	79.9	79.7	0.7	0.52
N&V_2	Housebuilding	90°24'11.357"E 23°52'47.864"N	83.9	80.3	0.54	0.55
N&V_3	Tongi Bridge	90°24'10.306"E 23°52'7.714"N	81.3	80.1	0.47	0.53
N&V_4	College Gate	90°24'11.214"E 23°52'51.304"N	82.3	80.4	0.68	0.65
N&V_5	Station Road	90°24'13.404"E 23°53'30.355"N	86.6	85.01	0.51	0.72

	Zone	Day	Night
GoB Noise Standard *	Silent area	50	40
	Residential	55	45
	Mixed area	60	50
	Commercial	70	60
	Industrial area	75	70
Vibration Standard	NSE**		

* The amended schedule-4, 2006, of (Noise Measurement Standard) Environmental Conservation Rules, 1997 **
NSE- No standards established yet

Prepared by
Md. Kawser Uddin
Jr. Environmental Specialist

Environment and Resource Analysis Center Ltd. ENRAC

Approved by
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Phone: +8801811446974, Email : info@enrac.com.bd

Riverbed Sediment Quality Test Results

জীবনের জন্য বিজ্ঞান

বাংলাদেশ বিজ্ঞান ও শিল্প গবেষণা পরিষদ (বিসিএসআইআর)
BANGLADESH COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH(BCSIR)

Institute Name: BCSIR Laboratories, Dhaka (Dhaka Lab)

Analysis Report

Analytical Service Cell Ref No: May2018010113	Unit (Lab/Inst.) Ref No: D-164
Lab ID: SE-839	Sample Receiving Date: 21/05/2018
Sample ID: Test Sample of Riverbed Sediment	Submission Date: 21/May/2018
	Report Delivery Date: 07/06/2018
Sample Description: Test Sample of Riverbed Sediment (RBS-1, RBS-2)	
Client's Details: Tahsin-Uz-Zaman ENRAC House#464/C (Ground Floor), Khilgaon, Dhaka-1219	
Number of Sample: 2	

Report Details:

Sample Details (as mentioned)	Sl. No.	Parameters	Methodology/Instrument	Results	
				RBS-1	RBS-2
Riverbed Sediment	01	Arsenic (As)	In-House Method (Atomic Absorption Spectrophotometer with HVG)	1.83 ppm	1.81 ppm
	02	Cadmium (Cd)	In-House Method (Atomic Absorption Spectrophotometer)	1.94 ppm	0.88 ppm
	03	pH	SSSA Method	6.37	5.32
	04	Mercury (Hg)	In-House Method (Atomic Absorption Spectrophotometer with MVU)	0.20 ppm	0.22 ppm
	05	Lead (Pb)	In-House Method (Atomic Absorption Spectrophotometer)	28.29 ppm	17.54 ppm
	06	Iron (Fe)	In-House Method (Atomic Absorption Spectrophotometer)	1.79 %	2.17 %
	07	Chromium (Cr)	In-House Method (Atomic Absorption Spectrophotometer)	36.67 ppm	33.01 ppm

10.6.18
Analyst
BADHAN SAHA
Senior Scientific Officer
Soil and Environment Section
Biological Research Division
BCSIR, Laboratories Dhaka
BCSIR, Dhanmondi, Dhaka-1205

10.06.18
Section/Division In-Charge
MOHAMMAD MONIRUZZAMAN
Senior Scientific Officer
Soil and Environment Section
Biological Research Division
BCSIR Laboratories, Dhaka
BCSIR, Dhanmondi, Dhaka-1205

10.6.18
In-Charge/Director
Dr. Md. Sarwar Jahan
Director (Addl.-Charge)
BCSIR Laboratories, Dhaka
Dr. Qudrat-e-Khuda Road
Dhaka-1205

Note:
a. The results reported here pertained to the sample received in this laboratory only.
b. Complain and/or query regarding delivered test report should be lodged within one month of report delivery date.
c. The laboratory is not responsible for the data quality affected due to sampling, transporting and storage conditions of the sample(s) maintained before received in the laboratory.
d. The report shall not be reproduced/published partly or fully without prior approval of the authority.

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Telephone:9671108,Fax: 88-02-9671108 E-mail:asc@bcsir.gov.bd Website: www.bcsir.gov.bd

Pages 1 of 1

7th of June 2018 04:44 PM

Construction of BRT Bus Depot

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: 853/ CC, DPHE, CL, Dhaka.

Date: 01-07-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018060118	Sample Receiving date: 07-06-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 07-06-2018	Sample Source: Ground Water
Sent by:Rashaduzzaman ,Jr. Environmental Specialist , DSCL Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (GW_BD)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date:	Date of Testing: 07/06/2018-28/06/2018

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	1	mg/L	5 days Incubation	0.1
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	Iron (Fe)	0.3-1	0.05	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.40	mg/L	AAS	0.03
8	Nitrogen (Ammonia)	0.50	0.4	mg/L	UVS	0.01
9	Total Suspended Solid (TSS)	10	1	mg/L	Gravity Multimeter	-
10	Turbidity	10	0.4	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.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer	01-07-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	01/07/2018 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory, Mohakhali, Dhaka
2.) Name: Taslima Akhter Designation: Sample Analyzer	01.07.18 Sample Analyzer DPHE, Central Laboratory Mohakhali, Dhaka	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: 850/ CC, DPHE, CL, Dhaka.

Date: 01-07-2018

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2018060117	Sample Receiving date: 07-06-2018
Ref. Memo No: DSCL/2018/Nill & Dated: 07-06-2018	Sample Source: Suface Water
Sent by:Rashaduzzaman ,Jr. Environmental Spedalist , DSCL, Mirpur DOHS, Dhaka-1216.	Dist:Gazipur, Upa:
Care Taker: DSCL (SW_BD)	Union:, Vill.:Bus Rapid Transit Project
Sample Collection date:	Date of Testing: 07/06/2018-28/06/2018

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	0.1
3	Chemical Oxygen Demand (COD)	4.0	8	mg/L	CRM	-
4	Coliform (Faecal)	0	12	N/100ml	MFM	-
5	Coliform (Total)	0	20	N/100ml	MFM	-
6	Iron (Fe)	0.3-1	0.36	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
8	Nitrogen (Ammonia)	0.50	0.3	mg/L	UVS	0.01
9	Total Suspended Solid (TSS)	10	12	mg/L	Gravity Mullimeter	-
10	Turbidity	10	25.4	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.

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Mahabuba Sabina Motin Designation: Sample Analyzer	01-07-18	1.) Name: Md. Biplab Hossain Designation: Chief Chemist	01/07/2018 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory, Mohakhali, Dhaka
2.) Name: Taslima Akhter Designation: Sample Analyzer	01.07.18 Sample Analyzer DPHE, Central Laboratory Mohakhali, Dhaka	2.) Name: Designation:	

মৃত্তিকা, পানি ও পরিবেশ বিভাগ
ঢাকা বিশ্ববিদ্যালয়
ঢাকা ১০০০
বাংলাদেশ

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

Date: 28. 06. 2018

Report of Analysis

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

Re.: Environmental Quality Test for Construction of Bus Rapid Transit (BRT) Bus Deport

Sample Title: Surface and Ground water quality test

Analytical Results:

Sl. No.	Water Source	Sample ID	Results of Test Parameters	
			Total Nitrogen (TN) (µg/ml)	Total Phosphorus (TP) (µg/ml)
1	Surface Water	SW_BD	2.87	0.06
2	Ground Water	GW_BD	3.30	0.11

Methods Used:

1. Total Nitrogen : Micro-Kjeldahl digestion and distillation method
2. Total Phosphorus : 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

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 June, 2018

Test Result of Ambient Air Quality Analysis

Parameter	Unit	Concentration at Project Site	Bangladesh Standard**	Duration (hours)	Weather Condition	Method of Analysis
PM_{10}	µg/m³	103.04	150	24	Sunny	Gravimetric
SPM	µg/m³	298.7	200	24		Gravimetric
SO_2	µg/m³	13.32	365	24		West- Geake
NOx	µg/m³	7.71	100	Annual		Jacob and Hochheiser
H_2S	µg/m³	0.089	NYS	8		Electro-Chemical Sensor
O_3	µg/m³	13.56	NYS	8		Photometric
O_2	%	17.56	NYS	8		Electro-Chemical Sensor
TVOC	µg/m³	371	NYS	8		Electro-Chemical Sensor
CO*	ppm	001	9	8		CO-Meter
CO_2	µg/m³	421	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 19th July 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	Bus Depot	23.995453°N; 90.396781°E	11:30am-12:30pm	28.72	34.83	2.3	South-East

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DOHS Mirpur, Dhaka-1216, Bangladesh. Tel: +8804478035444
Email: dscl@dsclbd.com Web: www.dsclbd.com

DSCL Multidisciplinary Development Consultants

Location	Sample Site Description
AAQ_01	➢ The weather was sunny. ➢ The construction work is going on during monitoring. ➢ Higher amount of dust particles are present. ➢ Low traffic volume. ➢ Low people movement.

Test Performed By:
Tonmoy Pandit
Jr. Environmental Specialist

Checked By:
Israt Jahan Sumi
Director

Development Solutions Consultant Ltd.
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Noise Level Measurement Result

DSCL

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

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 Coordinate	23.99541° N 90.39645° E
Description of sample	Noise Level
Sample Collector	Collected by DSCL Personnel
Sampling Date	06 June, 2018

Noise Level Analysis

ID	Location	Zone	GPS Location	Noise Level dB(A) at Day Time (LAeq)	Bangladesh Standard at Day Time dB (A)**
NM_BD	BRT Bus Depot Area	Residential	23.99541° N 90.39645° E	61.50	55

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.*

Abbreviation:
NM- Noise Measurement, dB- decibel

Test Performed By:
Tonmoy Pandit
Jr. Environmental Specialist

Development Solutions Consultant Limited * DSCL *

Checked By:
Israt Jahan Sumi
Director

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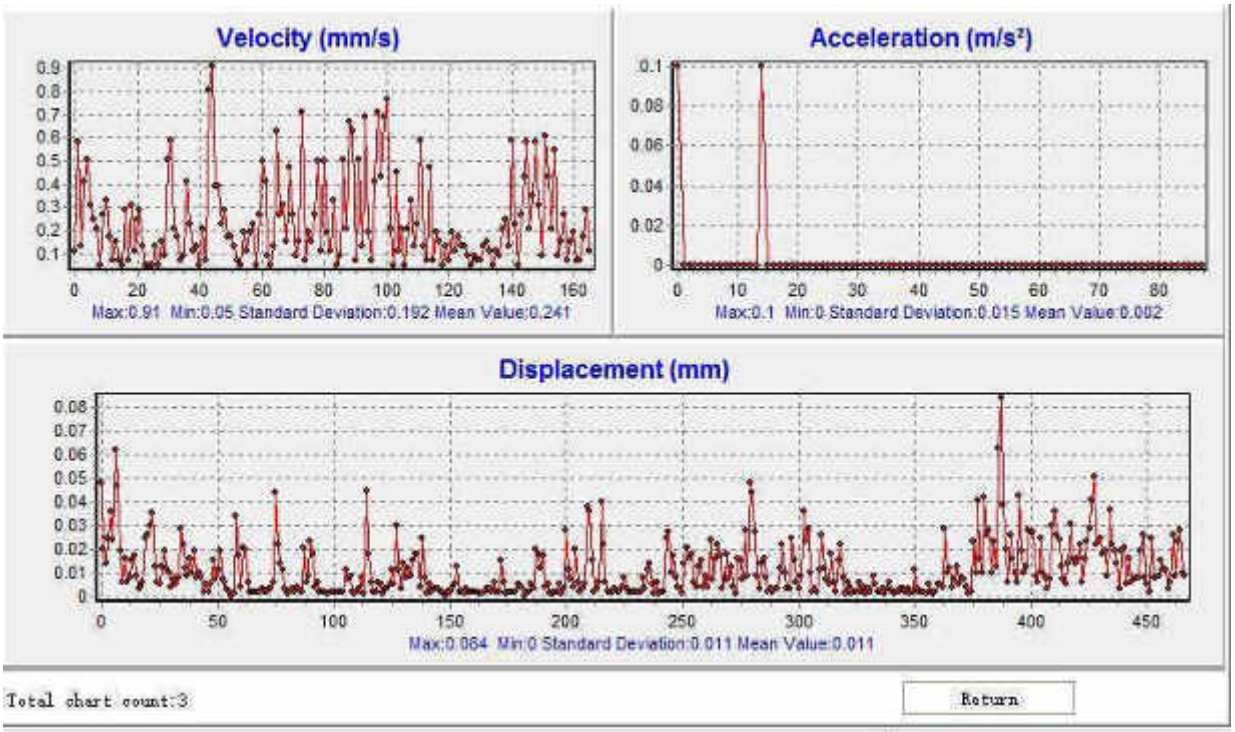
Vibration Level Measurement Results



Soil 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: 28. 06. 2018

Report of Analysis

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

Re.: Environmental Quality Test for Construction of Bus Rapid Transit (BRT) Bus Deport

Sample Title : Soil Quality Test
Sample ID : SL_BD

Analytical Results:

Sl. No.	Test Parameters	Units	Results
1	pH (1 : 2.5)	-	8.35
2	Cadmium (Cd)	(mg/kg)	0.09
3	Chromium (Cr)	(mg/kg)	0.11
4	Zinc (Zn)	(mg/kg)	35.75
5	Arsenic (As)	(mg/kg)	2.052

Methods Used:
1. **Arsenic**: Hydride Generation Atomic Absorption Spectrometry (HG-AAS)- **APHA 3114**
2. **Cd, Cr, Zn**: Aqua-regia digestion and AAS method
3. **pH**: pH meter

(Professor Dr. Sirajul Hoque)
Chairman

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